

AI Integration to Improve Teachers' Efficiency in Developing Instructional Media

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Abstract

Although Artificial Intelligence (AI) has been widely explored in higher education, research on its integration in elementary teacher training remains limited, particularly in developing contexts. This study investigates whether AI-based training can enhance teachers' efficiency in developing instructional media. A quasi-experimental design with a one-group pre-test–post-test approach was employed. Twenty elementary school teachers from Indonesia participated in a four-week training program involving lectures, guided practice, and mentoring on AI platforms such as ChatGPT, QuillBot, Canva AI, and Quizizz AI. Data were collected through pre-test and post-test assessments (15 multiple-choice items) and a perception questionnaire using a five-point Likert scale. Results showed a significant increase in teachers' understanding, with mean scores rising from 55.6 to 86.1, indicating a 30.5-point improvement. Teachers also reported high satisfaction with the training ($M = 4.76/5$), especially regarding efficiency and applicability in classroom practice. These findings suggest that short-term AI-based professional development can reduce teachers' workload, strengthen digital literacy, and support sustainable educational innovation. The study contributes to global discussions on leveraging AI for teacher capacity building, particularly in resource-constrained elementary education systems.

Keywords: artificial intelligence, teacher efficiency, instructional media

INTRODUCTION

Instructional media are essential in bridging curriculum content and student comprehension. Well-designed media strengthen perception, sustain attention, and facilitate information retention (Heinich et al., 2015; Seechaliao, 2024). Yet, many teachers face persistent challenges in developing effective instructional resources due to time limitations, administrative demands, and limited technological competence. This issue is particularly critical in elementary education, where teachers are expected to provide engaging and age-appropriate learning experiences with constrained resources (Abdulrahman et al., 2020).

Artificial Intelligence (AI) has recently emerged as a transformative tool in education, enabling applications such as personalized learning, automated assessment, and adaptive content generation (Zawacki-Richter et al., 2019; UNESCO, 2022; Wang et al., 2024). While much of the literature has concentrated on higher education, especially in relation to learning analytics and intelligent tutoring systems, research on AI integration in elementary teacher training remains scarce (Tan et al., 2024; Tan, 2024). This represents an important gap, as elementary teachers are key actors in fostering foundational digital literacy and innovative teaching practices (Mulyani, 2025).

Evidence suggests that AI-based platforms like ChatGPT, QuillBot, and Canva AI can reduce teachers' preparation time while maintaining the quality of instructional media (Ehtsham et al., 2025; Zhou et al., 2025). However, barriers such as limited digital literacy, inadequate infrastructure, and lack of professional development remain prominent in resource-constrained educational settings (Lisda & Nailah, 2025; Haleem et al., 2022). These challenges underscore the need for structured, practice-oriented training programs that enable teachers to integrate AI tools into their pedagogy effectively.

Indonesia, as a developing country, presents a valuable context for exploring these dynamics. Many elementary and madrasah teachers express strong motivation to engage with digital technologies but have limited access to training opportunities (Arif et al., 2024). MI Al Iman Banaran, an Islamic elementary school

located in Semarang, exemplifies this condition: teachers demonstrate high commitment yet face obstacles in efficiently producing instructional media.

Against this background, the present study examines the effectiveness of AI-based professional development in improving teachers' efficiency at MI Al Iman Banaran. Specifically, it seeks to assess the extent to which a short-term training program can enhance teachers' understanding of AI-supported instructional media development and their perceptions of its applicability in classroom practice. By situating this study within a developing country and school-specific context, the findings aim to contribute to international discussions on how AI can empower teachers, reduce workload, and support sustainable educational transformation in elementary education worldwide.

METHOD

This study employed a quantitative descriptive approach using a quasi-experimental one-group pre-test–post-test design. The objective was to evaluate the effectiveness of AI-based training in improving elementary school teachers' efficiency in developing instructional media.

The research was conducted at MI Al Iman Banaran, an Islamic elementary school in Semarang, Indonesia. Twenty teachers from various grade levels participated in the four-week training program held in July 2025. The training included lectures, demonstrations, hands-on practice, and mentoring on the use of AI platforms such as ChatGPT, QuillBot, Canva AI, and Quizizz AI.

Two instruments were used for data collection. First, a pre-test and post-test, consisting of 15 multiple-choice items, was administered to measure teachers' understanding of AI-supported instructional media development before and after the training. Second, a perception questionnaire, designed with a five-point Likert scale, was distributed at the end of the program to capture participants' evaluations regarding the relevance, clarity, and applicability of the training.

Data analysis was conducted descriptively. The pre-test and post-test scores were compared using mean, minimum, maximum, and gain values to identify improvements in teachers' understanding. Meanwhile, responses from the perception questionnaire were analyzed by calculating the mean score of each indicator, which reflected the overall level of teacher satisfaction with the training.

This method allowed the study to capture both measurable improvement in teachers' knowledge and their subjective perceptions of AI integration, providing a comprehensive picture of the training's effectiveness in enhancing teacher efficiency.

RESULT & DISCUSSION

Teacher's Cognitive Performance

The training on AI integration at MI Al Iman Banaran resulted in a substantial improvement in teachers' understanding of AI-supported instructional media development as seen in Table 1.

TABLE 1. Comparison of Pre-test and Post-test Scores

Statistic	Pre-test (n=20)	Post-test (n=20)	Gain (Δ)
Mean	55.6	86.1	+30.5
Minimum score	40	74	+34
Maximum score	70	98	+28

The results reveal a mean gain of 30.5 points, with all participants demonstrating learning progress. The rise in minimum scores from 40 to 74 indicates that teachers with initially low digital literacy were able to catch up through the training. This finding aligns with Ehtsham et al. (2025), who reported that AI-based professional development significantly improves teacher productivity and competence. Similarly, Dakulagi et al. (2025) found that AI tools with intuitive interfaces enable faster adoption and understanding, even among novice users.

These results suggest that short-term training, when structured with both theoretical input and hands-on practice, can effectively enhance teachers' cognitive performance. This supports Liu and Li's (2018) argument that personalized, technology-mediated approaches reduce barriers for teachers in adopting innovative tools. Furthermore, the findings expand upon global research that has primarily examined AI integration in higher education (Zawacki-Richter et al., 2019; Wang et al., 2024), highlighting its potential in elementary education.

Teacher's Perception

As seen in Table 2, teachers' perceptions of the training program were overwhelmingly positive.

TABLE 2. Teachers' Perceptions of the Training

Indicator	Mean Score	Interpretation
Relevance of training materials	4.85	Very Satisfied
Clarity of delivery	4.70	Very Satisfied
Availability of practice and mentoring	4.55	Satisfied
Applicability of AI tools in teaching practice	4.80	Very Satisfied
Contribution to teacher efficiency	4.90	Very Satisfied
Overall Mean	4.76	Very Satisfied

The highest-rated aspect was the contribution to teacher efficiency ($M = 4.90$), which indicates the direct relevance of AI tools to teachers' daily tasks. Before the training, teachers typically required 3–5 hours to prepare instructional media; afterward, the time was reduced to 1–2 hours. This efficiency gain is consistent with studies highlighting the role of AI in reducing workload and streamlining instructional design (Haleem et al., 2022; Zawacki-Richter et al., 2019).

The slightly lower score for practice and mentoring ($M = 4.55$) suggests that participants desired more intensive, hands-on sessions. This mirrors Situmorang's (2023) findings that sustainable professional development requires continuous practice opportunities. It also resonates with Tan (2024), who emphasized that AI literacy for teachers must extend beyond technical proficiency to encompass sustained pedagogical application.

Overall, the positive perceptions confirm that AI-based training is both acceptable and beneficial for teachers in elementary education. These findings echo Zhou et al. (2025), who highlighted that AI not only improves efficiency but also enhances teachers' confidence in adopting digital innovations. By situating these results in the context of an Indonesian madrasah, the study demonstrates that such interventions can be successfully adapted to resource-constrained settings, contributing to the broader international discourse on equitable digital transformation in education.

Challenges and Implications

Despite the overall success, several challenges were identified during the training. The relatively lower satisfaction score for practice and mentoring ($M = 4.55$) suggests that participants desired more opportunities for hands-on application and individualized support. Similar findings were reported by Situmorang (2023), who highlighted that short-term interventions may raise initial awareness but must be followed by sustained professional development to ensure long-term impact.

Another challenge relates to infrastructural limitations. Although the training introduced accessible platforms such as ChatGPT, QuillBot, and Canva AI, several participants indicated difficulties with internet connectivity and device availability. These barriers are consistent with observations by Firman and Tola (2020) and Lisda & Nailah (2025), who emphasized that technology integration in schools is often hindered by external resource constraints rather than teachers' willingness to adapt.

From a broader perspective, these findings carry important implications for global education systems. First, they demonstrate that AI integration is not limited to well-resourced schools or higher education institutions; it can be successfully adapted to elementary education in developing contexts. Second, the study shows that efficiency gains can directly reduce teachers' workload, freeing time for pedagogical preparation—a concern that resonates internationally (Haleem et al., 2022; Tan, 2024). Finally, the results highlight the need for continuous, scalable professional development models to ensure sustainable digital transformation across diverse educational settings (Zawacki-Richter et al., 2019; Wang et al., 2024).

By documenting both achievements and challenges, this study contributes practical insights for policymakers, school leaders, and international stakeholders seeking to leverage AI to support teacher capacity building and equitable educational innovation.

CONCLUSION

This study set out to examine the effectiveness of AI-based training in improving elementary school teachers' efficiency in developing instructional media at MI Al Iman Banaran. The findings demonstrate that a short-term training program significantly enhanced teachers' cognitive performance and generated strong positive perceptions toward the use of AI tools in education.

The study underscores the potential of AI integration not only to reduce teachers' workload but also to strengthen digital literacy and pedagogical innovation in elementary education. In practical terms, AI-supported professional development can be adopted by schools and teacher training institutions to accelerate teachers' capacity in preparing high-quality instructional resources within limited time.

To ensure sustainability, future training programs should incorporate extended mentoring sessions and continuous professional development opportunities. At the policy level, efforts are needed to provide

adequate infrastructure and to mainstream AI literacy within teacher education curricula. Beyond the local context, the study contributes to global discussions on how AI can support equitable digital transformation in education systems, particularly in developing countries with constrained resources.

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