The Effectiveness of Flipbook-Based Blanded Leaning Technology on Thinking Skills and Student Learning Outcomes

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ABSTRACT

This study uses a quasi-experimental design to examine the effectiveness of a flipbook-based blended learning method on student learning outcomes at SMPN 3 Banjarmasin. Participants included an experimental group (n=30) utilizing the flipbook-based method and a control group (n=31) using traditional approaches. Pre-test and post-test assessments measured learning outcomes. Results showed that the experimental group significantly outperformed the control group, achieving an average post-test score of 85.97 compared to 75.90, with a mean difference of 10.06 (p < 0.001). ANCOVA analysis demonstrated the learning method's significant impact on post-test scores (F = 15.508, p < 0.001), independent of pre-test performance (F = 0.032, p = 0.860). Residual analysis raised concerns about the assumptions of linearity and normal distribution, warranting further validation of the model. The learning method accounted for 25% of post-test score variability, suggesting the influence of additional factors. These findings affirm the method's effectiveness and call for comprehensive model assessments in educational studies.

Keywords:

Blended Learning; Flip Book; Critical Thinking; Learning Outcomes.

ABSTRAK

Penelitian ini mengkaji efektivitas metode pembelajaran campuran berbasis flipbook terhadap hasil belajar siswa di SMPN 3 Banjarmasin melalui desain kuasi-eksperimen. Peserta terdiri dari kelompok eksperimen (n=30) yang menggunakan metode berbasis flipbook dan kelompok kontrol (n=31) yang menggunakan pendekatan tradisional. Penilaian dilakukan melalui pre-test

dan post-test untuk mengukur hasil belajar. Hasil menunjukkan bahwa kelompok eksperimen secara signifikan mengungguli kelompok kontrol dengan skor rata-rata post-test sebesar 85,97 dibandingkan 75,90, dengan selisih rata-rata 10,06 (p < 0,001). Analisis ANCOVA menunjukkan bahwa metode pembelajaran memiliki pengaruh signifikan terhadap skor post-test (F = 15,508, p < 0,001), terlepas dari skor pre-test (F = 0,032, p = 0,860). Analisis residual mengindikasikan perlunya validasi lebih lanjut terhadap asumsi linearitas dan distribusi normal. Metode pembelajaran ini menjelaskan 25% variabilitas skor post-test, menunjukkan pengaruh faktor tambahan lainnya. Temuan ini menegaskan efektivitas metode berbasis flipbook dan pentingnya evaluasi model yang komprehensif dalam penelitian pendidikan.

Kata kunci:

Blended Learning; Flip Book; Berfikir Kritis; Hasil Belajar.

1. Introduction

The rapid evolution of information and communication technology has fundamentally transformed educational paradigms, compelling educators and researchers to continuously reimagine pedagogical approaches (Kumar et al., 2021; Yu, Dai, & Wang, 2023; Z. Zhang & Huang, 2024). Blended learning emerges as a sophisticated instructional model that strategically integrates traditional face-to-face instruction with digital online learning environments, offering unprecedented flexibility and accessibility for contemporary learners. This hybrid approach transcends traditional educational boundaries and leverages technological innovations to enhance cognitive engagement and learning outcomes across diverse educational contexts.

Digital flipbooks represent a promising technological innovation within blended learning frameworks, offering an interactive and dynamic mediation of educational content. These digital publications simulate traditional printed books while introducing sophisticated interactive features that transform passive reading experiences into active learning opportunities. The technological affordances of digital flipbooks include page-turning animations, embedded multimedia elements, and interactive annotations, which potentially scaffold deeper cognitive processing and promote more engaging knowledge construction for students.

The intersection of blended learning methodology and digital flipbook technology presents a compelling research landscape for understanding technology-enhanced learning environments. Empirical investigations are critically needed to systematically examine how these innovative digital tools can be strategically integrated into educational practices to optimize student learning experiences. By exploring the pedagogical potential of digital flipbooks within blended learning contexts, researchers can contribute meaningful insights into emerging educational technologies and their transformative potential in contemporary educational ecosystems.

The novelty of this study lies in the integration of flipbook technology in the blended learning model, which has not been explored before, especially in the context of developing thinking skills and achieving student learning outcomes. This study not only evaluates the effectiveness of using flipbooks as a learning aid but also compares its impact with traditional and blended learning methods that do not involve flipbooks. Previous research has shown various results related to the effectiveness of blended learning. Identifying that blended learning can improve student learning outcomes through

increased interaction and accessibility of materials (Novitasari, Listiani, & Prasasti, 2023; Sudiarta & Sadra, 2016; Syarifuddin, Aisyah, & Triana, 2022). Meanwhile, studies show blended learning often contributes to increased student motivation and engagement compared to conventional learning methods.

However, the research generally does not focus on the specific integration of technologies such as flipbooks in blended learning (Anggraeni, Supriana, & Hidayat, 2019; Angin & Juwitaningsih, 2023; Darmawan, 2013; Fadhilatunisa, Fakhri, & Rosidah, 2020). In addition, research that explores the use of multimedia technology in education and finds that technology that provides visual and multimedia interaction can improve students' conceptual understanding and thinking skills (Mutiani, Supriatna, Abbas, Rini, & Subiyakto, 2021; Nuha, Wahyuni, Budiarso, Hasanah, & Anggraini, 2021; Syarifuddin, St. Aisyah. Jumriadi, 2024).

However, there has been no study that specifically assesses the effectiveness of digital flipbooks in this context, thus providing space for this research to fill the gap. This study explores the effectiveness of flipbook-based blended learning technology on students' thinking skills and learning outcomes.

Considering the increasingly diverse and demanding educational needs, it is important to evaluate how integrating flipbooks in blended learning models can affect students' learning processes and academic outcomes. Thinking skills, which include analytical, synthetic, and evaluation skills, as well as learning outcomes measured by students' academic achievement, are the main focus of this study. Through a quantitative approach, this study will analyze the impact of using flipbooks in blended learning on these two aspects. The results of this study are expected to provide valuable insights for educators and policymakers in designing more effective and innovative learning strategies. Thus, this research contributes to developing educational theories and more effective educational practices in today's digital era.

2. Methods

2.1. Research Design

This study employed a quasi-experimental design to evaluate the impact of a flipbook-based blended learning model on students' critical thinking skills and academic performance in social studies. The design involved two groups: an experimental group, which engaged in learning through the innovative flipbook-based blended learning model, and a control group, which followed traditional teaching methods devoid of flipbook integration. The quasi-experimental approach allowed for a comparative analysis of the outcomes between these two groups, offering insights into the effectiveness of the intervention.

2.2 Population and Sample

The research was conducted at 3rd Junior High School Banjarmasin, geographically located at coordinates -3.3108° S, 114.5861° E. The study population comprised all students enrolled in the institution during the research period. A purposive sampling technique was utilized to select participants, resulting in an experimental group of 30 students and a control group of 31 students. This sampling strategy ensured a balanced representation of learners for the intervention and control conditions.

2.3 Data Collection

Data collection involved instruments; learning outcome assessments were designed to evaluate students' academic performance and mastery of social studies content. The instrument was administered to the experimental and control groups before and after the intervention.

2.4 Validity and Reliability

To ensure the validity and reliability of the instruments, the critical thinking skills test and learning outcome assessments were pilot-tested with a separate group of students before the main study. Adjustments were made based on pilot test results to enhance the precision and applicability of the instruments.

2.5 Data Analysis

Data collected during the study were analyzed using SPSS version 29, employing a systematic approach to ensure accuracy and reliability: 1) Normality Test: A normality test was conducted to verify the distribution of the dataset. This step was crucial for determining the appropriateness of subsequent statistical tests; 2) Independent Samples t-test: This test was applied to compare the mean scores of critical thinking skills and learning outcomes between the experimental and control groups. It provided insights into whether the observed differences were statistically significant; and 3) Analysis of Variance (ANOVA): In cases where data variance was unequal, or the assumption of normality was not met, ANOVA was used as an alternative statistical method to identify significant differences between groups.

3. Results and Discussion

Implementing Project Learning integrated with digital flipbook technology revealed significant insights into enhancing students' critical thinking capabilities. Statistical analysis using Analysis of Covariance (ANCOVA) demonstrated a nuanced understanding of the intervention's effectiveness across multiple cognitive domains. The comparative examination between experimental and control classes provided empirical evidence of the method's potential to systematically develop higher-order thinking skills (Geng, Law, & Niu, 2019; Park & Doo, 2024; Zen, Reflianto, Ariani, & Hidayati, 2023).

The critical thinking skill assessment focused on four pivotal cognitive indicators: fluency (ability to generate multiple ideas), flexibility (adaptive thinking approaches), originality (innovative conceptualization), and elaboration (comprehensive problem deciphering). Statistical findings revealed substantial variations in performance between experimental and control groups, suggesting that the project-based learning approach combined with digital flipbook technology creates a more conducive environment for cognitive skill development. The ANCOVA test results indicated statistically significant differences that underscore the potential of technology-enhanced pedagogical interventions. A comprehensive data analysis highlights the transformative potential of integrating advanced technological tools with constructivist learning methodologies. The observed variations in critical thinking skill development suggest that innovative pedagogical approaches can substantially mediate cognitive growth (Fortune & Suranto, 2023; Poon, 2013). While the findings demonstrate promising outcomes, they invite further investigation into the complex interactions between technological interventions, learning design, and cognitive skill enhancement. Future research should

continue exploring the nuanced mechanisms through which digital educational technologies can optimize learning experiences and foster higher-order thinking capabilities.

Table 1. Average students' thinking skills

Group Statistics					
	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Learning outcomes	Control	31	75.9032	10.13033	1.81946
	Eksperimen	30	85.9667	7.36011	1.34377

Source: SPPS 29 data processing

The data in Table 1 compares average thinking skills between a control group and an experimental group. The control group, which included 31 students, achieved a mean score of 75.9032 in learning outcomes, with a standard deviation of 10.13033 and a standard error mean of 1.81946. In contrast, the experimental group, composed of 30 students, attained a significantly higher mean score of 85.9667, with a lower standard deviation of 7.36011 and a standard error mean of 1.34377. These results suggest a marked improvement in thinking skills among students in the experimental group.

The data highlights the effectiveness of the intervention applied to the experimental group. Their higher mean score and reduced standard deviation indicate superior cognitive performance and greater consistency in learning outcomes. This supports prior research suggesting innovative instructional strategies can enhance cognitive skills and improve educational achievement (ElSayad, 2023; Usman, Lestari, Siregar, Rafiqa, & Sentryo, 2024). The experimental group's smaller standard error further reinforces the reliability of the observed difference.

This comparison aligns with the body of literature emphasizing the role of active and experiential learning strategies in fostering critical thinking and problem-solving skills (Z. Zhang & Huang, 2024). These findings underscore the importance of employing evidence-based teaching practices to support cognitive development in students.

Future research should explore the scalability and applicability of such interventions in broader educational contexts. Preliminary data show that the flipbook-based learning method in the experimental group produces higher and more consistent learning outcome values than the traditional method in the control group. The results of this study are in line with previous research which states that the blended learning model not only increases the average learning outcome score but also produces more consistent results and more accurate estimates (Andini & Fitriana, 2018; B & Purwatiningsih, 2023; Nurhidayati, Putro, & Widiyaningtyas, 2018; Ristanto, Rusdi, Mahardika, Darmawan, & Ismirawati, 2020).

Table 2. Results of the T-Test of students' thinking skills

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
						Significance		Mean Differe	Std. Error Differe		
						One-Sided p	Two-Sided p				
		F	Sig.	t	df			nce	nce	Lower	Upper
Learning outcomes	Equal variances assumed	1.308	.257	-4.426	59	<,001	<,001	-10.063 44	2.2735 7	-14.612 85	-5.5140 3
	Equal variances not assumed			-4.4490	54.79	<,001	<,001	-10.063 44	2.2618 9	-14.596 76	-5.5301 2

Source: SPPS 29 data processing

   Based on the results of the analysis of the t-test of the p-value value (Sig. Two-Tailed) for both assumptions of variance (with the same and unequal variance) is <0.001. This shows that the difference in the average learning outcome score between the experimental group and the control group is statistically significant. The mean value difference between the experimental and control groups was -10.06344. Since this value is negative, it indicates that the experimental group has a higher average learning outcome score compared to the control group. The confidence interval for the mean difference in values is between -14.61285 and -5.51403 (for the same variance assumption) or between -14.59676 and -5.53012 (for the variance assumption is not the same). Since this interval does not cover zero, it confirms that the mean difference between the two groups is statistically significant. The data showed a significant difference in learning outcomes between students who participated in learning with a flipbook-based blended learning model (experimental group) and students who followed traditional methods (control group). The experimental group had significantly better learning outcomes compared to the control group. These differences are consistent regardless of the assumption of the same or unequal variance.

   Furthermore, the cognitive learning outcomes data in the form of pre-test and post-test scores were analyzed using the Anakova test to determine the influence of the Flipbook-based Project Based-Learning learning model (Table). The results of the Anacova test analysis show a significance level of 0.000 <0.05, which means that the Blended Learning learning model using flipbooks influences student learning outcomes. This research is consistent with the results of previous research which shows that blended learning methods, especially technology-based ones, provide significant benefits compared to traditional methods. Statistically significant differences in learning outcomes and measurable positive influences indicate an effective method for improving student learning outcomes (Muhayyang, Limbong, & Ariyani, 2021; Rahmadani & í, 2023; W. Zhang & Zhu, 2017).

Table 3. ANCOVA test data student learning outcomes

Tests of Between-Subjects Effects

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1546.527[a]	2	773.264	9.651	<,001
Intercept	5921.161	1	5921.161	73.901	<,001
Pretest	2.531	1	2.531	.032	.860
Metode	1242.549	1	1242.549	15.508	<,001
Error	4647.145	58	80.123		
Total	404958.000	61			
Corrected Total	6193.672	60			

a. R Squared = .250 (Adjusted R Squared = .224)

Source: SPPS 29 data processing

The statistical analysis of educational intervention effectiveness employed Analysis of Covariance (ANCOVA) to examine the intricate dynamics of learning methodologies and their impact on student outcomes. This sophisticated analytical approach provides a nuanced examination of the complex interrelationships between initial baseline measurements, instructional strategies, and subsequent academic performance. The overall model demonstrated remarkable statistical significance, with an F value of 9.651 and a p-value of <0.001. This robust statistical finding indicates the model's substantial explanatory power in analyzing variations in posttest scores, suggesting that the selected variables offer meaningful insights into educational intervention effectiveness (Kumar et al., 2021; Sala et al., 2024).

A critical analysis focused on the pretest variable, revealing an intriguing statistical pattern. With an F value of 0.032 and a p-value of 0.860, the initial baseline measurements demonstrated no significant influence on subsequent posttest results. This unexpected finding challenges traditional assumptions about the predictive power of initial student knowledge states (Geng et al., 2019). The lack of significant correlation between pretest and posttest scores implies a more complex understanding of learning dynamics. It suggests that the effectiveness of an educational intervention may be more directly attributed to the implemented instructional approach rather than students' initial knowledge baseline. This insight opens new avenues for understanding pedagogical effectiveness beyond conventional measurement approaches (Poon, 2013).

The learning method variable analysis emerged as the most compelling component of the research, yielding an F value of 15.508 with a p-value of <0.001. These statistically significant results unequivocally underscore the substantial impact of instructional methodology on student learning outcomes. The comparative analysis between flipbook-based blended learning and traditional teaching methods revealed significant differences in post-test performance. A quantitative assessment of the model's explanatory capacity revealed nuanced insights. The R-squared value of 0.250 indicates that the identified variables account for approximately 25% of the variance in post-test scores. The adjusted R Squared of 0.224 provides a more conservative estimate, suggesting a complex interplay

of factors influencing student learning beyond the immediately observable variables (Kumar et al., 2021). The research contributes significantly to the growing literature exploring effective pedagogical strategies in contemporary educational contexts. It challenges traditional assumptions about learning measurement and highlights the potential of innovative instructional approaches to transform educational outcomes. The findings suggest that alternative methodologies, such as flipbook-based blended learning, may offer promising alternatives to conventional teaching methods.

Despite robust statistical analysis, the researchers acknowledge the inherent limitations of explaining only 22.4% of the post-test score variability. This measured approach demonstrates academic rigor and provides a transparent assessment of the research's scope and potential areas for future investigation. The partial explanatory power invites continued scholarly exploration of educational intervention mechanisms. The implications of this research extend beyond immediate statistical findings. By highlighting the significant impact of learning methodologies, the study provides valuable insights for educational practitioners, curriculum developers, and policymakers. It underscores the importance of innovative approaches in addressing diverse learning needs and enhancing student academic performance. Ultimately, the research is a critical contribution to understanding the complex dynamics of educational interventions. It exemplifies the potential of sophisticated statistical analysis to unravel the intricate learning mechanisms while simultaneously acknowledging the multifaceted nature of educational processes. The findings invite continued scholarly dialogue and research into effective pedagogical strategies that can meaningfully improve student learning outcomes.
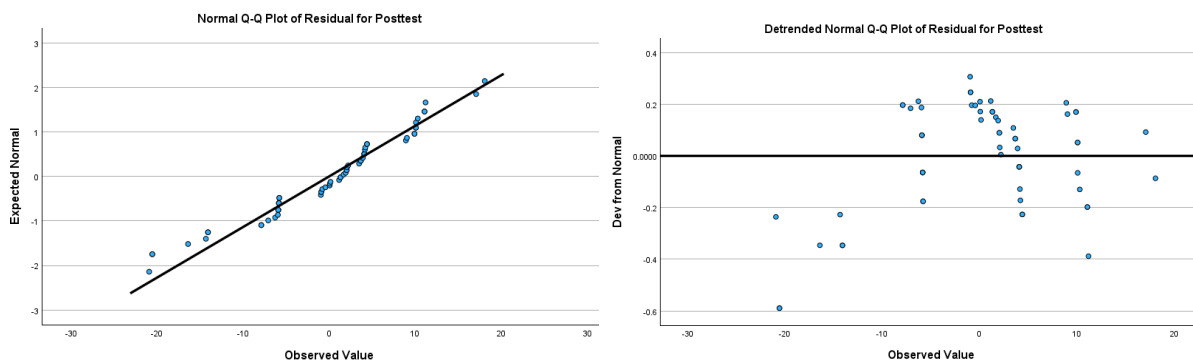
Figure 1. Linear data distribution of student learning outcomes

The ANCOVA test is widely recognized for its ability to control for covariate effects and evaluate the differences between groups on a dependent variable. One of the critical assumptions of ANCOVA is linearity, which requires that the relationship between an independent variable, such as a learning method, and the dependent variable, such as posttest scores, remains linear after accounting for the covariate variable, typically pretest scores. Ensuring linearity is fundamental to the validity of ANCOVA results, as violations of this assumption may compromise the reliability of the findings (Sala et al., 2024).

In this study, the ANCOVA test results indicate that the model effectively differentiates between learning methods in terms of their impact on post-test scores. However, further evaluation of the linearity assumption is necessary to substantiate the validity of these findings. Specifically, the

relationship between the covariate (pretest) and the dependent variable (posttest) must be scrutinized to confirm that it adheres to the linear model. Without this verification, the results could be misinterpreted, potentially undermining the reliability of conclusions regarding the effectiveness of the learning methods (Banda & Nzabahimana, 2023; Glaser & Brunstein, 2007).

If the linearity assumption is unmet, additional diagnostic measures such as residual plots and regression analysis should be undertaken to verify the model's accuracy. These steps ensure that any deviation from the linear relationship is appropriately addressed, enhancing the ANCOVA analysis's robustness. According to (Hair, Hollingsworth, Randolph, & Chong, 2017), examining residuals can provide critical insights into the underlying assumptions and help mitigate potential biases in the model.

The emergence of innovative pedagogical approaches continues to transform educational landscapes, with blended learning models presenting particularly promising trajectories for enhanced student engagement and academic performance. In this context, the current study investigates the efficacy of a flipbook-based blended learning methodology, employing a rigorous empirical approach to understand its potential impact on student learning outcomes (Park & Doo, 2024).

This comprehensive research reveals a nuanced relationship between the flipbook-based blended learning model and student achievement, demonstrating that approximately 25% of the variability in post-test scores can be attributed to this innovative instructional method. This statistically significant result visualized comprehensively in Figure 1, provides empirical evidence of the model's substantive contribution to educational effectiveness while simultaneously acknowledging the complex, multifaceted nature of learning processes (Fortune & Suranto, 2023).

Statistical analysis underscores that while the flipbook-based blended learning approach represents a substantial explanatory factor, it does not encompass all student learning variations. The remaining 75% of score variability suggests the profound influence of external variables such as individual learner characteristics, prior knowledge, motivation, and contextual learning environments. This observation necessitates a holistic and interdisciplinary approach to understanding educational interventions and their potential impact (İşçi & Yazici, 2023).

Its commitment to comprehensive validation processes further emphasizes the study's methodological rigor. By critically examining model assumptions and advocating for the incorporation of additional explanatory variables, the research contributes to a more sophisticated understanding of blended learning's potential. Such an approach aligns with contemporary scholarly recommendations for nuanced, context-sensitive educational research methodologies (Geng et al., 2019; Yu et al., 2023; H. Zhang, 2024).

Moreover, the research highlights the transformative potential of technology-enhanced learning strategies, positioning the flipbook-based blended learning model as a promising avenue for pedagogical innovation. The findings suggest that strategically designed technological interventions can significantly augment traditional educational approaches, creating more dynamic, interactive, and personalized learning experiences that cater to diverse student needs and preferences (Maharani et al., 2024).

Ultimately, this study critically contributes to the growing body of literature on technology-mediated education, offering theoretical insights and practical recommendations for educators and

instructional designers. The research invites further investigation and dialogue about the future of technology-enhanced pedagogical strategies by elucidating the complex interplay between innovative learning models and student outcomes. The methodological transparency and analytical depth demonstrated herein are a robust foundation for subsequent research endeavors to optimize educational interventions in an increasingly digital learning landscape (Turkay, 2022).

4. Conclusion

This study shows that the flipbook-based learning method in the blended learning model significantly improves student learning outcomes compared to the traditional method. The data show that the experimental group using this method has a higher and more consistent average learning outcome score than the control group. Statistical tests, including t-test and ANCOVA, showed a significant difference between the two groups, with the experimental group obtaining statistically better results. This indicates that implementing the flipbook-based learning method effectively improves critical thinking skills and student learning outcomes. However, although the flipbook-based learning model was proven to have a positive impact, the analysis also showed that other factors influenced the post-test results outside the variables tested. After controlling for the learning method variable, the pretest score did not significantly affect the posttest results, indicating that the differences in learning outcomes were more influenced by the method applied. This study provides additional evidence regarding the effectiveness of technology-based blended learning but also emphasizes the need for further research to explore other factors that may influence student learning outcomes.

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