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THE EFFECT OF FLIPBOOK MEDIA ON ELEMENTARY SCHOOL STUDENTS' MOTIVATION AND MATHEMATICS LEARNING OUTCOMES

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Abstract

This study examines the effect of using flipbook media on motivation and cognitive learning outcomes in elementary school mathematics. It employed a quasi-experimental design involving second-grade students at two schools, comparing an experimental group that used flipbook media with a control group that used conventional textbooks in learning plane geometry. Pretest and posttest measurements, supported by a motivation questionnaire, showed that the experimental group significantly outperformed the control group in both motivation and cognitive achievement. Statistical analysis indicated that flipbook media effectively increased students' engagement and understanding through its interactive features, multimedia elements, and suitability for diverse learning styles. These findings confirm the potential of flipbooks as an innovative pedagogical tool that not only delivers content but also fosters intrinsic and extrinsic motivation and contributes to improved academic performance. Implications for educators include integrating digital interactive media into the classroom to promote active learning and to support sustainable paperless education. The limitations point to opportunities for further research on long-term effects and other learning domains.
Keywords: *Flipbook, Interactive, Mathematics, Motivation.*

Abstrak

Penelitian ini membahas pengaruh penggunaan media flipbook *terhadap motivasi dan hasil belajar kognitif dalam matematika sekolah dasar. Dilakukan dengan desain kuasi-eksperimental yang melibatkan siswa kelas dua di dua sekolah. Penelitian ini membandingkan kelompok eksperimen yang menggunakan media* flipbook *dengan kelompok kontrol yang menggunakan buku teks konvensional dalam pembelajaran geometri bidang. Pengukuran pra-uji dan pasca-uji yang didukung oleh kuesioner motivasi menunjukkan bahwa kelompok eksperimen secara signifikan mengungguli kelompok kontrol, baik dalam motivasi maupun prestasi kognitif. Analisis statistik menunjukkan bahwa media* flipbook *secara efektif meningkatkan keterlibatan dan pemahaman siswa melalui fitur interaktifnya, elemen multimedia, dan kesesuaian dengan beragam gaya belajar. Temuan ini menegaskan potensi* flipbook *sebagai alat pedagogis inovatif yang tidak hanya menyampaikan konten, tetapi juga menumbuhkan motivasi intrinsik dan ekstrinsik, serta berkontribusi pada peningkatan kinerja akademik. Implikasi bagi pendidik termasuk mengintegrasikan media interaktif digital di ruang kelas untuk mempromosikan pembelajaran aktif dan mendukung pendidikan berkelanjutan tanpa kertas. Keterbatasan menunjukkan peluang untuk penelitian lebih lanjut tentang efek jangka panjang dan domain pembelajaran lainnya.*
Kata Kunci: *Flipbook, Interaktif, Matematika, Motivasi.*

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INTRODUCTION

In the global context, digital learning based on *flipbooks* and interactive e-modules has become one of the main trends in twenty-first-century educational innovation. A number of international studies show that the use of interactive digital media, including *flipbooks* and *e-books*, contributes significantly to improving motivation and mathematics learning outcomes.[1] Other studies confirm that integrating technology into learning helps students understand abstract concepts through interactive visualization and more meaningful multimodal learning experiences.[2] The application of *flipbook*-based learning media in elementary schools is therefore relevant in supporting the transformation of education toward active and sustainable digital learning.

Learning media play an important role in supporting the effectiveness of the teaching and learning process. As facilitators, teachers are required to choose appropriate media so that students remain actively engaged and motivated throughout the learning process.[3] Appropriate media not only help teachers deliver material but also make it easier for students to understand abstract concepts, especially in mathematics, which is often considered difficult. However, a preliminary study at SD Negeri Sedono found low learning outcomes among second-grade students, with an average score of only 55, below the Minimum Mastery Criterion (KKM) of 60. Of 26 students, only 10 (39%) achieved mastery, while the rest did not meet the standard. This low achievement is thought to be caused by a lack of variety in learning media and the continued dominance of conventional methods such as lectures and the use of textbooks.

Observations in the elementary schools of Cluster VI, Kapanewon Semin, show that most teachers have not used digital media in learning even though technological facilities are available. This condition indicates a gap between the potential use of technology and classroom learning practice. To address this problem, this study proposes the use of *flipbook* media as an innovative alternative that combines text, images, animation, video, and sound in a single interactive digital platform.[4] *Flipbook* media allow students to learn concepts visually and independently while increasing their learning motivation through interaction and an enjoyable learning experience.[5]

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[1] Atikah et al., "E-Module Mathematics by Using Kvisoft Flipbook in Elementary School"; Choirin Attalina et al., "Efektivitas Media Pembelajaran Berbasis Virtual Reality (Vr) Untuk Meningkatkan Kemampuan Pemahaman Materi Pada Siswa Sekolah Dasar"; Wijaya et al., "A Meta-Analysis of the Effects of E-Books on Students' Mathematics Achievement"; Siano and Potane, "Using Interactive E-Books to Improve Students' Academic Achievement in Mathematics."

[2] Cholilah et al., "Development of a Flipbook-Based E-Module Integrated with GeoGebra and Genially on Similarity"; Yuyun et al., "Developing Flipbook-Based Physics E-Module to Increase Students' Learning Outcome and Motivation."

[3] Arsyad, *Media Pembelajaran*; Ulfa, "Pengaruh Penggunaan Media Pop Up Book Alim (Alat Indra Manusia) Terhadap Hasil Belajar IPA Siswa Kelas IV SD Negeri 4 Tahunan Jepara"; Choirin Attalina et al., "Efektivitas Media Pembelajaran Berbasis Virtual Reality (Vr) Untuk Meningkatkan Kemampuan Pemahaman Materi Pada Siswa Sekolah Dasar."

[4] Rahayu et al., "Penerapan Media Pembelajaran Flipbook Interaktif Untuk Memingkatkan Hasil Belajar Siswa"; Triwahyuningtyas et al., "The Problem-Based Learning e-Module of Planes Using Kvisoft

Theoretically, the advantages of *flipbooks* in learning can be explained through the multimedia learning theory of Mayer and Clark, which holds that the simultaneous combination of text, visuals, and audio can strengthen students' retention and conceptual understanding.[6,7] This principle indicates that students learn more effectively when information is presented through verbal and visual channels at the same time. The use of *flipbooks* is therefore expected to overcome the limitations of conventional media, which tend to be passive and unappealing to elementary school students.[8]

Various previous studies have shown the effectiveness of *flipbooks* in increasing motivation and learning outcomes. For example, Pratama and Sari found that the use of interactive digital media can increase student engagement and improve academic achievement.[9] Meanwhile, research by Widodo and by Triwahyuningtyas et al. shows that *flipbook*-based geometry learning helps students understand the concepts of space and the shapes of plane figures more easily.[10,11] In addition, research by Saptono and by Aisyah and Wibowo confirms that *flipbooks* play a role in fostering students' intrinsic motivation because they are attractive and interactive.[12,13] It can therefore be concluded that *flipbooks* are not merely a medium for delivering information but also a means of creating motivating and meaningful learning experiences.

Based on the description above, this study aims to analyze the effect of using *flipbook* media on elementary school students' motivation and cognitive learning outcomes in mathematics. Specifically, it seeks to answer the following questions: (1) What is the effect of using *flipbook* media on elementary school students' learning motivation? (2) What is the effect

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Flipbook Maker for Elementary School Students"; Triwahyuningtyas et al., "E-Module of Cube and Beam Based on Inquiry for Five Grade Students of Elementary School."

[5] Fitrianawati and Setiyawati, "Pengembangan Modul Digital Flipbook Dengan Pendekatan Etnomatematika Untuk Materi KPK Dan FPB Pada Kelas IV Sekolah Dasar"; Desyandri et al., "The Development of Problem-Based Learning Model E-Module Integrated with Multiculturalism in Elementary Schools."

[6] Mayer, *Multimedia Learning*.

[7] Clark and Mayer, *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*.

[8] Saptono, "The Effectiveness of E-Books in Learning: An Analysis of Trends in Elementary Schools"; Aisyah and Wibowo, "Efforts to Improve Early Reading Skills and Learning Motivation Through Digital Flipbook Media."

[9] Sari, "Pengaruh Penggunaan Media Pembelajaran Berbasis Teknologi Terhadap Motivasi Belajar Siswa."

[10] Widodo, "Efektivitas Media Flipbook Dalam Pembelajaran Geometri Untuk Meningkatkan Pemahaman Siswa SD."

[11] Triwahyuningtyas et al., "E-Module of Cube and Beam Based on Inquiry for Five Grade Students of Elementary School."

[12] Saptono, "The Effectiveness of E-Books in Learning: An Analysis of Trends in Elementary Schools."

[13] Aisyah and Wibowo, "Efforts to Improve Early Reading Skills and Learning Motivation Through Digital Flipbook Media."

of *flipbook* media on students' cognitive learning outcomes? (3) Is there a significant difference between students who learn with *flipbook* media and those who use conventional textbooks in learning about plane figures?

RESEARCH METHODS

This study used a quasi-experimental method with a *nonequivalent control group pretest–posttest design*.[14] This design was chosen because, although there are experimental and control groups, it does not allow full control of extraneous variables that may affect the learning process. Through this design, two groups were compared: an experimental group that received instruction using *flipbook* media and a control group that learned through a conventional textbook-based method. This model is considered effective for evaluating the effect of a treatment on students' learning outcomes and motivation comparatively.[15]

The experimental group learned mathematics using *flipbook* media, while the control group was taught with a conventional method using textbooks. This approach is consistent with the practice of *field-based sampling* in elementary education research, which emphasizes the equivalence of the groups' initial characteristics.[16] The research design can be described as follows:

Experimental group: $O_1 – X – O_2$

Control group: $O_1 – – O_2$

Notes: O_1 = *pretest*; O_2 = *posttest*; X = instruction using *flipbook* media.

The study was limited to SD Negeri Sedono and SD Negeri Ngepoh as research sites in Cluster VI, Kapanewon Semin, Gunungkidul Regency, in the odd semester of the 2025/2026 academic year (July–September 2025). The population consisted of all 117 second-grade students in Cluster VI, Kapanewon Semin. The sample was determined by *simple random sampling*: class II of SDN Sedono (28 students) as the experimental group and class II of SDN Ngepoh (28 students) as the control group.

The study involved two types of variables, independent and dependent. The independent variable was the use of *flipbook* media, while the dependent variables were students' learning motivation and cognitive learning outcomes in mathematics. Two instruments were used to measure these variables. The first was a learning outcomes test consisting of 20 validated multiple-choice items and 5 short-answer items. The test was administered as a *pretest* and *posttest* to assess students' cognitive learning outcomes, particularly at levels C1–C4 of Bloom's

[14] McMillan and Schumacher, *Research in Education: Evidence-Based Inquiry.*

[15] Triwahyuningtyas et al., "The Problem-Based Learning e-Module of Planes Using Kvisoft Flipbook Maker for Elementary School Students."

[16] Rosana and Setyawarno, *Panduan Statistik Terapan Untuk Penelitian Pendidikan*; Letchumanan, "Understanding the Use of Mobile Ebooks Among Mathematics Postgraduates."

taxonomy. The second was a learning motivation questionnaire using a four-point Likert scale (from strongly agree to disagree). The questionnaire covered indicators of interest in and attention to learning, enthusiasm for completing tasks, responsibility for learning, enjoyment of learning activities, and responses to the teacher's stimuli.

Data were obtained by administering a *pretest* and *posttest* to both groups to measure cognitive learning outcomes and by administering a questionnaire to measure students' motivation. Observation was also conducted as supporting data to examine the implementation of learning with *flipbooks* in the classroom. Instrument validity was established through *expert judgment* on the test blueprint, the instruments, and the lesson materials. Construct validity was then tested by trialing the instruments with students outside the research sample. Instrument reliability was calculated using Cronbach's alpha, and instruments were declared reliable if the coefficient exceeded 0.60.[17]

The data were analyzed with SPSS 25 using inferential statistical tests. A *paired-samples t-test* was used to examine the difference between *pretest* and *posttest* scores in each group. An *independent-samples t-test* was used to compare learning outcomes and motivation between the experimental and control groups. In addition, a MANOVA was applied to determine the simultaneous effect of *flipbook* media on students' learning motivation and cognitive learning outcomes in mathematics, as recommended in quantitative experimental education studies.[18] This analytical approach has also been used in recent research on the effectiveness of e-books for students' cognitive achievement.[19] Overall, this research method is expected to provide a comprehensive empirical picture of the effect of *flipbook* media on elementary school students' motivation and learning outcomes and to enrich the literature on digital learning media innovation in a local context.

The use of learning media in the elementary schools of Cluster VI, Kapanewon Semin, is still limited, and some teachers have not used media at all in teaching and learning. *Flipbooks* were therefore chosen as an alternative medium with various interactive features expected to increase students' motivation and learning outcomes. The study used a quasi-experimental design with a *pretest–posttest control group* model. The *pretest* was given to determine students' initial abilities before the treatment, while the *posttest* was conducted to measure the results after learning with *flipbooks*. This design makes it possible to analyze the extent to which *flipbooks* affect second-grade students' motivation and cognitive learning outcomes in mathematics.

[17] Rosana and Setyawarno, *Panduan Statistik Terapan Untuk Penelitian Pendidikan*.

[18] Siano and Potane, "Using Interactive E-Books to Improve Students' Academic Achievement in Mathematics."

[19] Cholilah et al., "Development of a Flipbook-Based E-Module Integrated with GeoGebra and Genially on Similarity"; Fitrianawati and Setiyawati, "Pengembangan Modul Digital Flipbook Dengan Pendekatan Etnomatematika Untuk Materi KPK Dan FPB Pada Kelas IV Sekolah Dasar."

RESULTS AND DISCUSSION

The descriptive analysis shows that the initial conditions of the experimental and control groups were relatively balanced. The mean *pretest* scores for learning motivation and cognitive learning outcomes did not differ markedly between the two groups. This indicates that, before the treatment, the two groups had equivalent initial abilities, so that differences at the *posttest* stage can be attributed to the treatment of learning with *flipbook* media.

Prerequisite tests, consisting of normality and homogeneity tests, were conducted to ensure that the data were normally distributed and homogeneous. The results of the normality test (Table 1) using Shapiro–Wilk show that all *pretest* and *posttest* data had significance values above 0.05 (control *pretest* = 0.254; experimental *pretest* = 0.510; control *posttest* = 0.552; experimental *posttest* = 0.293). The data can therefore be declared normally distributed.

Table 1**.** Tests of Normality of Motivation and Pretest–Posttest Scores in the Experimental and Control Classes

	Kolmogorov–Smirnov[a]			Shapiro–Wilk		
Variable	**Statistic**	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Control, motivation	.088	28	.200∗	.990	28	.994
Experimental, motivation	.163	28	.054	.945	28	.147
Control, pretest	.116	28	.200∗	.954	28	.254
Control, posttest	.157	28	.073	.969	28	.552
Experimental, pretest	.163	28	.056	.967	28	.510
Experimental, posttest	.137	28	.193	.956	28	.293

∗ This is a lower bound of the true significance. a. Lilliefors significance correction.

Source: Research data (IBM SPSS Statistics 25 output).

Furthermore, the results of the homogeneity test using Levene's test show a significance value for learning motivation in the experimental and control classes of 0.819 (Table 2) and for the *posttest* of 0.118 (Table 3). In both the homogeneity test of learning motivation and the homogeneity test based on mean *posttest* scores, the significance values were greater than 0.05. This confirms that the variances between groups were homogeneous. The research data therefore met the assumptions for parametric analysis using the *t-test* and MANOVA.

Table 2**.** Test of Homogeneity of Learning Motivation

Variable	**Basis**	**Levene Statistic**	**df1**	**df2**	**Sig.**
Motivation	Based on mean	.053	1	54	.819
	Based on median	.014	1	54	.908
	Based on median and with adjusted df	.014	1	53.072	.908
	Based on trimmed mean	.045	1	54	.883

Source: Research data (IBM SPSS Statistics 25 output).

Table 3**.** Test of Homogeneity of the Control and Experimental Classes Based on Test Scores

Variable	Basis	Levene Statistic	df1	df2	Sig.
Control_PP	Based on mean	2.530	1	54	.118
	Based on median	2.477	1	54	.121
	Based on median and with adjusted df	2.477	1	46.413	.122
	Based on trimmed mean	2.525	1	54	.118
Experimental_PP	Based on mean	.067	1	54	.797
	Based on median	.055	1	54	.816
	Based on median and with adjusted df	.055	1	52.881	.816
	Based on trimmed mean	.065	1	54	.800

Source: Research data (IBM SPSS Statistics 25 output).

Table 4 below presents a summary of the descriptive statistics for the *pretest* and *posttest*. It shows a mean *pretest* score of 20.29 and a mean *posttest* score of 23.18 for a sample of 28 students. The *pretest* had a standard deviation of 2.63, while the *posttest* had a standard deviation of 2.90. Table 5 then shows the correlation between *pretest* and *posttest* scores. The significance value of the correlation between the *pretest* and *posttest* was 0.002, which is less than 0.05. It can therefore be concluded that there was a correlation between the *pretest* and *posttest*.

Table 4**.** Paired Samples Statistics, Control Class

	Score	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Control posttest	23.18	28	2.907	.549
	Control pretest	20.29	28	2.637	.496

Source: Research data (IBM SPSS Statistics 25 output).

Table 5**.** Paired Samples Correlations, Control Class

	Pair	N	Correlation	Sig.
Pair 1	Control posttest & control pretest	28	.549	.002

Source: Research data (IBM SPSS Statistics 25 output).

The criterion for interpreting the *paired-samples t-test* is that if the significance value is < 0.05, there is a significant difference between *pretest* and *posttest* results, whereas if it is > 0.05, there is no significant difference. Based on Table 6, the significance value obtained in the control class was 0.00, with a mean difference of 2.89. This result shows an improvement in learning outcomes in the control class, which used textbooks. However, this improvement still needs to be compared with the achievement of the experimental class to see the extent to which the use of *flipbook* media has a greater effect. The paired-samples statistics and paired-samples test for the experimental class, which used *flipbook* media, are detailed in Tables 7 and 8 below.

Table 6**.** Paired Samples Test, Control Class

Pair	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper			
Control posttest − control pretest	2.893	2.644	.500	1.868	3.918	5.791	27	<.001

Source: Research data (IBM SPSS Statistics 25 output).

Table 7**.** Paired Samples Statistics, Experimental Class

	Score	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Experimental posttest	24.75	28	2.382	.450
	Experimental pretest	22.11	28	2.699	.510

Source: Research data (IBM SPSS Statistics 25 output).

The paired-samples statistics for the experimental class show a mean *pretest* score of 22.11 for a total of 28 students. The standard deviation of the *pretest* was 2.69, while that of the *posttest* was 2.38. The experimental class achieved a mean *posttest* score of 24.75.

Table 8**.** Paired Samples Test, Experimental Class

Pair	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper			
Experimental posttest − experimental pretest	2.643	3.434	.649	1.311	3.974	4.072	27	<.001

Source: Research data (IBM SPSS Statistics 25 output).

The results of the *paired-samples t-test* in the control class show a significance value of 0.000 with a mean pretest–posttest difference of 2.89. This indicates a significant improvement in learning outcomes even though learning used only conventional media in the form of textbooks. This improvement reflects the effect of the routine teaching and learning process, but its effectiveness relative to innovative media cannot yet be determined.

In the experimental class, the *paired-samples t-test* also shows a significant difference between the *pretest* and *posttest*, with a significance value of 0.001 and a mean difference of 2.643. This finding confirms that the use of *flipbook* media can significantly improve students' learning outcomes compared with their initial abilities. This improvement shows that interactive digital media make a positive contribution to the mathematics learning process in the experimental class.

Table 9 shows the results of the learning motivation questionnaire. The control class, with 28 students, had a mean score of 59.21, while the experimental class, also with 28 students, had a mean score of 62.14. The standard deviation was 3.54 for the control class and 3.69 for the experimental class. The mean of the experimental group exceeded that of the control group. The mean difference between the control and experimental groups is shown in Table 10.

Table 9**.** Group Statistics of Learning Motivation

Variable	Class	N	Mean	Std. Deviation	Std. Error Mean
Motivation	Control	28	59.21	3.542	.669
	Experimental	28	62.14	3.699	.699

Source: Research data (IBM SPSS Statistics 25 output).

The significance value for equal variances assumed shows the result of the parametric test applied to the responses to the learning motivation questionnaire. Table 10 below shows a significance value of 0.004. This result indicates a difference between the control and experimental groups, as the significance value from the data output is lower than the decision criterion. The decision criterion is that if the significance value is below 0.05, there is a significant difference in learning motivation between the control and experimental classes.

Table 10**.** Independent Samples Test of Learning Motivation

		Levene's Test for Equality of Variances		t-Test for Equality of Means					95% CI of the Difference	
Variable	Assumption	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Motivation	Equal variances assumed	.053	.819	−3.026	54	.004	−2.929	.968	−4.869	−.988
	Equal variances not assumed			−3.026	53.899	.004	−2.929	.968	−4.869	−.988

Source: Research data (IBM SPSS Statistics 25 output).

These results lead the researchers to conclude that the use of *flipbooks* significantly affects elementary school children's learning motivation. The analysis of these values supports the study's hypothesis of a significant difference in learning motivation between the control and experimental classes, that is, between the class using conventional media and the class using *flipbook* media.

The data were then tested to compare the control and experimental groups based on the *posttest* results (Table 11). The control and experimental groups each consisted of 28 students. The results show a difference in means between the two groups, with the experimental group achieving a higher mean than the control group. Table 12 below presents the results of the analysis used to confirm the difference in mean *posttest* scores between the control and experimental classes.

Table 11**.** Group Statistics of Cognitive Learning Outcomes

Score	Class	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Control	28	20.29	2.637	.498
	Experimental	28	22.11	2.699	.510
Posttest	Control	28	23.18	2.907	.549
	Experimental	28	24.75	2.382	.450

Source: Research data (IBM SPSS Statistics 25 output).

Table 12**.** Independent Samples Test of Cognitive Learning Outcomes

		Levene's Test for Equality of Variances		t-Test for Equality of Means					95% CI of the Difference	
Variable	**Assumption**	**F**	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
Pretest	Equal variances assumed	.046	.831	−2.554	54	.013	−1.821	.713	−3.251	−.392
	Equal variances not assumed			−2.554	53.971	.013	−1.821	.713	−3.251	−.392
Posttest	Equal variances assumed	1.566	.216	−2.213	54	.031	−1.571	.710	−2.995	−.147
	Equal variances not assumed			−2.213	51.997	.031	−1.571	.710	−2.997	−.146

Source: Research data (IBM SPSS Statistics 25 output).

The table above shows that the significance value for cognitive learning outcomes is 0.013, which is below 0.05. This result shows a substantial difference in learning outcomes between the control and experimental classes. The analysis of these values supports the hypothesis of this study, indicating a significant effect that distinguishes the control group, which used conventional media, from the experimental group, which used *flipbook* media.

The results of the *independent-samples t-test* show a significant difference between the control and experimental groups. For learning motivation, the mean *posttest* score of the experimental group (62.14) was higher than that of the control group (59.21), with a significance value of 0.004 (< 0.05). Likewise, for cognitive learning outcomes, the experimental group obtained a mean *posttest* score of 24.75, compared with 23.18 for the control group. A significance value of 0.013 (< 0.05) confirms a significant difference between the two groups. Learning with *flipbooks* has thus proven more effective than conventional media in improving students' motivation and cognitive learning outcomes in mathematics.

A multivariate analysis of variance (MANOVA) was used to examine the simultaneous effect of *flipbooks* on motivation and cognitive learning outcomes. The analysis yielded a significance value of 0.01 (< 0.05), meaning that the use of *flipbook* media had a significant simultaneous effect on both dependent variables.

Table 13**.** MANOVA Results: Tests of Between-Subjects Effects

Source	**Dependent Variable**	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected model	Motivation	120.071[a]	1	120.071	9.156	.004
	Control_PP	156.446[b]	1	154.446	19.371	<.001
	Experimental_PP	54.018[c]	1	54.018	7.726	.007
Intercept	Motivation	206185.786	1	206185.786	15722.862	<.001
	Control_PP	26448.018	1	26448.018	3317.862	<.001
	Experimental_PP	30039.446	1	30039.446	4296.627	<.001
Class	Motivation	120.071	1	120.071	9.156	.004
	Control_PP	154.446	1	154.446	19.371	<.001
	Experimental_PP	54.018	1	54.018	7.726	.007
Error	Motivation	708.143	54	13.114		

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
	Control_PP	430.143	54	7.973		
	Experimental_PP	377.536	54	6.991		
Total	Motivation	207014.000	56			
	Control_PP	27033.000	56			
	Experimental_PP	30471.000	56			
Corrected total	Motivation	828.214	55			
	Control_PP	584.982	55			
	Experimental_PP	431.554	55			

a. R squared = .145 (adjusted R squared = .129). b. R squared = .256 (adjusted R squared = .250). c. R squared = .125 (adjusted R squared = .109).

Source: Research data (IBM SPSS Statistics 25 output).

The results show that the use of *flipbooks* can improve students' cognitive learning outcomes. In the experimental class, the mean *posttest* score reached 24.75, higher than the control class's 23.18, with a significance value of 0.013 (< 0.05). This shows that *flipbooks* are significantly more effective than conventional media in improving students' understanding. This finding is also in line with the multimedia learning theory proposed by Mayer and Clark, which states that learning is more effective when information is presented through a combination of text, visuals, and audio.[20] The visual and interactive features of *flipbooks* make mathematical concepts easier to understand.[21] This finding is also consistent with the study by Rahayu and Handayani, which confirms the effectiveness of interactive digital media in improving students' understanding.[22]

Besides affecting learning outcomes, *flipbooks* have also been shown to increase students' learning motivation. The questionnaire results show that the mean learning motivation of students in the experimental class was 62.14, higher than the control class's 59.21, with a significance of 0.004 (< 0.05). This means that the use of *flipbooks* provided a significant motivational boost for students. The attractive and interactive display and the ability to adapt to students' learning styles foster enthusiasm for learning. This finding supports Sari's research[23] and is in line with theories of learning motivation proposed by other researchers.[24,25]

[20] Clark and Mayer, *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*; Mayer, *Multimedia Learning*.

[21] Rahayu et al., "Penerapan Media Pembelajaran Flipbook Interaktif Untuk Memingkatkan Hasil Belajar Siswa"; Triwahyuningtyas et al., "The Problem-Based Learning e-Module of Planes Using Kvisoft Flipbook Maker for Elementary School Students."

[22] Widodo, "Efektivitas Media Flipbook Dalam Pembelajaran Geometri Untuk Meningkatkan Pemahaman Siswa SD."

[23] Sari, "Pengaruh Penggunaan Media Pembelajaran Berbasis Teknologi Terhadap Motivasi Belajar Siswa."

[24] Uno, *Teori Motivasi Dan Pengukurannya*.

[25] Dimyati and Mudjiono, *Belajar Dan Pembelajaran*.

These results are consistent with the studies by Wijaya et al.[26] and by Siano and Potane,[27] which found that the use of interactive e-books significantly improved students' academic achievement in mathematics learning. Similarly, Atikah et al. and Choirin Attalina et al.[28] state that integrating Kvisoft *Flipbook* Maker into learning can strengthen students' conceptual understanding through attractive and contextual multimodal presentation of information. This is further supported by Yuyun et al.,[29] who show that a *flipbook*-based e-module not only improves understanding but also strengthens students' motivation and curiosity about the subject matter.

The improvement in learning outcomes found in this study can also be explained through a constructivist approach, in which students actively construct their knowledge through interactive digital learning experiences. With *flipbooks*, students can control their learning pace, repeat parts they have not understood, and connect visual concepts with textual explanations.[30] This differs from conventional one-way learning, in which students are more passive in receiving information. Besides affecting cognitive learning outcomes, *flipbooks* have also been shown to increase students' learning motivation. The attractive display, interactive navigation, and audio-visual elements of *flipbooks* create an enjoyable learning atmosphere and reduce students' boredom.[31]

Research by Pratama also shows that digital learning media increase intrinsic motivation because they foster curiosity and learning satisfaction.[32] These findings show that *flipbooks* can fulfill two main functions of learning media, namely as a means of delivering information and as a motivational tool.[33,34]

The MANOVA results show that learning motivation makes a major contribution to improving cognitive learning outcomes. Students with high motivation tend to show greater

[26] Wijaya et al., "A Meta-Analysis of the Effects of E-Books on Students' Mathematics Achievement."

[27] Siano and Potane, "Using Interactive E-Books to Improve Students' Academic Achievement in Mathematics."

[28] Atikah et al., "E-Module Mathematics by Using Kvisoft Flipbook in Elementary School"; Choirin Attalina et al., "Efektivitas Media Pembelajaran Berbasis Virtual Reality (Vr) Untuk Meningkatkan Kemampuan Pemahaman Materi Pada Siswa Sekolah Dasar."

[29] Yuyun et al., "Developing Flipbook-Based Physics E-Module to Increase Students' Learning Outcome and Motivation."

[30] Fitrianawati and Setiyawati, "Pengembangan Modul Digital Flipbook Dengan Pendekatan Etnomatematika Untuk Materi KPK Dan FPB Pada Kelas IV Sekolah Dasar"; Cholilah et al., "Development of a Flipbook-Based E-Module Integrated with GeoGebra and Genially on Similarity."

[31] Aisyah and Wibowo, "Efforts to Improve Early Reading Skills and Learning Motivation Through Digital Flipbook Media"; Saptono, "The Effectiveness of E-Books in Learning: An Analysis of Trends in Elementary Schools."

[32] Sari, "Pengaruh Penggunaan Media Pembelajaran Berbasis Teknologi Terhadap Motivasi Belajar Siswa."

[33] Uno, *Teori Motivasi Dan Pengukurannya*.

[34] Dimyati and Mudjiono, *Belajar Dan Pembelajaran*.

perseverance in completing tasks and understanding the concepts taught.[35] This correlation between motivation and learning outcomes is in line with previous research, which found that increased learning motivation contributes directly to improved cognitive achievement.[36]

In practical terms, teachers can use *flipbooks* to increase student engagement in learning. This medium can also serve as an environmentally friendly digital alternative because it supports the paperless principle. In addition, *flipbooks* are relevant to the learning needs of the digital era. This study thus confirms that *flipbooks* are effective in improving students' cognitive learning outcomes and learning motivation and have a simultaneous effect on both.

The results of this study reinforce multimedia theory, which holds that learning based on a combination of text, images, and animation can strengthen students' retention and conceptual understanding.[37] These findings are also in line with the meta-analysis by Wijaya et al., which shows that e-books and interactive digital media have a significant effect on improving mathematics learning outcomes.[38] In practical terms, this study provides a basis for elementary school teachers to integrate *flipbook* media into learning in order to increase student engagement and motivation. The use of *flipbooks* can become part of a digital learning strategy in the modern era that emphasizes paperless and personalized learning. In addition, school policy support and teacher training are important factors for implementing digital media such as *flipbooks* effectively and sustainably.[39]

These findings also support the view that interactive digital media such as *flipbooks* can strengthen students' cognitive and affective engagement in elementary school mathematics. Besides being relevant to the needs of twenty-first-century education, the use of *flipbooks* is also in line with national education policy, which emphasizes digital transformation in teaching and learning. The results of this study thus strengthen the empirical evidence that *flipbook* media are not merely visual aids but pedagogical instruments that can improve the quality of students' learning experience comprehensively.

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[35] Sardiman A. M., *Interaksi Dan Motivasi Belajar Mengajar*; Schunk, "Learning Theories: An Educational Perspective."

[36] Triwahyuningtyas et al., "E-Module of Cube and Beam Based on Inquiry for Five Grade Students of Elementary School."

[37] Clark and Mayer, *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*; Mayer, *Multimedia Learning*.

[38] Wijaya et al., "A Meta-Analysis of the Effects of E-Books on Students' Mathematics Achievement"; Siano and Potane, "Using Interactive E-Books to Improve Students' Academic Achievement in Mathematics."

[39] Aisyah and Wibowo, "Efforts to Improve Early Reading Skills and Learning Motivation Through Digital Flipbook Media"; Saptono, "The Effectiveness of E-Books in Learning: An Analysis of Trends in Elementary Schools"; Triwahyuningtyas et al., "The Problem-Based Learning e-Module of Planes Using Kvisoft Flipbook Maker for Elementary School Students."

CONCLUSION

The results of this study confirm that the use of *flipbook* media contributes significantly to improving elementary school students' motivation and cognitive achievement in mathematics. The difference in achievement between the experimental and control groups shows that integrating interactive digital media can strengthen learning engagement as well as the effectiveness of conceptual understanding. Simultaneously, *flipbooks* serve not only as a medium for delivering material but also as a motivational trigger that directly affects the quality of learning outcomes.

In practical terms, these findings show that elementary school mathematics teachers can use *flipbooks* as a pedagogical strategy to address students' low motivation and cognitive achievement. Institutional support, through the provision of facilities and teacher training, is needed so that the use of similar digital media can be sustained. Theoretically, this study reinforces Mayer's multimedia theory that the combination of text and interactive visuals improves retention and conceptual understanding.

This study has several limitations. First, the sample was limited to two elementary schools and the lower grades, which limits the generalizability of the results. Second, the intervention was relatively short, so long-term effects could not be observed. Third, the analysis covered only motivation and cognitive learning outcomes, while affective and psychomotor aspects were not examined. These limitations open opportunities for future research to broaden the context, extend the intervention period, and include more comprehensive dimensions of learning outcomes.

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