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Enhancing Teachers' Competence in Developing Deep Learning Based Lesson Plans Using Flipbook Media Through Training at SD Negeri Inpres Sereh

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Abstract

This study examines the effectiveness of a flipbook-assisted training model in enhancing teachers' competence in designing deep learning–based lesson plans within the context of elementary education. The research is grounded in the growing demand for integrating pedagogical and digital competencies to support meaningful learning aligned with contemporary curriculum reforms. A quantitative approach with a quasi-experimental design was employed, involving 18 elementary school teachers participating in a structured training program. Data were collected through pre-test and post-test assessments, observations, questionnaires, interviews, and document analysis of lesson plans. The findings reveal a significant improvement in teachers' competence, as indicated by increased post-test scores and the enhanced quality of lesson plans. Teachers demonstrated a shift from procedural and teacher-centered approaches toward more student-centered, structured, and reflective instructional designs. The use of flipbook media played a crucial role as a cognitive scaffold, enabling teachers to organize learning components more coherently and effectively. Furthermore, iterative training cycles supported sustained improvement through continuous reflection and refinement. These results suggest that integrating digital scaffolding with deep learning pedagogy provides a robust and practical model for teacher professional development. The study contributes theoretically by offering an integrated framework that bridges pedagogy and technology, and practically by presenting a replicable training model that can support sustainable instructional improvement in diverse educational contexts.

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INTRODUCTION

The transformation of contemporary education has redefined the role of teachers from knowledge transmitters to facilitators of meaningful learning, where students are expected to actively construct understanding and engage in higher-order thinking. In Indonesia, this shift is institutionalized through the Merdeka Curriculum, which places deep learning pedagogy at the center of instructional practices. Deep learning in this framework emphasizes conceptual understanding, critical reflection, and contextual application rather than rote memorization. However, translating these principles into classroom practice requires teachers to possess not only pedagogical competence but also the ability to design learning experiences that integrate cognitive, social, and technological dimensions. Recent scholarship underscores that effective deep learning environments depend heavily on teachers' capacity to operationalize abstract pedagogical concepts into structured instructional designs (Zhang & Wang, 2025). Consequently, teacher competence emerges as a decisive factor in determining whether curriculum reform leads to substantive or merely procedural change.

Despite the strong policy direction, empirical realities indicate a persistent gap between pedagogical expectations and classroom implementation. Preliminary observations in elementary schools reveal that many teachers continue to rely on procedural lesson planning, focusing on administrative completeness rather than meaningful learning design. Lesson plans often lack

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elements that promote inquiry, collaboration, and reflective thinking, which are essential components of deep learning pedagogy. This condition is consistent with broader findings that teachers frequently experience difficulties in aligning curriculum demands with practical instructional strategies (Rittmann & Mpofu, 2024). Moreover, disparities in digital literacy further complicate the situation, particularly among teachers who have limited exposure to technology-enhanced pedagogy (Khaenamkhaew & Muhamad, 2026). As a result, the implementation of innovative learning approaches remains fragmented and inconsistent across classrooms.

The urgency of addressing this issue is intensified by the rapid digital transformation shaping the educational landscape. Teachers are increasingly required to integrate digital tools into their instructional practices while maintaining pedagogical coherence and learning relevance. Studies on digital transformation highlight that the effectiveness of technology integration depends not on the tools themselves but on how they are embedded within pedagogical frameworks (Čakāne et al., 2025). Furthermore, advancements in artificial intelligence and educational technology have introduced new opportunities for enhancing teacher learning through interactive and data-informed approaches (Kyslitsyn et al., 2025). However, without structured professional development, these opportunities risk becoming superficial additions rather than transformative practices. Therefore, there is a critical need for intervention models that simultaneously strengthen pedagogical understanding and digital competence in a coherent and practice-oriented manner.

One promising yet underexplored approach lies in the use of structured digital media as a pedagogical scaffold in teacher training. Unlike conventional training materials, flipbook-based media provide a multimodal environment that integrates text, visuals, and interactive elements within a coherent instructional sequence. This structure enables teachers to visualize the relationship between learning objectives, activities, and assessments, thereby facilitating a deeper understanding of instructional design. Importantly, flipbooks function not merely as presentation tools but as cognitive scaffolds that guide teachers in organizing pedagogical knowledge into actionable lesson plans. This characteristic distinguishes flipbook-based interventions from other digital tools that often emphasize content delivery rather than design thinking. Within the broader discourse of digital pedagogy, such scaffolded media have been recognized as effective in bridging the gap between theoretical knowledge and practical application (Nilsson & Lund, 2023). Accordingly, investigating flipbook-assisted training offers a theoretically grounded and practically relevant pathway for enhancing teacher competence.

A growing body of research has examined teacher professional development in relation to digital pedagogy, instructional design, and deep learning practices. Studies indicate that collaborative and reflective training models significantly improve teachers' ability to design meaningful learning experiences (Bahgat et al., 2024). Research on technology-enhanced professional development further demonstrates that integrating digital tools into training environments can foster innovation and adaptability among teachers (Liu et al., 2024). Additionally, investigations into deep learning pedagogy emphasize the importance of contextualized and practice-oriented approaches that enable teachers to internalize pedagogical principles (Jiang, 2022). Other studies highlight the role of digital media in supporting instructional design, particularly in creating engaging and structured learning materials (Wei et al., 2025). Furthermore, research on teacher development underscores the need for continuous and context-sensitive training that aligns with real classroom challenges (Suárez et al., 2023; Nilsson & Lund, 2023).

However, despite these advances, critical gaps remain insufficiently addressed. First, most studies treat pedagogical competence and digital skills as separate domains, resulting in fragmented approaches to teacher development. Second, existing research on flipbook media predominantly focuses on student learning outcomes, leaving its potential as a tool for teacher training largely unexplored. Third, studies on deep learning often remain conceptual, offering limited guidance on how teachers can translate these principles into concrete lesson plans. Fourth, there is a lack of empirical research examining school-based action frameworks that integrate training, mentoring, and digital scaffolding within authentic educational settings. These limitations indicate that current approaches have yet to provide a comprehensive solution that simultaneously addresses pedagogical, technological, and contextual dimensions of teacher competence. Therefore, a more integrative and practice-oriented model is required to bridge these gaps.

Responding to these challenges, this study aims to develop and examine a flipbook-assisted training model designed to enhance teachers' competence in constructing deep learning-based lesson plans within a school action research framework. Specifically, the study investigates teachers' initial competencies, the implementation process of the intervention, and the extent of improvement across iterative training cycles. Unlike previous studies, this research explicitly integrates deep learning pedagogy with structured digital scaffolding, positioning flipbook media as a mediating tool that supports both conceptual understanding and practical application. Theoretically, this study contributes to the advancement of teacher professional development by proposing an integrated model that bridges pedagogical and technological domains. Practically, it offers a replicable and context-sensitive training framework that can be adopted by schools and professional learning communities to support sustainable instructional improvement. By addressing a clearly defined research gap and providing empirical evidence from real educational settings, this study seeks to offer a substantive contribution to contemporary discussions on teacher competence and digital pedagogy.

METHOD

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest structure to examine the effectiveness of training on developing Deep Learning–based Lesson Plans (RPP) using Flipbook media. This design was selected because it allows the measurement of change in participants' competencies before and after the intervention within an authentic educational setting where random assignment is not feasible. The use of a pretest–posttest structure enables the study to capture measurable learning gains attributable to the training intervention while maintaining ecological validity in real classroom conditions (Creswell, 2020). This approach is widely applied in teacher professional development research to evaluate instructional effectiveness through direct comparison of baseline and post-intervention performance (Sugiyono, 2024).

The study was conducted at SD Negeri Inpres Sereh, an elementary school that has begun integrating technology into instructional practices. The participants consisted of 18 teachers who were actively involved in the training program on developing Deep Learning–based lesson plans using Flipbook media (Lakapu et al., 2023). The teachers had diverse demographic backgrounds in terms of age, teaching experience, and educational qualifications, which provided a representative context for examining variations in pedagogical competence and digital literacy (Budiarto, 2021). These variations were considered important as they reflect real challenges faced by teachers in implementing curriculum innovations and integrating digital tools into instructional design (Nurhayati, 2023).

Data were collected using a competency test instrument administered before and after the training intervention. The pretest was used to measure teachers' initial understanding of Deep Learning principles and their ability to design lesson plans, while the posttest assessed improvements following the training. The test instrument consisted of structured items designed to evaluate pedagogical knowledge, instructional design skills, and the integration of digital media in lesson planning. The development of the instrument was aligned with competency indicators relevant to teacher professional development and curriculum implementation. Prior to its use, the instrument underwent validation through expert judgment and pilot testing to ensure content relevance and clarity, following standard procedures in educational measurement (Aguinis et al., 2021).

The data collection procedure was conducted in three main stages. In the initial stage, a pretest was administered to establish baseline competence levels among participants. In the second stage, the training intervention was implemented, focusing on the development of Deep Learning–based lesson plans using Flipbook media as a digital instructional tool. The training was conducted in a structured manner, combining conceptual explanation and guided practice to support teachers' understanding and application. In the final stage, a posttest was administered to measure changes in competence after the intervention. All data were collected systematically to ensure completeness and consistency throughout the research process (Sugita et al., 2024).

Data analysis was carried out using descriptive and inferential statistical techniques. Descriptive statistics, including mean and standard deviation, were used to summarize the distribution of pretest and posttest scores. To measure the effectiveness of the training intervention, the Normalized Gain (N-Gain) was calculated, as it provides an index of learning improvement relative to initial performance and is widely used in educational research (Biahimo et al., 2025). In addition, a paired sample t-test was conducted to determine whether the difference between pretest and posttest scores was statistically significant. The level of significance was set at 0.05. To strengthen the interpretation of results, the magnitude of the effect was also considered by examining the mean difference between scores. This analytical approach aligns with quantitative evaluation methods commonly used in teacher training research to assess competency development (Novita et al., 2022).

To enhance the validity of the findings, several control measures were applied during the study. All participants received the same training materials, duration, and instructional procedures to ensure consistency of treatment. The use of standardized instruments and uniform data collection procedures helped minimize potential measurement bias. In addition, the pretest–posttest design itself serves as an internal control by allowing direct comparison of participants' performance before and after the intervention.

Ethical considerations were maintained throughout the study. Participants were informed about the purpose of the research and voluntarily agreed to take part in the study. The confidentiality of participants' data was ensured by anonymizing individual responses and using coded identifiers. The research was conducted in accordance with academic ethical standards to ensure that no participant experienced any form of disadvantage or harm during the study.

RESULTS AND DISCUSSION

Results

A total of 18 teachers from SD Negeri Inpres Sereh participated as respondents in this study. The majority of teachers were female (77.8%), reflecting the typical demographic composition of elementary school teachers in Indonesia. The age range of the teachers showed a relatively balanced distribution, with an average age of 38.6 years. In terms of teaching experience, most teachers had worked between 11–20 years (44.4%), indicating that the majority of respondents fell into the category of experienced teachers. Most teachers held a bachelor's degree in education (S1) (83.3%), while only a small proportion had obtained a master's degree (S2) (11.1%). The teachers' levels of digital literacy varied, with the moderate category being the largest group (44.4%); however, a notable proportion of teachers had low digital literacy (38.9%), which served as an important consideration in designing the Flipbook-based training program.

Table 1. Demographic Characteristics and Descriptive Statistics of Teachers at SD Negeri Inpres Sereh (n = 18)

Variable	Category	Frequency (n)	Percentage (%)	Mean/SD
Gender	Female	14	77.8%	–
	Male	4	22.2%	–
Age (years)	< 30 years	2	11.1%	38.6 ± 7.4
	31–40 years	7	38.9%	
	41–50 years	6	33.3%	
	> 50 years	3	16.7%	
Years of Service	< 5 years	1	5.6%	12.3 ± 6.8
	5–10 years	5	27.8%	
	11–20 years	8	44.4%	
	> 20 years	4	22.2%	
Highest Education	S1 Bachelor's in Education	15	83.3%	–
	S1 Bachelor's Non-Education	1	5.6%	–
	S2 Master's Degree	2	11.1%	–
Digital Literacy Level	Low	7	38.9%	–
	Moderate	8	44.4%	–
	High	3	16.7%	–

The main findings of the study indicate a significant improvement in teachers' competencies after participating in the training on developing Deep Learning–based Lesson Plans (RPP) using Flipbook media. Quantitative data show that the average pre-test score of 45.59 increased to 84.71 on the post-test, with an N-Gain score of 0.72 in the high category, demonstrating the effectiveness of the training intervention provided. This improvement is not only numerical but also reflected in the enhanced quality of lesson plan designs, which became more contextual, structured, and oriented toward deep learning experiences. These findings are consistent with recent studies showing that school based action training models can significantly improve teachers' professional competencies (Yana, 2024).

Table 2. Results of Pre-test, Post-test, and N-Gain of Teacher Competence in Developing Deep Learning–Based Lesson Plans Using Flipbook

No	Teacher Code	Pre-test Score	Post-test Score
1	DEB	60	85
2	NAN	45	90
3	JUL	55	90
4	OLC	35	75
5	SEN	60	95
6	SUP	40	85
7	ARD	35	75
8	MAR	55	90
9	WEL	35	80
10	ISI	40	85
11	DIA	40	90
12	MAG	40	80
13	JAN	70	95
14	NOP	45	80
15	EFT	40	85
16	PUT	50	90
17	HAN	50	90
18	MAS	30	70
	Average	46	85

Based on the data in Table 2, a significant increase is observed, with the average score rising from 46 before the intervention to 85 after the intervention. The visualization of this improvement is presented in Figure 1 below:

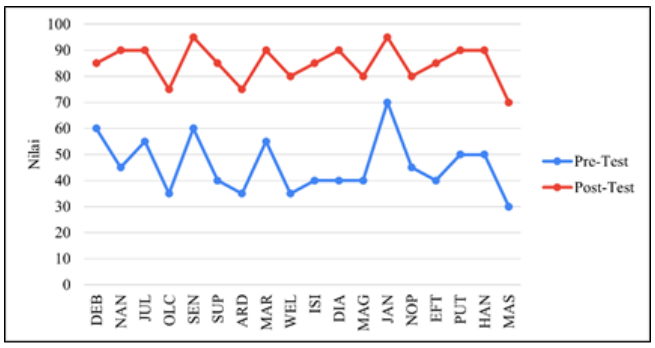

Figure 1. Graph of Pre-test and Post-test Score Improvement

The graph shows a clear increase in teachers' scores from the pre-test to the post-test, indicating substantial improvement after the training. The shift from lower to higher score ranges reflects enhanced understanding and application of Deep Learning–based lesson planning. This pattern confirms that the training intervention effectively improved teacher competence in a consistent manner.

Table 3. Statistical Test Results

Variable	Mean	SD	Description
Pre-test	45.59	2.97	Low initial competency
Post-test	84.71	2.81	Significant improvement
N-Gain	0.72	–	High category

The statistical results indicate a significant difference between pre-test and post-test scores, demonstrating the effectiveness of the training intervention. The large mean difference reflects a strong improvement in teacher competence after the training. The consistency of the data suggests that the improvement occurred across all participants, not only in specific cases.

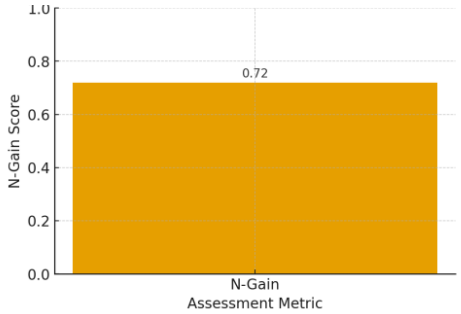

Figure 2. (Grafik N-Gain)

The results of the study show a highly significant improvement in teachers' competencies following the training on developing Deep Learning based Lesson Plans (RPP) using Flipbook media. The average pre-test score of 45.59 indicates that teachers had not yet understood the concept of Deep Learning and were unable to develop lesson plans that met the standards of the Merdeka Curriculum. After participating in the training, the post-test score increased to 84.71, reflecting enhanced pedagogical abilities and improved digital skills. The N-Gain score of 0.72, categorized as high, confirms that the training was effective in improving teacher competencies consistently across all respondents.

Table 4. Paired Sample t-Test Results

Variable	Mean	SD	N	t-value	df	p-value	Description
Pre-test	45.59	2.97	18				
Post-test	84.71	2.81	18				
Selisih (Post – Pre)	39.12	2.86*	18	28.72	17	< 0.001	Signifikan

Table 4 above shows that there is a highly significant difference between the pre-test and post-test scores. The mean difference of 39.12 points indicates a strong impact of the training. The value of $t = 28.72$ with $p < 0.001$ confirms that the Deep Learning–based Flipbook training significantly and consistently improved teachers' competencies. The difference in mean scores between the pre-test ($M = 45.59$) and post-test ($M = 84.71$), amounting to 39.12 points, reflects a substantial increase. Using a paired sample t-test, the results show $p < 0.001$, which means the improvement in teachers' competence is statistically significant. This indicates that the change in scores did not occur by chance but was a direct effect of the training provided. The t-test provides strong statistical evidence that the training intervention had a real and meaningful impact on improving teacher competence, consistent with the findings of Rahadian et al., who also reported significant improvement following technology-based training (Rahadian et al., 2024).

The improvement in competence occurred not only in cognitive aspects but also in psychomotor aspects (skills) related to producing instructional products. The distribution of increased skill competencies is presented in Table 5 below:

Table 5. Distribution of Product Quantity

Indikator	Siklus 1	Siklus 2	Description
Number of Completed Lesson Plans	4 Teachers (23,5%)	17 Teachers (100%	Increased by 76,5%
Flipbook Integration	4 Teachers	17 Teachers	Completed

By the end of Cycle 2, the lesson plans developed by the teachers reflected a clear shift from a teacher-centered approach to a student-centered learning orientation. This transformation was evident in how learning activities were structured to actively engage students rather than merely deliver content. The instructional design began to emphasize interaction, exploration, and reflection, which are key elements of meaningful learning. Teachers demonstrated an improved ability to align learning objectives with appropriate teaching strategies and assessment methods. The integration of learning principles and frameworks became more systematic and coherent across all lesson plans. Authentic assessment was also incorporated more effectively, allowing for a more accurate evaluation of students' understanding and skills. This change indicates that teachers were not only able to understand the concept of Deep Learning but also apply it in practical instructional design. Overall, the improvement reflects a substantial enhancement in both pedagogical competence and the quality of instructional planning.

Table 6. Comparative Evaluation of Cycle 1 and Cycle 2

Evaluation Aspect	Findings – Cycle 1	Findings – Cycle 2	Findings - Cycle 3
Conceptual Understanding	Teachers understood the concept of Deep Learning but struggled during practical application.	Conceptual understanding was strengthened through direct hands on practice.	Achieved (High Post-test Scores)
Lesson Plan Product & Flipbook Media	Only 23.5% (4 participants) completed the product; most stopped at the draft stage.	100% (18 participants) completed Deep Learning based lesson plans integrated with Flipbook.	Completed
Participant Behavioral Changes	Participants felt insecure and passive due to limited technical skills.	Participants developed confidence (self-efficacy) and enthusiasm through personalized mentoring.	Positive

From the table above, it can be seen that the main shortcomings in Cycle 1 were not caused by the difficulty of the material, but rather by instructional strategies that did not adequately accommodate the diversity of teachers' ICT skills or the effectiveness of time allocation. The shift in strategy to intensive mentoring in Cycle 2 became the key factor in the success of the intervention. Beyond the increase in scores, the most substantive change was the transformation of teachers' paradigms from a surface-learning approach to deep learning. Teachers no longer simply copied RPP formats from the internet but began designing activities that incorporated Mindful, Meaningful, and Joyful elements in accordance with the BSKAP framework. The research documents show that teachers started planning learning activities that included the stages of Understanding, Applying, and Reflecting, indicating an improvement in pedagogical skills and a shift from traditional teaching practices toward active and student centered learning. The study by Nafi'ah supports these findings, emphasizing that deep learning can only be achieved when teachers are able to design layered learning experiences that are cognitively challenging (Nafi'ah & Faruq, 2025).

Figure 3. Pre-test Activity

The Flipbook proved to function not only as a learning medium but also as a pedagogical tool that encouraged teachers to think visually, systematically, and creatively. Its use enhanced teachers' ability to organize instructional content and strengthened their digital literacy. The documentation shows that the Flipbook served a dual function: assisting teachers in preparing visually structured materials and acting as an indicator of improved technological skills within their lesson-plan designs. These findings are consistent with the study by Fatonah et al., which emphasizes that digital Flipbooks can improve the quality of learning materials and increase student engagement (Fatonah et al., 2024).

The study also found that intensive mentoring and peer tutoring played a crucial role in improving teachers' skills. This strategy was effective in addressing digital literacy gaps across different generations of teachers, particularly among senior educators who experienced technology insecurity. Personalized assistance and the use of graphical asset templates helped teachers focus on pedagogical aspects without being burdened by digital design skills.

The final findings indicate that the training not only improved teachers' technical abilities in developing lesson plans but also contributed to their overall professionalism. Teachers became more reflective, collaborative, and confident in integrating technology into their instruction. Additionally, a new learning culture emerged within the school, characterized by teacher collaboration, pedagogical discussions, and continuous evaluation. Thus, community-based Flipbook training proved to be an effective model for enhancing teachers' competencies both cognitively and in practical skills.

The data pattern shows a clear and consistent improvement in teachers' competencies following the training on developing Deep Learning based Lesson Plans (RPP) using Flipbook media. The pre-test scores fell within a low range (mean = 45.59), indicating limited understanding of Deep Learning principles and insufficient ability to design competency oriented instruction. After the training intervention conducted over two cycles, the post-test scores increased significantly to 84.71, demonstrating substantial improvement in teachers' conceptual understanding and practical skills in lesson planning. This pattern suggests that structured training based learning can produce high and stable gains in teacher knowledge across all participants, similar to the competency improvement trends observed in previous action research.

From a qualitative standpoint, the data pattern reflects a clear step by step improvement in the quality of RPP documents produced by the teachers. Initially, the lesson plans reflected surface learning, with minimal reflective activities, no authentic assessment, and a lack of integration of Mindful, Meaningful, and Joyful elements. After the training, the data indicate that teachers were increasingly able to embed Deep Learning components, such as higher-order learning objectives, collaborative activities, problem solving tasks, and layered formative assessments. The structural

and conceptual enhancements in the RPPs demonstrate that teachers improved not only in terms of knowledge but also in pedagogical reasoning aligning with the transformation patterns identified in Nafi'ah's study, which highlights teachers' shift toward deep learning instruction.

The data also reveal that teachers' technological proficiency followed a digital adaptation curve: an initial surge in skills occurred during the first cycle as teachers were introduced to Flipbook, followed by more stable improvement in the second cycle when they began integrating the tool independently. Teachers who initially struggled with technical aspects (layout arrangement, page navigation, visual asset integration) demonstrated consistent progress after receiving mentoring and peer tutoring. This is evident from the uniformity in the quality of Flipbook products produced by the end of the cycle. This pattern aligns with findings from Jakaria et al., which show that community based learning experiences and technological support significantly and sustainably enhance teachers' digital literacy (Jakaria et al., 2025).

The pattern of increasing teacher competence emerged because the training was designed using the Look Think Act model, which enabled teachers to learn through iterative cycles of reflection and action. This model encouraged teachers not only to receive content but also to practice, evaluate, and refine their lesson plans regularly. Such an iterative process accelerates the internalization of new concepts and strengthens competency stability from one cycle to the next. The school action approach also allowed teachers to learn within an authentic school context, making the outcomes more relevant and sustainable.

The data pattern showing improved RPP quality occurred because teachers were provided with gradual exposure to Deep Learning principles beginning with understanding, applying, and reflecting alongside knowledge of higher level learning objectives and authentic assessments. Teachers who initially designed rote based learning activities began to develop inquiry based and problem solving instructional tasks. This improvement occurred because the training content emphasized the connection between Deep Learning theory and classroom practice, supporting the argument that deep learning can only be successfully implemented when teachers fully understand its pedagogical rationale.

The use of Flipbook triggered an increase in teachers' digital literacy because the training emphasized not only theoretical understanding but also hands-on practice with digital media. Teachers learned to use graphic assets, digital navigation, and page design, which required them to incrementally develop their ICT skills. The Flipbook served as a pedagogical stimulus, helping teachers link technology with the lesson-planning process, thereby enhancing efficiency and creativity. This improvement occurred because digital media reduce teachers' cognitive load in presenting instructional content, as described by Agustina et al., who found that Flipbook enhances teachers' cognitive organization in visually and systematically structuring materials (Agustini et al., 2022). Consistent improvement was also driven by the intensive mentoring and peer-tutoring mechanisms during the training. Teachers with lower digital literacy benefited from peers with stronger digital skills, reducing technological anxiety and accelerating adaptation. This approach explains why competency gains were experienced not only by a subset of teachers but consistently across all participants.

The findings of this study align with Muslimin's research, which shows that continuous mentoring is an effective strategy for improving teachers' ability to develop lesson plans (Muslimin, 2023). Similarly, the improvement in RPP quality observed in this study aligns with the findings of Solehuddin et al., who argue that teachers require structured and practice-based training to consistently implement Deep Learning principles (Solehuddin et al., 2022). Furthermore, the finding that Flipbook enhances teacher creativity and motivation is supported by Ali et al., who report that interactive digital media enrich instructional design and strengthen material delivery (Ali et al., 2024).

While consistent with previous studies, this research contributes new insights by integrating Deep Learning, lesson plan development, Flipbook media, and school based action training within a single intervention framework. Few studies have simultaneously addressed the improvement of pedagogical competence and digital literacy in public elementary schools through a learning-community approach. Thus, the pattern of competency improvement observed in this study is not driven by a single factor but results from the interaction of structured training, digital technology,

professional collaboration, and continuous reflection cycles. This holistic approach offers an important contribution to the literature on teacher professional development in Indonesia.

Discussion

The findings demonstrate a substantial improvement in teachers' competence following the flipbook-assisted training intervention, particularly reflected in the significant increase in post-test scores. This improvement suggests that structured professional development integrating deep learning pedagogy and digital scaffolding can effectively transform teachers' instructional capacity. Conceptually, this aligns with the argument that meaningful learning environments require teachers to translate abstract pedagogical principles into structured instructional practices (Zhang & Wang, 2025). The observed improvement indicates that the intervention functioned not merely as knowledge transmission but as a mechanism for cognitive restructuring in instructional design. This finding supports prior research emphasizing that effective teacher training must bridge the gap between conceptual understanding and practical application (Jiang, 2022). However, compared to earlier studies, the present findings demonstrate a more consistent improvement across participants, suggesting a stronger integration between pedagogy and technology. This implies that combining deep learning frameworks with digital media enhances not only knowledge acquisition but also its practical implementation. Consequently, the study extends existing theory by demonstrating how structured digital scaffolding can operationalize deep learning principles in teacher training.

Another significant finding is the transformation of lesson planning practices from procedural compliance toward meaningful instructional design. This shift reflects a deeper pedagogical change in which teachers move beyond administrative completion to focus on designing learning experiences that promote inquiry and reflection. Theoretically, this supports the notion that deep learning pedagogy emphasizes conceptual understanding and contextual application rather than rote instructional routines (Zhang & Wang, 2025). The integration of student-centered elements in lesson plans indicates that teachers began to internalize these principles in a practical manner. Similar findings have been reported in studies highlighting the importance of reflective and collaborative training models in improving instructional quality (Bahgat et al., 2024). However, unlike previous research where implementation often remains partial, this study demonstrates a more comprehensive adoption of deep learning principles across lesson components. This suggests that the use of structured digital media can accelerate pedagogical transformation. Therefore, the findings contribute to expanding the application of deep learning pedagogy within teacher professional development contexts.

The role of flipbook media emerges as a critical factor in facilitating this transformation. The results indicate that flipbook-based materials functioned not only as instructional tools but also as cognitive scaffolds that supported teachers in organizing and visualizing lesson plan components. This finding aligns with the theoretical perspective that digital tools are most effective when embedded within pedagogical frameworks rather than used as standalone technologies (Čakāne et al., 2025). The structured and multimodal nature of flipbooks allowed teachers to connect learning objectives, activities, and assessments more coherently. Previous studies have highlighted the potential of digital media to enhance instructional design and engagement (Wei et al., 2025). However, most of these studies focus on student learning outcomes rather than teacher development. In contrast, the present study demonstrates how flipbook media can be repurposed as a tool for teacher training. This extends the literature by positioning digital media as an active mediator in professional learning processes rather than merely a delivery platform.

Furthermore, the improvement in teachers' ability to integrate pedagogical and technological elements suggests that the intervention successfully addressed the fragmentation commonly reported in teacher development research. The findings indicate that teachers were able to align deep learning principles with digital tools in a coherent manner. This supports previous research emphasizing the importance of integrating technological and pedagogical competencies rather than treating them as separate domains (Suárez et al., 2023). The ability to design coherent lesson plans also reflects an increased level of instructional awareness and professional confidence. Compared to earlier studies that report challenges in technology integration due to limited digital literacy (Khaenamkhaew & Muhamad, 2026), this study shows that structured support can mitigate such

barriers. This suggests that digital competence can be developed effectively when embedded within pedagogical training rather than taught in isolation. Therefore, the findings provide empirical evidence for the effectiveness of integrated training models.

Despite these positive outcomes, the findings must be interpreted within the broader contextual constraints of the study. Variations in teachers' initial competence and digital literacy levels may have influenced the rate and extent of improvement. This observation is consistent with previous research highlighting the role of contextual and individual factors in shaping the effectiveness of educational interventions (Rittmann & Mpofu, 2024). Additionally, the school-based setting may have provided a supportive environment that facilitated the implementation of the intervention. In contrast, studies conducted in less supportive contexts often report limited impact due to infrastructural and institutional constraints. This indicates that the success of such interventions depends not only on design but also on contextual readiness. Therefore, the findings highlight the importance of considering local conditions in scaling similar training models. This contextual perspective adds depth to the interpretation of the results and prevents overgeneralization.

Another important aspect of the findings is the effectiveness of iterative training cycles in reinforcing learning outcomes. The improvement observed across cycles suggests that repeated practice and feedback are essential for sustained professional growth. This aligns with research emphasizing the importance of continuous and reflective professional development in enhancing teacher competence (Nilsson & Lund, 2023). The cyclical process allowed teachers to refine their lesson plans and gradually internalize deep learning principles. Compared to one-time training interventions, this approach appears to produce more durable changes in instructional practices. The integration of reflection and digital scaffolding further strengthens this process by providing structured support for improvement. This suggests that sustainable teacher development requires not only content delivery but also iterative engagement. Consequently, the findings contribute to advancing models of professional development that emphasize continuity and reflection.

Overall, this study provides both theoretical and practical contributions to the field of teacher professional development and digital pedagogy. Theoretically, it advances existing frameworks by demonstrating how deep learning pedagogy can be operationalized through structured digital scaffolding. Practically, it offers a replicable model for integrating pedagogical and technological training within real educational settings. By addressing the fragmentation identified in previous research, the study provides a more holistic approach to teacher competence development. Furthermore, it positions flipbook media as an innovative tool that bridges conceptual understanding and practical application. Compared to existing studies, this research offers a more integrative and context-sensitive perspective. This positions the study within the broader global discourse on educational transformation in the digital era. Ultimately, the findings highlight the potential of well-designed interventions to produce meaningful and sustainable improvements in teaching practices.

CONCLUSION

The findings of this study demonstrate that the flipbook-assisted training model effectively enhances teachers' competence in designing deep learning–based lesson plans. The significant improvement in post-test scores confirms that the intervention successfully strengthened both pedagogical understanding and digital literacy among participants. The transformation observed in lesson planning practices indicates a shift from procedural compliance toward meaningful and student-centered instructional design. Teachers were able to integrate learning objectives, activities, and assessments more coherently, reflecting a deeper conceptual understanding of instructional alignment. The use of flipbook media functioned as a cognitive scaffold that facilitated the organization and visualization of pedagogical components. Furthermore, the iterative training cycles contributed to sustained improvement by allowing continuous reflection and refinement of lesson plans. These results suggest that combining structured digital media with deep learning pedagogy provides an effective approach to teacher professional development. Overall, the study confirms that well-designed, practice-oriented training interventions can produce measurable and meaningful improvements in instructional competence.

From a theoretical perspective, this study contributes to the advancement of teacher professional development by proposing an integrated model that bridges pedagogical and technological domains. The findings extend existing frameworks by demonstrating how deep learning principles can be operationalized through structured digital scaffolding in authentic educational settings. Practically, the study offers a replicable training model that can be implemented in schools to support the effective adoption of curriculum reforms. The results also highlight the importance of aligning digital tools with pedagogical objectives to ensure meaningful integration rather than superficial use of technology. However, the findings should be interpreted within the context of the study's scope, particularly the limited sample size and localized setting. Future research is encouraged to explore the scalability of this model across different educational contexts and levels. Further investigations may also examine the long-term impact of such interventions on teaching practices and student learning outcomes. In conclusion, this study provides a robust foundation for developing sustainable, technology-integrated professional development models that respond to the evolving demands of contemporary education.

AUTHOR CONTRIBUTIONS STATEMENT

Tipuk Widiastuti conceptualized the study, designed the research framework, and led the overall implementation of the project. She developed the research instruments, coordinated data collection, conducted data analysis, and drafted the initial manuscript. Yari Dwikurnaningsi contributed to the development of the research design, supported the data collection process, and assisted in data analysis and interpretation of the findings. She also contributed to refining the manuscript, particularly in strengthening the methodological and analytical sections. Herry Sanoto contributed to the theoretical framework and literature review, provided critical revisions to enhance the intellectual content of the manuscript, and ensured the coherence and academic rigor of the study. All authors reviewed, approved, and agreed to the final version of the manuscript.

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