



Training on Utilizing Artificial Intelligence in Designing Deep Learning-Based Instruction

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Abstract

The ongoing paradigm shift in education necessitates that teachers, particularly those of Islamic Religious Education (PAI) and Character Education, innovate and integrate Artificial Intelligence (AI) into instructional design to ensure relevance in the contemporary era. This study aims to analyze the effectiveness of AI utilization training in enhancing teachers' ability to design deep learning-based instruction. The research employed a collaborative-participatory approach through a Community Service Program based on Scientific Work (PKM-KI), conducted at SDN 11 Pontianak Timur on November 16, 2025, involving 39 PAI teachers. The program comprised several stages: needs analysis, program planning, training implementation (lectures and hands-on practice), intensive mentoring in developing teaching modules, and outcome evaluation. The needs analysis revealed that the majority of teachers (77.4%) had prior experience using AI; however, its application varied and was not yet optimized for deep learning models. Evaluation was conducted by comparing pre-test and post-test results. Findings indicate a significant improvement in competence, with the mean pre-test score of 63.40 ($SD = 7.523$) rising sharply to 91.93 ($SD = 4.968$) in the post-test. Shapiro-Wilk normality tests confirmed that the data were normally distributed ($p > 0.05$), permitting analysis via a One-Sample T-Test. This increase in mean scores demonstrates that AI utilization

training effectively strengthened digital literacy and teachers' capacity to design PAI teaching modules based on deep learning. The study offers a practical contribution in the form of a training model that can be adopted to ensure that AI integration is accompanied by competent deep learning instructional design.

Keywords: Artificial Intelligence (AI), Deep Learning, Islamic Religious Education (PAI), Teaching Module, Teacher Training

INTRODUCTION

The paradigm shift in education reflects fundamental changes in both the understanding and practice of teaching across time (Kurniawan, 2019). This transformation is evident in curriculum dynamics, instructional approaches, and the increasingly sophisticated utilization of technology and media (Rahayu et al., 2022). Within this context, educators are required to continually innovate in designing adaptive and relevant learning experiences, including the development of teaching modules, which constitute a crucial instrument in the teaching-learning process (Kurniawan, 2019). For teachers of Islamic Religious Education (PAI) and Character Education, professional transformation has become a strategic necessity to ensure that PAI instructional designs can address contemporary challenges while supporting the contextual application of religious values (Minarti & Wahab, 2024). Accordingly, developing high-quality teaching modules is essential for realizing effective, innovative, and learner-centered PAI instruction.

In the era of Artificial Intelligence (AI), the instructional design process has entered a new stage characterized by greater adaptability, efficiency, and personalization of learning experiences (Radja Leba et al., 2025). AI technology has evolved beyond administrative functions to serve as a pedagogical partner capable of enhancing learning needs analysis, automatically generating instructional content, recommending appropriate teaching strategies, and providing comprehensive, data-driven performance evaluations (Crompton & Burke, 2023). In primary education, AI utilization is particularly crucial, as learners are in developmental phases that demand engaging, interactive, and meaningful experiences to foster active participation. Teachers at SDN 11 Pontianak Timur, as integral actors in the primary education ecosystem, have strategic opportunities to integrate AI into instructional design, enabling learning processes to be structured more creatively, relevantly, and contextually, in line with students' needs and societal developments.

Research on social facts serves as a critical foundation for understanding how communities respond to technological advancements, including AI in education (Amriyah et al., 2025). From a sociological perspective, social facts are not merely observable phenomena but also reflect patterns of action, values, and collective expectations that shape individual behavior within a social system. In the educational context, the shift from traditional to technology-enhanced active learning necessitates in-depth analysis of teacher readiness, learner needs, and cultural transformation in learning practices (Dzulfian Syafrian, 2025). AI utilization training constitutes part of this social dynamic, as it pertains to educators' capacity to adapt to digital innovations. By examining these social realities, the study explores how teachers perceive technology, the challenges they encounter, and the opportunities that arise in designing deep learning-based instruction that aligns with contemporary demands.

A review of the literature indicates that AI adoption in education has developed significantly over the past decade. Multiple studies have demonstrated AI's capacity to enhance instructional effectiveness, provide personalized learning experiences, and support more precise learning data analysis (Kurniawan et al., 2024). However, the majority of research has focused on AI as a tool for assessment, administrative task automation, or adaptive learning support. Research on the strategic application of AI in instructional design, specifically for developing deep learning-based learning experiences, remains limited, particularly in the context of teacher training in Indonesia (Indrayani, 2025). This research gap underscores the need for a novel approach that integrates AI capabilities with deep learning principles, emphasizing critical analysis, creativity, problem-solving, and reflection. The originality of this study lies in the development of understanding and training models that specifically guide teachers in designing AI-assisted deep learning instruction comprehensively.

This study aims to analyze the effectiveness of AI utilization training in enhancing teachers' ability to design deep learning-based instruction. Additionally, it seeks to identify the needs, challenges, and competency transformations experienced by teachers during the training process. Consequently, the study not only evaluates training outcomes but also examines the internal processes involved in teachers' pedagogical knowledge and skill transformation. Based on these objectives, the following research questions are formulated: (1) How do teachers perceive and prepare for utilizing AI in instructional design? (2) What forms of training effectively enhance teachers' capacity to design AI-assisted deep learning instruction? (3) What are the impacts of training on the quality of teachers' instructional designs? (4) What challenges do teachers face in integrating AI into instructional design processes? These questions constitute the primary focus of the analysis.

The study posits that AI utilization alone will not yield significant impact unless teachers are equipped with deep instructional design competencies. Therefore, the quality of training is a critical factor in ensuring that AI functions not merely as a technical tool but as a pedagogical partner that enriches the learning process. The research provides a theoretical contribution by reinforcing the concept that AI integration must be accompanied by deep learning design competencies, combining content analysis, higher-order thinking strategies, and AI-generated data utilization. Practically, the study offers a training model that can be adopted by educational institutions or schools to enhance teachers' ability to design more interactive, critical, and meaningful learning experiences. This contribution is expected to accelerate educational transformation in the digital era and ensure that AI integration is oriented toward improving the quality of learners' educational experiences.

METHODOLOGY

This community service activity was conducted at SDN 11 Pontianak Timur, West Kalimantan, involving 39 teachers. The program took place on Friday, November 16, 2025. The PKM-KI initiative was implemented in partnership with the Islamic Religious Education (PAI) Teacher Working Group (KKG) of public elementary schools in Pontianak Timur, serving as a professional forum with a pivotal role in enhancing teachers' pedagogical capacity. The school was strategically selected to represent the need for improving teacher competencies at the primary education level.

The program was systematically designed through a series of interconnected stages to ensure the effectiveness of the intervention. These stages included partner needs analysis,

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program planning, training implementation, mentoring during implementation, and program outcome evaluation (Haryanti et al., 2025). The entire process employed a collaborative-participatory methodology, enabling teachers to play an active role in every activity, thereby ensuring that the program could generate sustainable impacts on the quality of instruction (Purnomo et al., 2024).

The implementation phase of the PKM-KI program began with a needs analysis in collaboration with the partner institution, the PAI Teacher Working Group (KKG) of Pontianak Timur. At this stage, the PKM-KI team engaged in intensive communication with the KKG PAI chairperson to obtain an initial overview of the teachers' actual needs in the field. Subsequently, a survey was distributed to the PAI teachers to identify aspects necessary for supporting the effective execution of their daily professional duties.

During the program planning stage, the PKM-KI team developed the training design based on the identified teacher needs, particularly emphasizing the importance of mastering deep learning in instructional practice. The program was then structured as a comprehensive training series on utilizing AI in instructional design, covering PAI teacher content and the spirit of learning, in-depth exploration of deep learning concepts, and technical training in applying AI to develop teaching modules.

The training was conducted systematically through lectures, hands-on practice, and guided discussions. Following the training sessions, the team provided mentoring in the development of teaching modules to ensure the effective transfer of competencies. An andragogical approach was applied to align the training process with adult learner characteristics. The methods employed included lectures, discussions, question-and-answer sessions, exercises, demonstrations, and practical applications, enabling participants to acquire both conceptual understanding and applied skills. Practical activities were given a dominant emphasis, comprising 75% of the program, while theoretical instruction accounted for 25%.

The program concluded with an evaluation phase to assess outcomes, challenges, and the impact of the training on enhancing PAI teachers' professional competencies. Prior to the training, teachers completed a pre-test, and following the training, they undertook a post-test to measure their knowledge of deep learning concepts and the functions of AI in developing teaching modules. The results from the pre- and post-tests were processed using JASP software.

RESULTS AND DISCUSSION

Needs Assessment and Training for the Islamic Religious Education (PAI) Teacher Working Group in East Pontianak

The initial phase of the PKM-KI implementation began with a seemingly simple yet profoundly meaningful conversation. The team reached out directly to the chairperson of the Pontianak Timur PAI Teacher Working Group (KKG) to uncover the hidden needs behind teachers' daily routines. This dialogue proved to be a critical first step in revealing the challenges educators face in designing instruction that remains relevant amidst the ever-evolving currents of technology.

Following this dialogue, the team distributed a survey via Google Forms. The survey was more than a mere form; it served as a window into the aspirations and concerns of teachers, who are the primary drivers of students' learning experiences. Its purpose was to identify specific areas in which teachers required support, particularly in applying deep learning models and integrating AI into PAI instruction.

Survey results indicated that the majority of teachers, approximately seventy-seven percent, had prior experience using AI in lesson planning. Nevertheless, around thirty-two percent had never engaged with the technology. This initial finding revealed a duality—a combination of interest and readiness, coupled with a clear need for structured guidance.

The frequency of AI use varied considerably. More than half of the teachers reported using AI only occasionally, a smaller proportion used it regularly, and some had not yet begun. This variability suggested that while interest existed, consistent and systematic application remained limited, and the journey toward mastery was still long.

Among the most frequently used tools were Gemini AI and Canva, each utilized by nearly two-thirds of the teachers. ChatGPT also enjoyed substantial use, followed by other educational applications such as Wordwall, Quizizz, and Kahoot. This pattern indicated that usage tended to focus on creative and administrative tasks rather than on instructional design grounded in deep learning principles.

These findings offer an important insight: while teachers exhibit curiosity and initial readiness, they require systematic mentoring to enhance both digital literacy and the ability to integrate technology meaningfully into instruction. Training, therefore, must bridge the gap between casual technology use and conceptually driven, strategic application.

This needs analysis provided the foundation for program planning. Based on these findings, the PKM-KI team designed a training program titled “Utilizing AI in Designing Deep Learning-Based Instruction.” The curriculum was specifically developed to address identified gaps, focusing on strengthening AI literacy and deep pedagogical competence.

The training unfolded as a layered experience. The first session, delivered by M. Amin, M.Pd., was titled “PAI Teachers and the Spirit of Learning.” This session encouraged participants to reflect on the essence of being a PAI teacher, emphasizing that technology is a servant rather than a replacement for human touch in education. Nova, M.Pd., moderated the session, ensuring that discussions were both profound and reflective.

The second session, led by Dr. Syamsul Kurniawan, M.Si., focused on the principles of deep learning. Emphasis was placed on fostering in-depth exploration, conceptual understanding, and higher-order thinking skills. Halimah, M.E., facilitated dialogue to translate theoretical concepts into practical strategies applicable in twenty-first-century classrooms.

Following a break for Asr prayer and reflection, the third session, conducted by Minarti, M.Pd., explored AI integration in instructional design. The focus was to enable teachers to develop teaching materials that are innovative, adaptive, interactive, and aligned with contemporary learning needs. Participants were guided to identify both opportunities and challenges in AI implementation, including digital competence, ethical use, and infrastructural limitations.

Through this session, teachers came to understand that digital transformation is not merely a matter of efficiency but a means of enriching instruction to make it more personalized and dynamic. Technology integration must remain pedagogically grounded so that innovation does not overshadow educational depth.

Participants were also encouraged to consider potential challenges, ranging from technical limitations to resource constraints. Such reflection emphasized that professional development requires not only skill acquisition but also critical awareness of contextual factors.

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The training was carefully balanced between theory and practice. Practical activities dominated, comprising seventy-five percent of the program, allowing teachers to experiment, iterate, and receive feedback. The remaining twenty-five percent provided conceptual grounding, ensuring that practice was informed by theory.

Mentorship accompanied hands-on activities, ensuring effective competency transfer. Teachers were guided in designing teaching modules that integrate AI with deep learning principles, translating abstract concepts into concrete instructional materials.

Finally, pre- and post-tests were administered to assess teachers' knowledge and skills. The results represented more than quantitative data; they narrated a story of growth, tracing the journey from initial curiosity to informed mastery, shaped through dialogue, reflection, and practical engagement.

Overall, the research demonstrated that AI training designed with pedagogical understanding can significantly enhance teachers' capacities. Beyond technical skill acquisition, the training cultivated adaptive and reflective mindsets—qualities essential for educators navigating the digital landscape of contemporary Islamic education.



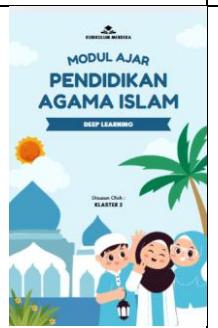
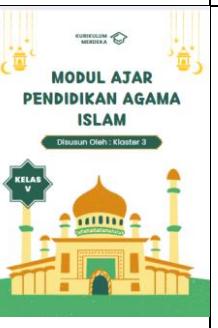
Figure 1: Training Activities (Source: Researcher Documentation, 2025)

The fourth phase involved intensive mentoring in the development of AI-based teaching modules, during which participants were organized into five clusters to engage in structured, hands-on practice. At this stage, participants utilized a variety of AI platforms: ChatGPT for designing module content, which was subsequently formatted using Canva; Wordwall to develop interactive educational games; and Quizizz as a digital medium for formative assessment. Additionally, the Gamma and Agnes platforms were employed to produce instructional materials that were more systematic, adaptive, and aligned with specific learning needs.

The mentoring process was facilitated continuously by Minarti, M. Amin, Nova, and Halimah, who provided both technical and pedagogical guidance. All final products were uploaded to a shared Google Drive repository, allowing participants to access, review, and implement their work in their respective schools.

The outcomes of this mentoring phase in creating AI-assisted, deep learning-based teaching modules are summarized in Table 1.

Table 1. Outcomes of Mentoring in Developing Deep Learning-Based Teaching Modules Using AI

Number				
1	2	3	4	5
Trainer				
Minarti	Halimah	Syamsul Kurniawan	Muhammad Amin	Nova Astariza
				

The fifth phase constituted the evaluation stage, aimed at measuring the overall effectiveness of the training provided to the PAI Teacher Working Group in Pontianak Timur, West Kalimantan. This evaluation was designed to assess participants' improvement in both knowledge and understanding of deep learning concepts, as well as their ability to apply artificial intelligence in instructional design.

Impact of Training on the Islamic Religious Education (PAI) Teacher Working Group in East Pontianak

Assessment was conducted using Pre-Tests and Post-Tests, which incorporated indicators of conceptual and practical competencies aligned with the training content. The Pre-Test served to map participants' initial capabilities, while the Post-Test provided a basis for evaluating the extent of progress achieved following the training program.

The evaluation results are presented in the following table:

Table 2. Pre-Test and Post-Test Results

No	Responden	Pre-Test	Post-Test
1	R1	58	80
2	R2	56	86
3	R3	60	94
4	R4	60	88
5	R5	70	86
6	R6	80	98
7	R7	50	82
8	R8	60	96

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No	Responden	Pre-Test	Post-Test
9	R9	58	90
10	R10	60	90
11	R11	58	98
12	R12	58	96
13	R13	60	94
14	R14	68	96
15	R15	66	92
16	R16	74	90
17	R17	66	98
18	R18	64	94
19	R19	60	94
20	R20	56	90
21	R21	76	100
22	R22	78	100
23	R23	66	90
24	R24	52	88
25	R25	66	90
26	R26	56	88
27	R27	64	90
28	R28	60	90
29	R29	70	94
30	R30	72	96
RATA-RATA		63	92

Graphically, the results of the Pre-Test and Post-Test are presented in Figure 2.

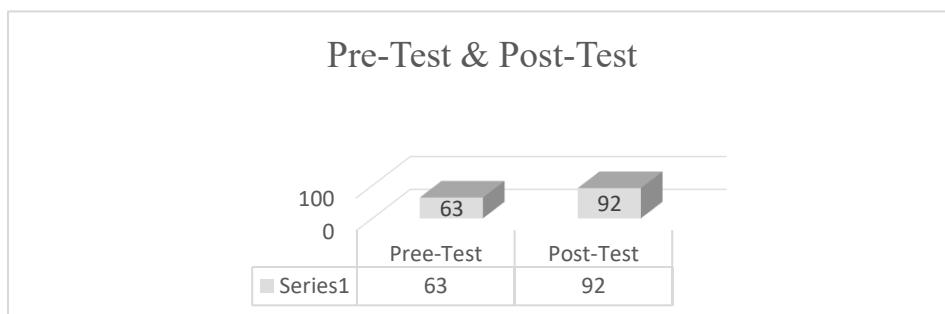


Figure 2. Graph of Pre-Test and Post-Test Results

Based on Table 2 and Figure 3, it can be described that the Pre-Test and Post-Test results from the Community Service Program reflect participants' performance before and after the intervention. The evaluation demonstrates a clear difference in scores between the initial and final assessments, representing the extent to which the training successfully enhanced participants' pedagogical and digital literacy.

Specifically, the Pre-Test yielded an average score of 63, while the Post-Test, conducted after the Community Service Program, achieved an average score of 92. To further analyze the data, the researchers tested for normality to determine whether the Pre-Test and Post-Test scores followed a normal distribution. The Shapiro-Wilk test was employed for this purpose, and the results are presented in the following table.

Table 3: *Test of Normality (Shapiro-Wilk)*

	W	p
Pre-Test	0.951	.177
Post-Test	0.956	.242

Note. Significant results suggest a deviation from normality.

The analysis results indicated that for the Pre-Test, the Shapiro-Wilk statistic (W) was 0.951 with a significance value of $p = 0.177$. Since the p-value exceeds 0.05, there is insufficient evidence to reject the null hypothesis, indicating that the Pre-Test data are normally distributed. For the Post-Test, the W value was 0.956 with a p-value of 0.242. This p-value, also greater than 0.05, confirms that the Post-Test data are normally distributed and show no significant deviation from normality.

Overall, these results demonstrate that both the Pre-Test and Post-Test data meet the assumption of normality. This condition allows for the application of parametric statistical tests in subsequent analyses, as the distributions of both datasets do not exhibit significant deviations from normality.

Given that both datasets are normally distributed, the analysis proceeded with a One-Sample t-Test. The One-Sample t-Test was employed to determine whether the mean scores of the Pre-Test and Post-Test differed significantly from a reference value of 0. The results of the One-Sample t-Test are presented in the following table:

Table 4: *One Sample T-Test*

	t	df	p
Pre-Test	46.16	29	< .001
Post-Test	101.35	29	< .001

Note. For the Student t-test, the alternative hypothesis specifies that the mean is different from 0.

The analysis using Student's t-test revealed that for the Pre-Test, the t-value was 46.16 with degrees of freedom (df) = 29 and a significance level of $p < 0.001$. This extremely small p-value indicates that the mean Pre-Test score differs significantly from 0. For the Post-Test, the t-value was 101.35 with $df = 29$ and $p < 0.001$, indicating that the mean Post-Test score also differs significantly from 0, with a very strong level of statistical significance.

Overall, both results demonstrate that participants' scores, for both the Pre-Test and Post-Test, are substantially higher than the reference value. The high statistical significance confirms that these differences are not due to random variation but reflect substantial achievement or effect across the two measurement phases.

The descriptive data are presented in the following table:

Table 5. Descriptive Data

Descriptives ▼					
	N	Mean	SD	SE	Coefficient of variation
Pre-Test	30	63.40	7.523	1.373	0.119
Post-Test	30	91.93	4.968	0.907	0.054

The descriptive data indicate that the number of respondents was the same for both the Pre-Test and Post-Test, totaling 30 participants. In the Pre-Test, the participants' mean score was 63.40 with a standard deviation of 7.523, reflecting a relatively high variation in initial competencies. The standard error of 1.373 indicates the precision of the mean estimate, while the coefficient of variation of 0.119 suggests a moderate dispersion of scores relative to the mean.

In the Post-Test, the mean score increased significantly to 91.93, accompanied by a decrease in the standard deviation to 4.968. This demonstrates not only an overall improvement in participants' abilities but also a more homogeneous distribution of scores. The standard error of 0.907 and the lower coefficient of variation (0.054) further indicate that participants' learning outcomes after the training were more stable and consistent. Overall, these data illustrate a substantial enhancement in participants' competencies following the AI-based instructional design training.

CONCLUSION

The conclusions of this study on the Community Service Program (PKM-KI) are as follows:

First, the AI-based training for designing Deep Learning-oriented instruction was effective in enhancing the competencies of PAI teachers at SDN Pontianak Timur. This is evidenced by the increase in the average evaluation scores from the Pre-Test (63.40) to the Post-Test (91.93).

Second, PAI teachers demonstrated initial interest and readiness in utilizing AI, with 77.4% having prior experience. However, its use remained largely focused on creative aspects and was not yet optimized for Deep Learning-based instructional design. The most frequently used AI tools included Gemini AI (64.5%), Canva (64.5%), and ChatGPT (58.1%).

Third, the training program, which employed a collaborative-participatory methodology, an andragogical approach, and a dominant practical component (75%), successfully facilitated the transfer of competencies. This was most evident in the guided development of AI- and Deep Learning-based instructional modules within each participant cluster.

Fourth, the Pre-Test and Post-Test data were normally distributed, allowing for the application of parametric statistical analyses. The One-Sample t-Test results demonstrated that the mean scores of the Pre-Test ($t = 46.16, p < 0.001$) and Post-Test ($t = 101.35, p < 0.001$) differed significantly from the reference value (0), reinforcing the substantial effect and achievement resulting from the training.

Overall, the training effectively facilitated the transformation of teachers' knowledge and skills, ensuring that AI was employed as a pedagogical partner to create deeper, more critical, and contextually relevant PAI learning experiences.

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