Digital Teaching Reinvented: The Effectiveness of AI-Based and IFP-Based Interactive Media in Improving Teacher Competence

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Abstract

Digital transformation in education requires teachers to have competencies that are not only technically strong, but also adaptive and creative in utilizing smart technologies. This study aims to analyze the effectiveness of "Digital Teaching Reinvented" training that integrates the use of Artificial Intelligence (AI) and Interactive Flat Panel (IFP)-based media in improving teachers' digital competence. The research design used a one-group pre-post test involving 32 teachers who participated in intensive training based on direct practice and media co-creation. Data was collected through competency evaluation instruments covering three main domains: AI-based media competence, IFP media competency and attitudes, and overall digital competence. Data analysis was carried out using a paired sample t-test, Wilcoxon test, and effect size calculation. The results of the study showed a significant increase in all competency domains. AI-based media competence increased from an average of 43.81 to 63.56 ($p < 0.001$; $d = 1.50$), IFP media competence and attitudes increased from 110.00 to 173.44 ($p < 0.001$; $d = 2.16$), while total digital competence increased from 76.91 to 118.50 ($p < 0.001$; $d = 2.03$). This improvement confirms that training that combines AI media design and IFP operation is able to strengthen technical skills, pedagogical readiness, and teachers' attitudes towards learning technology. These findings also show that integrative training models can accelerate teachers' ability to design innovative, interactive, and student-centered learning. This research provides theoretical and practical contributions through empirical evidence that AI–IFP integration-based training can be an effective strategy to improve teachers' digital competencies in the era of smart learning. This training model is recommended as an approach that can be replicated in various educational contexts to strengthen teachers' readiness to face the challenges of sustainable digital transformation.

Keywords: artificial intelligence, digital competence, digital transformation, interactive flat panel, learning media, teacher training

Introduction

The transformation of learning in the digital era requires teachers to have new competencies in utilizing technology effectively. Ideally, 21st-century teachers are required to master *digital pedagogy*, *technological literacy*, the use of *AI-powered media*, and

the use of interactive devices to improve the quality of learning (UNESCO, 2023). Modern learning models require teachers to be able to develop digital teaching materials, utilize artificial intelligence in lesson planning, and operate *Interactive Flat Panel* (IFP) devices as interactive media that increase student participation (OECD, 2024). Learning that is integrated with AI and interactive media has been shown to increase the effectiveness of material delivery, personalization of learning, teacher creativity, and the efficiency of the teaching process (Schwab & Zahidi, 2023; Harsono et al., 2025)).

However, the reality on the ground shows that the digital competence of teachers in Indonesia is still not up to this ideal standard. The 2023 report by the Ministry of Communication and Information Technology (Kominfo) shows that more than 60% of teachers are still in the basic digital literacy category and have not been able to utilize AI-based technology in learning. The findings of the Curriculum Standards and Educational Assessment Agency (BSKAP) of the Ministry of Education and Culture, 2023 also show that only 23% of teachers feel confident in using interactive digital media, and the use of devices such as IFP is still very limited due to a lack of technical training. In addition, the Katadata Insight Center's national survey (2023) reported that 70% of teachers have never developed AI-assisted interactive teaching materials, even though digital devices are already available in schools. This is in contrast to the development of global research which shows that the integration of AI and interactive media has great potential to improve the quality of teaching (Rahman et al., 2025). The study of Alqahtani et al. (2023) states that the use of AI in the creation of teaching materials increases teacher creativity and accelerates the learning design process. Another study by García-Morales & Garrido-Moreno (2022) found that interactive digital media such as IFP significantly increased motivation and participation. Meanwhile, research by Khalid et al. (2024) shows that the combination of AI and *interactive media* results in a significant increase in teacher efficacy in designing digital learning.

Although various studies have shown the benefits of using AI and interactive media, there are several research *gaps* that have not been widely studied. First, most research is still focused on the effectiveness of AI *or* IFP separately, rather than as an integrated medium. Second, there is little research that combines the use of AI for learning content generation with its implementation in IFP as an interactive presentation medium. Third, previous research has rarely measured changes in teacher competence directly using pre-post test design, even though this approach provides stronger

empirical evidence on the effectiveness of training. In addition, most research in developing countries has not used specific AI-based digital competency indicators, such as teachers' ability to generate images with AI, create automated quizzes, design AI-assisted interactive slides, and integrate AI content with *interactive media*.

In addition, the operational definition **of teachers' digital competencies** needs to be explicitly clarified so that the conceptual framework of this research has a strong and measurable empirical footing. In this study, teachers' digital competence is not understood simply as a basic ability to use technological tools, but as a multidimensional construction that includes cognitive, technical, pedagogical, and affective aspects in the use of digital-based learning technology. Operationally, a teacher's digital competence is defined as the ability of teachers to (1) understand the basic concepts and principles of digital technology and artificial intelligence (AI), (2) produce and adapt AI-based learning media such as the creation of text, visual, automated quizzes, and interactive slides (3) operate Interactive Flat Panel (IFP) devices effectively as a medium for interaction and presentation of learning, and (4) demonstrate a positive attitude, confidence, and continuous motivation in integrating digital technology into pedagogical practice. This operational definition is the basis for the preparation of research instruments, the determination of measurement indicators, and the analysis of changes in teacher competence through pre-test and post-test designs. With this clarification, teachers' digital competencies are positioned not only as technical skills but as professional capacities that play a strategic role in supporting the transformation of intelligent and student-centered technology-based learning.

Based on this research gap, this research offers *a state of the art* by combining two increasingly important domains in the digital education ecosystem, namely AI-based media creation and IFP-based interactive delivery. This study not only evaluates the competence of the use of AI and IFP media, but also measures real changes in teachers' abilities based on pre-test and post-test data. *The novelty of* this research lies in the integration of the use of AI and IFP as a comprehensive learning media, as well as in an evaluation model that directly measures competency changes through instruments based on AI literacy indicators and interactive media operating skills that are rarely used in similar research. Taking into account ideal conditions, realities in the field, global empirical evidence, and existing research gaps, this study aims to analyze the effectiveness of the use of AI-based and IFP-based interactive media on improving

teachers' digital competence, as reflected through the results of teachers' self-evaluation in pre-test and post-test.

The novelty of this study becomes stronger when compared systematically with previous studies. A number of previous studies have shown that the use of Artificial Intelligence (AI) in education is able to increase the efficiency of learning design, teacher creativity, and personalization of teaching materials, but generally positions AI as an individual tool that stands alone and is not directly integrated with the medium of learning delivery in the classroom (Alqahtani et al., 2023; Kohnke et al., 2025; Tan et al., 2025). On the other hand, research on the use of interactive media such as Interactive Flat Panels (IFPs) places more emphasis on improving student engagement, classroom interaction, and learning motivation, with a primary focus on the technical aspects of device use and learners' learning experiences (García-Morales & Garrido-Moreno, 2022; Chien et al., 2023; Riyadi & Ningsih, 2024). However, most of these studies have not linked the use of interactive media with the strengthening of teachers' digital competence comprehensively, and rarely measure changes in teacher competence directly through pre-test and post-test designs. In contrast to previous studies, this study integrates AI as a learning media production engine (text, visual content, automated quizzes, and interactive slides) which is then operationalized directly through IFP as a learning interaction medium in the classroom. In addition, this study explicitly positions teachers' digital competence as the main variable that is measured operationally and empirically through indicators of AI-based media competence, IFP competence, and professional attitudes towards technology. With this approach, this study provides a new scientific contribution in the form of empirical evidence that the integration of AI-IFP in one integrated training model not only impacts the use of technology, but significantly improves teachers' digital competence in technical, pedagogical, and affective aspects simultaneously, which is still rarely found in the digital education literature, especially in the context of developing countries. This research is expected to make a theoretical and practical contribution to the development of an intelligent media-based learning digitalization training model for teachers in Indonesia.

Research Method

This study uses a quasi-experimental design with a one-group pre-test–post-test model, which aims to measure the effectiveness of the use of Artificial Intelligence (AI)

and Interactive Flat Panel (IFP) based interactive media in improving teachers' digital competence. This design was chosen because it allows the analysis of changes in teachers' competencies before (O_1) and after (O_2) participating in digital media training interventions (X), so that it can show empirical improvement in competence based on the difference in pre-post test scores. The research subjects were all teachers who participated in the learning digitization training program, and the sample was determined using the total sampling technique, namely all participants who filled out the pre-test and post-test instruments completely through a digital form. Thus, all responses entered in the PRE-TEST and POST-TEST files were used as the main data for this study.

The research instrument is in the form of a self-evaluation questionnaire based on the Likert scale 1–5 which measures three components of teachers' digital competence, namely AI-based media competence, competence in the use of IFP, and attitudes and motivations towards the use of digital media. AI competencies include the ability to understand AI concepts, create teaching materials with ChatGPT or Gemini, generate digital images, create automated quizzes, and design AI-assisted interactive slides. IFP's competencies include the ability to understand basic features, operate devices, create digital annotations, display interactive teaching materials, and manage learning files through IFP. Meanwhile, attitude aspects include comfort, perception of benefits, motivation, and teachers' intentions to apply the technology in a sustainable manner. This instrument has been validated through expert judgment by three experts (learning media, educational technology, and digital learning), and tested for reliability using *Cronbach's Alpha* with a value that meets the ≥ standard of 0.70.

The data collection procedure begins with the implementation of a pre-test to photograph the teacher's initial competency before the training begins. Furthermore, teachers participated in learning digitalization training that focused on creating teaching media using AI, creating automated quizzes, producing interactive visual media, designing slides with AI features, and using IFP as a presentation tool and classroom interaction. At the end of the activity, teachers fill out a post-test to measure changes in competence after obtaining an intervention. The collected data is double-checked to ensure there are no duplicate responses, missing data, or incompleteness that could affect the reliability of the analysis. Data analysis is carried out in several stages. First, descriptive analysis was used to describe the distribution of pre-post scores, including

minimum, maximum, mean, and standard deviation values on each digital competency indicator. Second, the Shapiro–Wilk or Kolmogorov–Smirnov normality test is used to determine the appropriate type of comparative test. Third, the effectiveness of the training was analyzed using the Paired Sample t-test if the data was normally distributed or the Wilcoxon Signed Rank Test if the data was abnormal. To strengthen the interpretation of competency change, Cohen's effect size d was also calculated which measures the magnitude of the increase (small = 0.2, medium = 0.5, large = 0.8). In addition, the results of the study were visualized through bar graphs, line graphs, and *radar charts* to clarify the pattern of changes in teachers' digital competencies.

The stages of research include: problem identification, literature study, development of evaluation instruments, instrument validation, pre-test data collection, implementation of AI and IFP-based media training, post-test data collection, quantitative analysis, interpretation of results, and preparation of scientific articles. The entire research process was carried out by paying attention to research ethics, including the confidentiality of participants' identities, voluntary participation through *informed consent*, and the use of data only for academic purposes.

Result and Discussion

This section presents the results of pre-test and post-test analysis of **32 teachers** who participated in the "Digital Teaching Reinvented" training, which is training in the development of learning media based on Artificial Intelligence (AI) and Interactive Flat Panel (IFP). All respondents followed two measurements, so that the data could be analyzed in *pairs*. The results of the initial analysis showed that teachers' digital competency scores increased in all competency domains after participating in the training.

The analysis was carried out on three competency domains: (1) AI-based media competence, (2) IFP media competence and attitudes, and (3) digital competence. The results *of the paired sample t-test* showed that the three domains experienced a significant increase. In AI-based media competency, the average pre-test score of 43.81 increased to 63.56 in the post-test (Δ = +19.75). The *paired sample t-test* showed significant differences, $t(31) = 8.49$, $p < 0.001$, with a large *effect size* (Cohen's $d = 1.50$). This improvement shows that training is very effective in strengthening teachers' ability to use AI to create digital teaching materials such as texts, images, automated quizzes, and interactive slides. In

the IFP media competence and digital attitude aspects, a more substantial increase can be seen from the average pre-test of 110.00 to 173.44 (Δ = +63.44). The t-test showed a value *of t*(31) = 12.22, *p* < 0.001, with a very large *effect size* (d = 2.16). This shows that training not only improves teachers' technical skills in operating IFPs, but also improves teachers' comfort, motivation, and readiness in using interactive technology. On the total score of digital competence, the average increased from 76.91 to 118.50 (Δ = +41.59). The results of the statistical test showed *t*(31) = 11.47, *p* < 0.001, with a large *effect size* (d = 2.03). These findings indicate that the training has succeeded in improving teachers' digital skills comprehensively, covering cognitive, psychomotor, and affective aspects.

To ensure consistency of results, a Wilcoxon Signed-Rank test was performed, which also showed significant differences across domains (p < 0.001). Thus, the improvement of teacher competence is not only parametrically significant but also nonparametrically.

Table 1 Results of t-test, Wilcoxon, and Effect Size Tests in
Three Digital Competency Domains Guru

Indicator	Pre Mean (SD)	Post Mean (SD)	Mean	t	p (t-test)	Wilcoxon p	Cohen's d
AI-based media competencies	43,81 (12,09)	63,56 (7,97)	19,75	8,49	1,389	4,828	1,50
IFP media competence and attitudes	110,00 (28,88)	173,44 (22,06)	63,44	12,22	2,183	2,330	2,16
Digital competencies	76,91 (19,54)	118,50 (14,92)	41,59	11,47	1,092	4,660	2,03

Table 1 shows that all competency domains experienced a significant increase after training. The IFP domain showed the greatest improvement, both in terms of mean and effect size, indicating that training is very effective in improving teachers' skills in operating interactive devices such as digital annotation, file management, and the use of learning applications in IFP. The increase in AI competence and total digital competence is also consistent with a *very small* p-value and a large *effect size* value , so that training is sure to have a strong and significant impact.
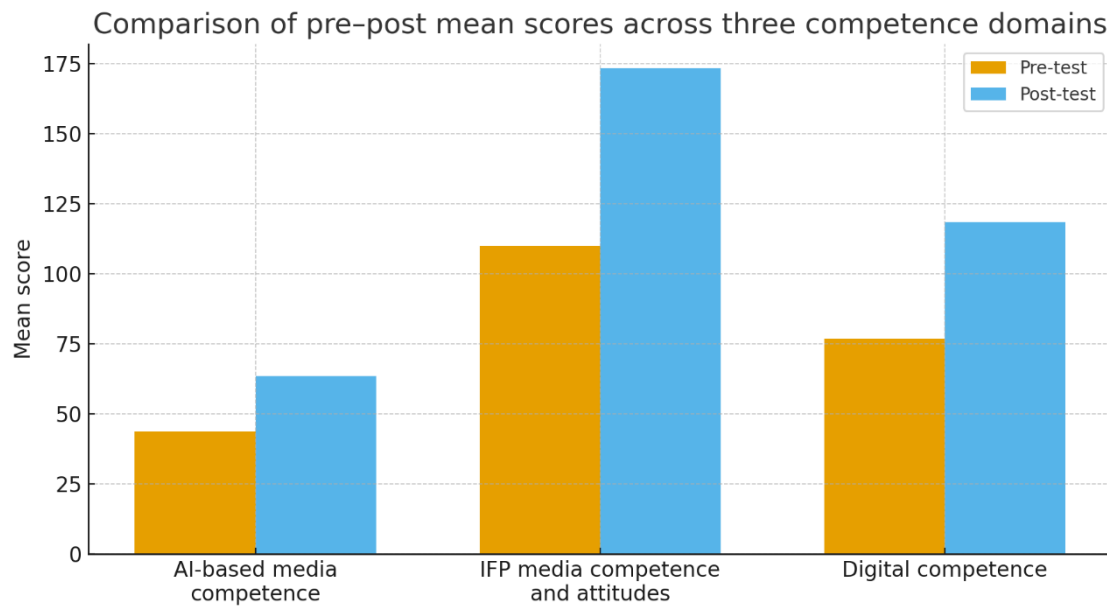
Figure 1 Comparison of The Average Pre-Test and Post-Test Scores in
The Three Competency Domains

Figure 1 shows a comparison of the average pre-test and post-test scores of teachers in the three domains of digital competence. In the domain of AI-based media competency, the average teacher score increased from 43.81 to 63.56, indicating a significant increase in the ability to understand AI concepts and utilize AI to create teaching materials such as texts, images, automated quizzes, and learning slides. In the domains of IFP media competence and attitude, a greater increase was seen, from 110.00 to 173.44, indicating that training was highly effective in strengthening teachers' skills in operating Interactive Flat Panels while increasing their comfort, motivation, and readiness for the use of digital learning technologies. As for the digital competency domain, which is a combination of the overall indicators of AI, IFP, and attitude, there was an increase in the score from 76.91 to 118.50, reflecting a holistic increase in digital competence. Overall, the graph shows that training had a positive and consistent impact across all domains measured, with the greatest improvements occurring in IFP media competence and attitudes
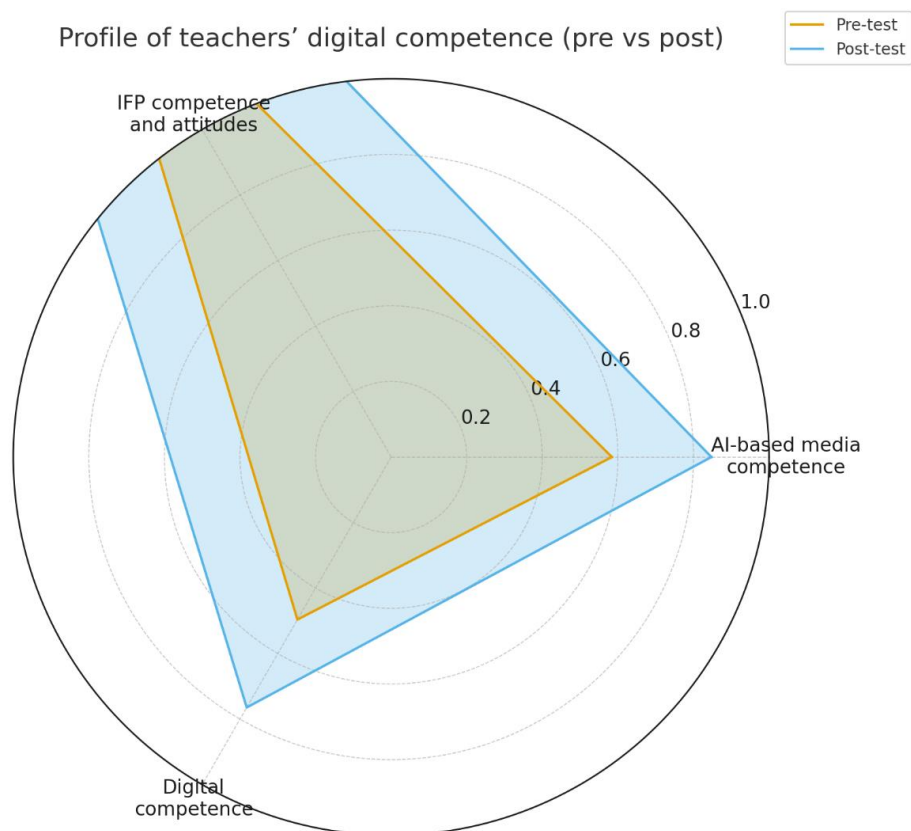
Figure 2 Teacher digital competency profile before and after training

The radar chart shows a proportional change in the teacher's digital competency profile. The area of the post-test curve appears to be wider in each domain, illustrating an overall improvement in both AI competence, IFP competence, and total competence. The IFP domain showed the largest area expansion, confirming the magnitude of the impact of training on improving teachers' skills in utilizing interactive media. This graph makes it clear that training does not only improve one type of competence, but provides a holistic improvement on all aspects of digital teaching. The results of this study show that the Digital Teaching Reinvented training that combines the use of Artificial Intelligence (AI) and *Interactive Flat Panel* (IFP)-based media is able to significantly improve teachers' digital competence in three main domains: (1) AI-based media competence, (2) IFP media competence and attitudes, and (3) overall digital competence. Consistent improvements across domains show that hands-on practice-based training interventions are able to accelerate teachers' digital transformation very effectively.

Significant improvements in AI-based media competencies show that teachers are becoming more able to utilize AI technology to design teaching materials such as text, visual, quizze, and other interactive media content. These results are in line with recent studies that show that the use of AI-based media can improve students' motivation, concept understanding, and learning experience when teachers are able to integrate them pedagogically (Fatmawati & Raharjo, 2024; Zahro & Siswono, 2025). Some studies also emphasize that teachers' ability to design AI-based media is still a global challenge, so most teachers are only passive users, not media designers (Kohnke et al., 2025; Tan et al., 2025). Thus, the findings of this study fill the gap by providing empirical evidence that practice-based training and *co-creation* can significantly improve the literacy and skills of AI media production by teachers.

The domains that showed the greatest improvement were IFP media competence and attitudes towards the use of interactive technology. This shows that teachers not only acquire technical skills in operating IFPs—such as digital annotation, the use of learning applications, and the management of interactive screens—but also experience positive changes in terms of comfort, motivation, and pedagogical readiness. These findings are consistent with the research of Riyadi & Ningsih (2024) and Patta et al. (2025) which states that the use of interactive panels can improve participation, interaction, and learning experiences if teachers understand them pedagogically. The literature also shows that IFP devices are highly effective when supported by learning designs based on SAMR or TPACK models so that teachers are able to transform the learning process, rather than simply moving slides to digital screens (Chien et al., 2023). By combining IFP and AI training in a single training model, this study makes a more integrative contribution than previous technology training models that usually stand alone.

The increase in the total score of digital competence showed that the training intervention not only strengthened teachers' technical skills, but also improved the cognitive (digital knowledge), affective (attitude towards technology), and metacognitive (evaluation of the use of technology). These results reinforce the global finding that digital competence, AI literacy, and attitudes towards AI are interrelated and mutually reinforcing (Dringó-Horváth et al., 2025; Galindo-Domínguez et al., 2024). Other research has also shown that teachers with high digital competence are better prepared to integrate AI in learning and are more confident in assessing its pedagogical benefits and risks (Mah & Groß, 2024; Lucas et al., 2024). Thus, the increase in the total

score of digital competence in this study can be understood as a natural result of training that focuses not only on the technical of the tool, but also on AI literacy, ethics, design readiness, and curriculum integration.

In the context of AI research in education, several recent systematic reviews (Tan et al., 2025; Amofa et al., 2025; Deng et al., 2025) emphasized that previous research emphasized the effectiveness of AI on student learning outcomes, rather than on teacher competency development. This research expands this scope by providing empirical evidence that strengthening teacher competencies can be done quickly, structured, and effectively through a practice-based training approach. In addition, the literature related to the digital transformation of educational institutions states that the success of digital transformation is highly dependent on the competence and readiness of teachers, not just infrastructure (Graham et al., 2023; Huang et al., 2025). The findings of this study confirm that structured training based on AI and IFP media is able to significantly boost such readiness.

The synthesis of this research discussion shows that the "Digital Teaching Reinvented" training that integrates the use of AI-based media and IFP media simultaneously is able to encourage a surge in teachers' digital competence at three levels at once: technical mastery, pedagogical readiness, and attitude change. The significant increase in the domain of AI-based media competency indicates that teachers are no longer just passive users of applications, but have begun to transform into digital media designers who are able to utilize AI to produce texts, visuals, quizzes, and interactive teaching materials that are in harmony with learning needs. At the same time, the enormous improvement in IFP's media competence and attitudes shows that when IFP is not taught as a mere technological tool, but as *a* learning orchestration platform that blends AI content, digital annotation, and classroom interaction, teachers become much more confident, comfortable, and motivated to make it a regular part of learning practice. Overall, the increase in total digital competency scores confirms that this training not only upgrades momentary technical skills, but strengthens the foundations of digital literacy and teacher AI literacy more comprehensively.

The main novelty of this research lies in the integrated training model that positions AI not as a stand-alone technology, but as a media production machine that is directly operationalized through IFP in the context of real learning scenarios. In contrast to many previous studies that photographed AI or IFP separately and highlighted its

impact on students, this study explicitly focused on teacher competence as a key variable and proved its effectiveness through a pre-post design with a very large *effect size*. Another novelty is its contribution from the educational context in the Global South, which shows that the transformation of AI-based learning and interactive media can be realized even with limited resources, provided that the training design emphasizes hands-on practice, media *co-creation*, and critical reflection on ethics and the pedagogical meaning of technology. Thus, this research not only fills the empirical gap related to the model of teacher professional development in the AI era, but also offers a practical framework that can be replicated by other educational institutions that want to prepare teachers to become key actors in the digital media-based intelligent learning ecosystem.

Conclusion

This study concludes that Digital Teaching Reinvented training that integrates the use of Artificial Intelligence (AI) and Interactive Flat Panel (IFP)-based media has proven to be very effective in improving teachers' digital competence. Significant improvements occurred in three main domains, namely AI-based media competence, IFP media competence and attitudes, and overall digital competence. The increase in pre-post scores accompanied by a large effect size shows that this training not only improves teachers' technical skills, but also strengthens their confidence, motivation, and pedagogical readiness in utilizing interactive learning technology. The integration of AI and IFP training allows teachers to transform from passive technology users to creative, adaptive, and able to deliver more meaningful learning experiences for students. These findings confirm that hands-on-based training, media co-creation, and critical reflection are effective approaches to prepare teachers to face the demands of digital age learning. Thus, this training model is recommended as a strategy that can be replicated by schools, colleges, and other educational institutions to strengthen teachers' capacity to support the sustainable digital transformation of education.

Referensi

Alqahtani, M., Rajab, K., & Alharthey, B. (2023). Artificial intelligence tools in education: Enhancing teacher creativity and instructional design. Education and Information Technologies, 28(12), 13145–13168. https://doi.org/10.1007/s10639-023-11428-5

Amofa, B., et al. (2025). Generative AI in higher education: A systematic review. Education Sciences, 15(7), 826. https://doi.org/10.3390/educsci15070826

Badan Standar Kurikulum dan Asesmen Pendidikan (BSKAP). (2023). Laporan Kompetensi Guru dan Transformasi Digital Pembelajaran 2023. Kemendikbudristek. https://www.kemdikbud.go.id

Chien, Y.-H., et al. (2023). Using interactive flat panel display for STEM. LNCS 14016. https://doi.org/10.1007/978-3-031-35129-7_16

Deng, R., et al. (2025). Does ChatGPT enhance student learning? Computers & Education, 227, 105224. https://doi.org/10.1016/j.compedu.2024.105224

Dhameria, V., et al. (2025). Digital transformation in education management. IJEQQR, 4(1), 17–29. https://doi.org/10.58418/ijeqqr.v4i1.135

Dringó-Horváth, I., Zátonyi, I., & Tóth, Z. (2025). University teachers' digital competence and AI literacy. Education Sciences, 15(7), 868. https://doi.org/10.3390/educsci15070868

Fatmawati, N. M., & Raharjo. (2024). AI-based learning videos. Golden Age Journal, 9(3). https://doi.org/10.14421/jga.2024.93-09

Galindo-Domínguez, H., Delgado, N., Campo, L., & Losada, D. (2024). Relationship between teachers' digital competence and attitudes towards artificial intelligence in education. International Journal of Educational Research, 126, 102381. https://doi.org/10.1016/j.ijer.2024.102381

García-Morales, V. J., & Garrido-Moreno, A. (2022). Interactive digital media and student engagement: Examining technological acceptance and learning motivation. Computers in Human Behavior, 136, 107263. https://doi.org/10.1016/j.chb.2022.107263

Graham, C. R., et al. (2023). Digital learning transformation. Education Sciences, 13(11), 1143. https://doi.org/10.3390/educsci13111143

Harsono, A. M., Nurmahmudah, F., Putra, E. C. S., Rahman, A., Dewantara, B. A., Arsyad, M. Z. T., & Alfarisa, F. (2025). Beyond the lesson plan: Reflective practice as a catalyst for teacher professional growth. Private Social Sciences Journal , 5(11), 289–301. https://doi.org/10.55942/pssj.v5i11.698

Huang, X., et al. (2025). Digital transformation in higher education. Frontiers in Psychology, 16, 1565591. https://doi.org/10.3389/fpsyg.2025.1565591

Khalid, M., Ahmed, S., & Malik, R. (2024). Artificial intelligence–driven interactive learning environments and teacher self-efficacy: Evidence from developing countries. Education Sciences, 14(1), 38. https://doi.org/10.3390/educsci14010038

Khalil, H., & Alsenaidi, S. (2024). Teachers' digital competencies for effective AI integration in higher education in Oman. Journal of Education and e-Learning Research, 11(4), 494–504. https://doi.org/10.20448/jeelr.v11i4.6097

Katadata Insight Center. (2023). Survei Literasi Digital Nasional 2023: Status Literasi Digital Masyarakat Indonesia. Katadata. https://katadata.co.id

Kementerian Komunikasi dan Informatika Republik Indonesia. (2023). Laporan Indeks Literasi Digital Indonesia 2023. Kominfo. https://www.kominfo.go.id

Kohnke, L., Zou, D., & Gu, M. (2025). Preparing future educators for AI-enhanced classrooms. Computers and Education: Artificial Intelligence, 8, 100398. https://doi.org/10.1016/j.caeai.2025.100398

Lee, D., Arnold, M., et al. (2024). The impact of generative AI on higher education. Computers and Education: Artificial Intelligence, 6, 100221. https://doi.org/10.1016/j.caeai.2024.100221

Lucas, M., Zhang, Y., Bem-Haja, P., & Vicente, P. N. (2024). The interplay between teachers' trust in artificial intelligence and digital competence. Education and Information Technologies. https://doi.org/10.1007/s10639-024-12772-2

Mah, D.-K., & Groß, N. (2024). Artificial intelligence in higher education: Faculty use and PD needs. Int. J. Educational Technology in Higher Education. https://doi.org/10.1186/s41239-024-00490-1

Mah, D.-K., Knoth, N., & Egloffstein, M. (2025). Perspectives of academic staff on artificial intelligence. Frontiers in Education, 10, 1484904. https://doi.org/10.3389/feduc.2025.1484904

OECD. (2024). OECD Digital Education Outlook 2024: Teaching, Learning and Working in the Digital Age. OECD Publishing. https://doi.org/10.1787/19939019

Patta, N. M., et al. (2025). Dampak penggunaan panel interaktif. STRATEGY, 5(4). https://doi.org/10.51878/strategi.v5i4.7850

Rahman, A., Nurmahmudah, F., Putra, E. C. S., Harsono, A. M. B., Dewantara, B. A., Arsyad, M. Z. T., & Alfarisa, F. (2025). Artificial Intelligence (AI) as the Reflective Partner: Empowering Teachers for Deep Learning Pedagogy. *RIGGS: Journal of Artificial Intelligence and Digital Business*, 4(3), 3877–3889. https://doi.org/10.31004/riggs.v4i3.2426

Riyadi, R., & Ningsih, T. (2024). IFP media in social science learning. Elementary School Education Journal, 8(3). https://doi.org/10.30651/else.v8i3.24401

Schwab, K., & Zahidi, S. (2023). The Future of Jobs Report 2023. World Economic Forum. https://www.weforum.org/reports

Sperling, K., et al. (2024). AI literacy in teacher education: A scoping review. Computers and Education Open, 6, 100169. https://doi.org/10.1016/j.caeo.2024.100169

Tan, X., Cheng, G., & Ling, M. (2025). AI in teaching and professional development. Computers and Education: Artificial Intelligence, 8, 100355. https://doi.org/10.1016/j.caeai.2024.100355

UNESCO. (2023). Guidance for Generative AI in Education and Research. UNESCO Publishing. https://unesdoc.unesco.org

Zahro, I. Z., & Siswono, H. (2025). AR–AI-based media in early childhood ELT. JETI, 8(1). https://doi.org/10.31537/jeti.v8i1.2325