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Deep Learning Based Flipbook Media to Improve Descriptive Text Learning in Elementary Schools

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Abstract: This study aims to analyze the effectiveness of a deep-learning approach assisted by flipbook media in improving Indonesian language learning outcomes on descriptive-text material for elementary students. The research involved 22 fifth-grade students at SD Negeri Salamrejo, Kulon Progo. A quantitative one-group pretest-posttest pre-experimental design was employed, with data collected through a validated multiple-choice test. Analysis included normality and homogeneity tests, Pearson correlation, paired-sample t-test, and normalized gain (N-Gain). The findings indicate a strong positive correlation between pretest and posttest scores ($r = 0.884$, $p < 0.001$), a significant mean difference ($t = –15.11$, $p < 0.001$, 95% CI [–20.17, –15.29]), and an average N-Gain of 0.55, classified as medium improvement. Notably, these findings confirm that integrating deep-learning pedagogy with flipbook media strengthens students' conceptual understanding, critical reflection, and higher-order thinking in descriptive-text learning. The results provide practical guidance for teachers to incorporate interactive flipbook-based activities that foster reflective discussion, contextual examples, and peer feedback, thereby enriching classroom practices and supporting the development of 21st-century literacy skills.

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Introduction

In the context of twenty-first century education, students are expected to develop higher-order thinking skills (HOTS), creativity, and digital literacy (Gunartha et al., 2024; Zuhri et al., 2024). The Indonesian national curriculum highlights four competencies (critical thinking, creativity, collaboration, and communication) that align with these demands. Within this framework, digital learning media play an essential role because they enhance access to information, expand vocabulary, and stimulate motivation in learning (Suryanti et al., 2024). Therefore, Indonesian language instruction must be contextual, interactive, and meaningful so students can explore texts deeply with appropriate technological support.

Indonesian language learning at the elementary level forms the foundation for literacy, communication, and character building (Halim, 2021; Suryanti et al., 2024). However, current classroom practices are still dominated by conventional, teacher-centered methods with limited technology integration (Siregar, 2024). This reduces students' active participation and weakens comprehension of text genres, particularly descriptive texts, which require observation, analysis, and detailed critical understanding. Prior studies show that digital flipbooks can significantly increase students' literacy motivation, signalling the importance of more engaging and interactive media (Lailiyah et al., 2024).

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Innovation in Indonesian language education has become increasingly urgent. Digital transformation in schools encourages teachers to adopt adaptive and interactive media that promote student motivation, participation, and critical thinking (Rosmala et al., 2025). Approaches such as authentic text-based learning, digital literacy instruction, and educational games have been reported to enhance student (Purnomo et al., 2024; Vikram et al., 2023). Reviews also indicate that digital media like flipbooks can improve academic achievement and foster 21st-century skills such as creativity and problem-solving (Sasrianti & Agustina, 2025). These findings affirm the need for methods that strengthen critical comprehension and creativity in Indonesian language classrooms.

Deep learning in education emphasises reflective and meaningful learning that goes beyond memorisation. It cultivates comprehensive conceptual understanding through reflection, interaction, and knowledge integration (Kewalramani et al., 2024, Warman et al., 2025). Evidence shows that deep learning improves active participation, critical thinking, and learning motivation among elementary students (Nurdiana, 2024), while fostering learner-centered instruction that contributes to character development (Sumarto, 2025). Thus, deep learning provides a strong pedagogical basis for instructional models aimed at deeper comprehension and contextual application.

A flipbook, meanwhile, is an interactive medium combining text, images, audio, video, and animation. Studies confirm that flipbooks improve students' performance, motivation, creativity, and critical thinking skills (Purnomo et al., 2024, Nafiah et al., 2025). Their multimodal and flexible format supports both classroom and distance learning, making flipbooks suitable for modern pedagogy and digital literacy development (Fikriansyah et al., 2023). These features position flipbooks as promising tools to support deep-learning strategies and to stimulate active engagement with language texts.

The potential synergy between deep learning and flipbooks is evident. Deep learning fosters critical conceptual connections, while flipbooks provide multimodal stimuli to strengthen comprehension. Previous studies that integrated deep learning with other interactive media, such as Canva, showed significant improvement in student achievement (Asmi & Wijayanto, 2025). Similarly, flipbooks have been shown to enhance flexible learning and motivation (Aswanti & Isnaeni, 2023). Yet, empirical studies that combine the reflective engagement of deep learning with the multimodal affordances of flipbooks to enhance critical comprehension of descriptive texts in Bahasa Indonesia are still lacking.

This study fills that gap by introducing an instructional model that unites deep learning and flipbook media for Indonesian language descriptive-text learning. While deep learning has been effective in science and geography (Arina & Isyanto, 2025; Syafril & Junaidin, 2025) and flipbooks in mathematics and literacy (Dauer et al., 2022), no research has specifically examined their combined effect on students' ability to critically comprehend descriptive texts. By focusing on this instructional and cognitive outcome, the study contributes an original approach that enhances critical text comprehension, digital literacy, and higher-order thinking, offering practical insights for teachers and curriculum developers to design more innovative and contextual Indonesian language instruction.

Research Method

This research uses a literature review method with a bibliometric approach to map international scientific publication trends related to solfeggio-based music education during the period 2016–2025. This approach was chosen because it can provide a systematic quantitative synthesis, allowing for the evaluation of the knowledge map formed from

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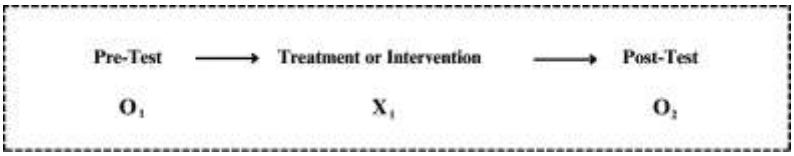

Figure 1. Flow of the Quantitative Study Using a One-Group Pretest–Posttest Pre-Experimental Design (Cranmer, 2017)

Figure 1 presents the flow of this quantitative study, which employed a one-group pretest–posttest pre-experimental design (Ma et al., 2019). The participants were 22 fifth-grade students at SD Negeri Salamrejo, Sentolo District, Kulon Progo Regency, during the 2024/2025 academic year. The entire class was included using a total-sampling technique due to the small population (Campbell et al., 2020). Students received instruction through a deep-learning model supported by flipbook media on descriptive-text material, with observations conducted twice, before the intervention (pretest) and after the intervention (posttest).

The research instrument was a multiple-choice test developed according to the learning indicators of descriptive-text material. Pretest and posttest items were constructed based on the same blueprint to ensure equivalence in both content coverage and cognitive levels (C2–C3) in line with the Merdeka Curriculum. The items focused on key competencies such as identifying text structures, interpreting descriptive details, and analyzing language features. Draft items were validated by two experts in Indonesian language education, while a pilot test involving 10 comparable students yielded a Cronbach's Alpha of 0.82, indicating good reliability (Blanca et al., 2017; Ghasemi & Zahediasl, 2012).

Pretest and posttest data were analyzed using inferential statistics. First, tests of normality and homogeneity were performed to meet the assumptions required for parametric analysis. Next, Pearson's product–moment correlation was used to examine the strength and significance of the relationship between pretest and posttest scores. A paired-sample t-test was then conducted to determine whether the mean difference between pretest and posttest scores was statistically significant, with the significance level set at $\alpha = 0.05$. Finally, instructional effectiveness was assessed using the Normalized Gain (N-Gain) formula as follows:

$$g = \left(\frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}\right)$$

Where:

a) Posttest Score = student's score after the intervention
b) Pretest Score = student's score before the intervention
c) Maximum Score = the highest possible score on the test

The N-Gain value (g) is interpreted using the following commonly accepted categories (Hake, 2000);

Table 1. N-Gain Score Categories and Interpretation

N-Gain (g) Value	Interpretation
$g \geq 0.70$	High improvement
$0.30 \leq g < 0.70$	Medium improvement
$g < 0.30$	Low improvement

Results and Discussion

Flipbook Content and Multimedia Design

The developed flipbook incorporated seven structured components: an introduction with objectives and a competency map, an explanation of descriptive-text concepts with

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authentic examples, multimodal resources (text, images, audio, video), tiered activities from reading to writing, formative quizzes with feedback, an interactive glossary, and a final product task requiring a descriptive paragraph. These elements were designed according to multimedia learning principles (contiguity, signaling, and interactivity) so as to promote dual-channel processing and reduce cognitive load, thereby enabling deeper meaning construction deeply (La Torre & Désiron, 2024; Mayer, 2024; Çeken & Taşkın, 2022).The sequencing of activities encouraged reflection and progressive mastery, allowing students to link new knowledge with prior experiences through text analysis and production, which stimulated higher-order thinking skills and critical literacy (Mayer, 2024; Shalikhah & Nugroho, 2023)

Integrating deep learning with flipbook media also fostered intrinsic motivation, collaboration, and problem-solving as supported by recent studies on digital learning (Indu & Djara, 2025; Kamberi, 2025; Surjanti et al., 2022). Interactive quizzes provided immediate feedback, visualized concepts reinforced comprehension, and final tasks required authentic application of descriptive-text competencies, promoting self-evaluation and sustained engagement (Tuyet et al., 2024). Empirical evidence further indicates that combining deep cognitive strategies with multimodal design significantly improves learning outcomes and digital literacy (Arina & Isyanto, 2025). Accordingly, the flipbook functions not only as a delivery medium but as an adaptive, reflective learning environment that cultivates critical thinking, collaboration, and information literacy—competencies essential for 21st-century learners.

Normality and Homogeneity Test

The normality tests indicated that the pretest scores were normally distributed (Shapiro–Wilk W = 0.945, p = 0.252; Kolmogorov–Smirnov p = 0.117), whereas the posttest scores showed slight deviations (Shapiro–Wilk W = 0.905, p = 0.038; Kolmogorov–Smirnov p = 0.018) (See Table 2). Given the moderate sample size and the robustness of paired-sample t-tests to minor departures from normality, the data remained suitable for parametric analysis (Blanca et al., 2017; Nornadiah & Yap, 2011).

Table 2. Normality test

	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
PreTest	0,166	22	0,117	0,945	22	0,252
Posttest	0,203	22	0,018	0,905	22	0,038

a. Lilliefors Significance Correction

Levene's test further confirmed variance homogeneity between the two measurement points (F = 0.001, p = 0.970), supporting the equivalence of variances across groups (See Table 3). This assumption is critical for ensuring unbiased estimation in paired comparisons (David et al., 2014) and justifies the subsequent use of Pearson correlation and paired-sample t-tests to evaluate the effect of the deep-learning approach with flipbook media on descriptive-text learning outcomes.

Table 3. Homogeneity of Variance

		Levene Statistic	**df1**	**df2**	**Sig.**
Experimental Class Scores	Based on Mean	0,001	1	42	0,970
	Based on Median	0,000	1	42	1,000

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	Based on Median and with adjusted df	0,000	1	41,117	1,000
	Based on trimmed mean	0,000	1	42	1,000

Correlation Analysis

The Pearson product–moment test showed a strong positive correlation between pretest and posttest scores (r = 0.884, p < 0.001, n = 22) (See table 4.). This significant coefficient indicates that students who entered the intervention with higher baseline abilities in descriptive-text learning tended to maintain or even extend their advantage after receiving instruction through the deep-learning model with flipbook support. In other words, while the intervention benefitted all learners, it particularly reinforced the progress of those who already demonstrated stronger initial skills, suggesting a compounding effect of prior knowledge on subsequent achievement.

Table 4. Pearson Product Moment

		Pretest Score	Posttest Score
Pretest Score	Pearson Correlation	1	.884**
	Sig. (2-tailed)		0,000
	N	22	22
Posttest Score	Pearson Correlation	.884**	1
	Sig. (2-tailed)	0,000	
	N	22	22

**. Correlation is significant at the 0.01 level (2-tailed).

This outcome aligns with the theoretical foundations of deep learning, which highlight the importance of conceptual connections, reflective engagement, and active meaning-making through multimodal resources (Järvelä & Järvenoja, 2011). By linking prior knowledge with new experiences, students were able to engage in deeper cognitive processing and critical text analysis. Similar findings have been reported in technology-enhanced language learning studies, where interactive digital media supported high pre–post correlations. Maghsoudi et al. (2022) demonstrated significant literacy improvements from multimodal digital materials, while Rahayu et al. (2024) observed comparable associations in gamified e-learning for elementary students. Together, these results affirm that combining deep-learning strategies with flipbook media can meaningfully strengthen both initial performance and subsequent learning outcomes.

Paired Sample t-Test

The paired-sample t-test revealed a significant difference between the pretest and posttest scores. The mean difference was –17.73 points (SD = 5.51, SE = 1.17), with a 95% confidence interval (CI) ranging from –20.17 to –15.29. The test produced a t-value of –15.11 with 21 degrees of freedom and a p-value < 0.001, indicating a highly significant improvement in student performance after the deep-learning and flipbook intervention. These results clearly demonstrate that the treatment produced a substantial positive effect on students' descriptive-text learning outcomes.

Table 5. Paired sample t-test

Paired Differences								
				95% Confidence interval of the difference				
Pretest & Posttest	Mean	Std.Deviation	Std.Error Mean	Lower	Upper	t	df	Sig.(2-tailed)

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Score	-17.727	5.505	1.174	-20.168	-15.287	-15.105	21	0.000

These results indicate that the integration of deep-learning and flipbook media substantially enhanced students' descriptive-text learning outcomes. The findings align with educational principles that position deep learning as a process of connecting new information with prior knowledge through reflective and analytical tasks (Shao et al., 2025; F. Zhang, 2024). The multimodal features of flipbooks (text, images, audio, and quizzes) foster attention and reduce cognitive overload, thereby optimizing engagement and academic success (Bouchey et al., 2021; Haas & Tussey, 2023). Similar evidence from technology-enhanced instruction confirms that interactive media can significantly improve motivation and performance, as seen in gamified learning studies across mathematics and language contexts (Karabıyık, 2024; Y. Zhang et al., 2024; Chen & Liang, 2022), reinforcing the role of multimedia approaches in creating dynamic and effective learning environments (Wei et al., 2024; Zainol, 2022).

N-Gain Analysis

Based on the pretest and posttest scores of 22 students, the average N-Gain was 0.55, which according to Hake (2000) classification falls in the medium improvement category ($0.30 \leq g < 0.70$). Individual scores ranged from 0.10 to 1.00, with 8 students achieving high improvement ($g \geq 0.70$), 12 students in the medium range, and only 2 students in the low range ($g < 0.30$). This distribution indicates that the majority of students experienced substantial conceptual growth following the deep-learning instruction supported by flipbook media.

This outcome is consistent with contemporary educational paradigms emphasizing technology integration and active learning (Pan & Chen, 2021). The improvement likely stems from the flipbook's capacity to support critical analysis, link prior and new knowledge, and provide immediate feedback for retention (Sastre et al., 2022; Rasalli & Matore, 2023). Moreover, integrating digital resources within a structured approach promotes student autonomy and deeper learning experiences (Seraj et al., 2021). Evidence across studies also highlights that interactive and multimodal methodologies enhance literacy, retention, and language acquisition (Sari & Abrar, 2024), supporting the conclusion that combining deep-learning strategies with flipbook media is effective in strengthening language education globally (Gligorea et al., 2023; Syathroh et al., 2021).

Discussion

The analysis revealed three converging outcomes: a strong positive correlation between pretest and posttest scores ($r = 0.884$, $p < 0.001$), a large mean difference confirmed by the paired-sample t-test ($t = –15.11$, $p < 0.001$, 95% CI [–20.17, –15.29]), and an average N-Gain of 0.55, categorized as medium improvement under Hake's criteria. These findings confirm that integrating a deep-learning approach with flipbook media significantly improved descriptive-text learning outcomes. The upward trends across all metrics suggest that the intervention fostered both knowledge acquisition and critical application skills, which are consistent with the principles of deep conceptual learning (Wong et al., 2024).

Beyond statistical improvements, classroom observations revealed how students demonstrated deep-learning behaviors. Learners frequently engaged in peer discussions, comparing and debating descriptive details across different texts. This exploratory dialogue encouraged them to question their interpretations and refine their understanding, mirroring findings that peer talk can cultivate critical thinking (Liang & Fung, 2020). Some students also introduced new descriptive examples from their everyday environment, which indicated

conceptual transfer by applying classroom learning to real-life contexts (Warman et al., 2025). Others corrected peers' inaccurate descriptions, showing reflective monitoring and collaborative regulation of understanding (Nurdiana, 2024). These behaviors illustrate that the intervention supported both active participation and higher-order thinking in authentic ways.

The multimodal nature of flipbook media helped facilitate these outcomes. By combining text, images, audio, and quizzes, the flipbook offered dual-channel input that maintained attention and reduced extraneous cognitive load (Mayer, 2024). This design provided students with multiple entry points to meaning-making, allowing them to connect prior knowledge with new information more effectively (Pan & Chen, 2021). Observed activities such as visual exploration, oral questioning, and collaborative problem-solving align with previous studies that reported higher student engagement and critical reflection when flipbooks were integrated into classroom practice (Aswanti & Isnaeni, 2023). Thus, the synergy between deep learning strategies and multimedia design appears central to the observed learning gains.

These results are consistent with related research in technology-enhanced language education. Subiyantoro et al. (2024) showed that multimodal compositions support both language acquisition and recovery of lost literacy skills after external disruptions. Similarly, Meilyawati et al. (2025) found that problem-based learning assisted by flipbooks enhanced students' critical thinking and performance. Wong et al. (2024) further demonstrated that low-stakes questioning in multimedia environments promotes self-regulation and conceptual understanding. Taken together, these studies confirm that integrating deep-learning pedagogy with interactive digital media consistently enhances comprehension, reflective engagement, and motivation across different educational contexts.

This study makes a novel theoretical contribution by clarifying how deep-learning principles can be operationalized through multimodal flipbook media. The innovation lies not only in combining two separate approaches but in showing how reflective engagement (critical reflection, synthesis of ideas, and conceptual transfer) emerges in classroom practice through interactive media. By merging deep-learning pedagogy with multimodal tools, the study expands existing theories of technology-enhanced learning by linking reflective cognition with digital interactivity (Kivimäki, 2024). Practically, these results encourage teachers and curriculum developers to integrate flipbook-based strategies into Indonesian language instruction to foster deeper comprehension and critical literacy. Nevertheless, the study's limitations mean the findings should be interpreted cautiously. Future research across multiple schools and longer timelines would strengthen the scalability and sustainability of the model.

Conclusion

This study showed that integrating a deep-learning approach with flipbook media effectively enhanced elementary students' mastery of descriptive-text material and strengthened higher-order thinking skills. The analysis revealed a strong positive correlation between pretest and posttest performance ($r = 0.884$, $p < 0.001$), a significant mean difference ($t = –15.11$, $p < 0.001$), and an average N-Gain of 0.55 classified as medium improvement. These converging outcomes validate the hypothesis that combining deep-learning pedagogy with interactive digital media fosters meaningful learning gains.

The findings indicate that deep learning's core mechanisms, conceptual coherence, critical inquiry, and reflective self-regulation, were successfully activated through the

flipbook's multimodal design. By linking prior knowledge with new concepts and providing real-time feedback, the intervention promoted sustained engagement and deeper conceptual understanding. This synergy between pedagogical strategy and digital media demonstrates how reflective, student-centered instruction can move learners beyond rote memorization toward critical analysis and creative application of language skills.

Moreover, this research offers an original scientific contribution by operationalizing a deep-learning framework within Indonesian language instruction through a digital flipbook platform. It provides empirical evidence that interactive multimedia not only improves descriptive-text achievement but also supports the development of digital literacy and 21st-century competencies such as critical thinking and collaboration. These insights address the study's objectives and hypothesis, affirming that the deep-learning plus flipbook model is a viable and scalable innovation for modern language education.

Recommendation

Teachers are encouraged to integrate flipbook media within a deep-learning approach to strengthen students' descriptive-text comprehension through reflective discussion, contextual examples, and peer feedback. Professional development programs should provide training on designing multimodal content, managing classroom interactions, and addressing digital literacy challenges. For broader validation, future studies should involve multiple schools, extended timelines, and learning-analytics features to capture engagement patterns and support evidence-based instructional practices.

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