Enhancing Teachers' Digital Competency through Participatory LMS Training for Junior High School Teachers

Abdul Rahman[1], Brezto Asagi Dewantara [2], Lazaro Kumala Dewi[3]

Email: abdulrahman@ulm.ac.id

Abstract: *The digital competency gap among teachers is a crucial barrier to integrating technology into learning and represents a real challenge for junior high school teachers, as technology proficiency remains uneven. This study aimed to examine the effectiveness of a participatory Learning Management System (LMS) training program designed to improve the digital competency of 28 teachers at State Junior High School (SMPN 24) in Banjarmasin City. This study used a one-group pre-test–post-test design. The Shapiro–Wilk normality test confirmed that the data were normally distributed ($p > 0.05$); therefore, a paired samples t-test was used to measure the impact of the intervention. The results showed a highly significant increase in teacher competency scores from before the training (mean = 75.00, SD = 13.264) to after the training (mean = 89.82, SD = 7.134), with a p-value ($p < 0.001$), indicating a statistically significant improvement in teachers' digital competency after participating in the LMS training program. These findings demonstrate that a participatory training approach effectively improves teachers' digital competency and can serve as a strategic model for professional development in the digital era.*

Keywords: *Digital Competency, Teacher Training, Learning Management System, Teacher Professional Development*

Abstrak: *Kesenjangan kompetensi digital di kalangan guru merupakan hambatan penting dalam mengintegrasikan teknologi ke dalam pembelajaran dan tantangan nyata yang dihadapi oleh guru SMP, di mana kemampuan teknologi masih belum merata. Penelitian ini bertujuan untuk menentukan efektivitas program pelatihan Sistem Manajemen Pembelajaran/LMS partisipatif yang dirancang untuk meningkatkan kompetensi digital 28 guru di SMP Negeri 24 di Kota Banjarmasin. Studi ini menggunakan desain pre-test–post-test satu kelompok. Uji normalitas Shapiro–Wilk mengonfirmasi bahwa data terdistribusi normal ($p > 0,05$); oleh karena itu, uji t sampel berpasangan digunakan untuk mengukur dampak intervensi. Hasil penelitian menunjukkan peningkatan yang sangat signifikan pada skor kompetensi guru dari sebelum pelatihan (rata-rata = 75,00, SD = 13,264) hingga setelah pelatihan (rata-rata = 89,82, SD = 7,134), dengan nilai p ($p < 0,001$), yang menunjukkan peningkatan yang signifikan secara statistik dalam kompetensi digital guru setelah mengikuti program pelatihan LMS. Temuan ini menunjukkan bahwa pendekatan pelatihan partisipatif secara efektif meningkatkan kompetensi digital guru dan dapat berfungsi sebagai model strategis untuk pengembangan profesional di era digital.*

Kata Kunci: *Kompetensi Digital, Pelatihan Guru, Learning Management System, Pengembangan Profesional Guru*

[1]*Educational technology, Lambung Mangkurat University*
[2]*Educational technology, Lambung Mangkurat University*
[3]*Educational technology, Lambung Mangkurat University*

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INTRODUCTION

Global education is in the midst of a transformation driven by advances in digital technology. The 21st-century learning paradigm demands a shift from traditional teacher-centered teaching models to a more dynamic, collaborative, and student-centered learning ecosystem (Fullan & Langworthy, 2014). In Indonesia, government initiatives such as the *"Merdeka Belajar"* program and the launch of the *"Platform Merdeka Mengajar"* explicitly encourage the use of technology to enrich learning experiences and facilitate instructional differentiation. However, the realization of this vision depends heavily on one fundamental element: the digital competency of educators. Digital competency is more than just the ability to operate hardware or software. It is a complex spectrum of skills, encompassing information literacy, digital communication, content creation, cybersecurity, and technology-based problem-solving (Redecker, 2017). For teachers, this competency becomes even more complex because it must be integrated with pedagogical and content domains. The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2009), provides a powerful theoretical framework for understanding this complexity. TPACK asserts that effective teaching with technology requires a dynamic synthesis of three core knowledge domains: Technology (TK), Pedagogy (PK), and Content (CK). Excellent teaching occurs at the intersection of these three domains, where teachers select and use appropriate technology to teach specific content using the most effective pedagogical methods. Despite this, numerous reports and studies indicate a significant gap in teacher TPACK mastery, both globally and nationally (Hakim, 2016; Susanto & Wibowo, 2021). This gap has given rise to the phenomenon of the "second-level digital divide," where the issue is no longer access to technology but rather the ability to use it meaningfully for learning purposes (Hargittai, 2002). Teachers may be adept at using technology personally but often struggle when it comes to integrating it into effective learning designs.

To bridge this competency gap, various professional development programs (PDPs) have been implemented. However, many of these are trapped in a top-down, theoretical, and passive "one-shot workshop" model. This model often fails to produce sustainable practice changes because it lacks contextualization and opportunities for practice and reflection. It also ignores adult learning principles (andragogy) that emphasize autonomy and relevance (Knowles et al., 2015). Teachers often return to the classroom with little change in their teaching practices, a phenomenon known as "training transfer failure" (Darling-Hammond, Hyler, & Gardner, 2017). As an alternative, participatory and collaborative training models, rooted in social constructivism theory and Communities of Practice (CoP), offer a more promising approach (Lave & Wenger, 1991). In this model, teachers are positioned as active learners who collaborate, share experiences, and co-construct new knowledge within the context of their practice. A Learning Management System (LMS) provides an ideal platform to facilitate this type of training model. An LMS can function as a digital "space" where teachers not only receive materials but also interact, collaborate on authentic tasks (e.g., designing digital lesson plans), and receive feedback from facilitators and peers. This approach aligns with digital-era learning theories such as connectivism, which views learning as a process of building knowledge networks (Siemens, 2005). While theoretically, the LMS-based participatory training model appears superior, empirical evidence that quantitatively measures its impact, particularly in the context of junior high school teachers in Indonesia, still needs to be strengthened.

Despite the increasing focus on digital competency in education, empirical evidence on the effectiveness of participatory LMS-based training models remains limited, particularly in the context of

junior high school teachers in Indonesia. In addition, previous studies have rarely integrated TPACK and Communities of Practice (CoP) within a structured training intervention. Therefore, this study contributes by providing empirical evidence on a participatory LMS-based training model that integrates TPACK and CoP to enhance teachers' digital competency and reduce competency gaps.

This study was designed to fill this gap. Specifically, it aims to answer the question: Does the Participatory LMS Training program significantly improve the digital competency of junior high school teachers? Practically, the results can provide data-based justification for education policymakers, education offices, and principals to shift from the conventional PDP model to a more participatory and sustainable model. Theoretically, this study contributes empirical evidence to the effectiveness of applying CoP and TPACK theories in the context of teacher professional development in the digital era.

RESEARCH METHODS

Research Design

This study used a one-group pre-test–post-test design. This design allows researchers to measure the impact of an intervention by comparing data from the same group at two different time points: before (O1) and after (O2) treatment (X). This design scheme can be described as follows: O1 → X → O2.

Participants and Research Context

The participants in this study were 28 teachers at junior high schools (SMPN 24) in Banjarmasin City. Participants were selected using a purposive sampling technique, with the following criteria: (a) active teachers with a minimum of two years of service; (b) teaching diverse subjects to ensure sample heterogeneity; and (c) willingness to participate in all research activities fully. The participants included teachers of various ages and varying technological experience. Before the study began, all participants were fully informed of the study's purpose and procedures, and they signed an informed consent form. Data confidentiality and participant anonymity are fully guaranteed.

Research Instrument

The primary instrument used for data collection was a digital competency test specifically designed to measure teachers' understanding and skills in utilizing LMS for learning. This test underwent expert validation and reliability testing, with a Cronbach's Alpha coefficient greater than 0.85. The test was distributed to teachers via Google Forms.

Intervention Procedure: Participatory LMS Training

The intervention (X) in this study is a training program designed based on participatory and collaborative principles. This approach is designed to create a temporary community of practice, where teachers learn not only from the facilitator but also from one another, in a context relevant to their work.

Data Analysis Techniques

Quantitative data analysis was conducted using IBM SPSS Statistics Version 24 software. The analysis steps were as follows: Descriptive statistical analysis was conducted to summarize the main characteristics of the pre-test and post-test data. The calculated statistics included the mean, standard deviation (SD), minimum score, and maximum score. This data was also visualized using a histogram to observe the distribution of scores. Before conducting the hypothesis testing, a normality test was performed. Given the relatively small sample size (N = 28), the Shapiro-Wilk test was chosen because it

has better statistical power for samples under 50. The criterion used was that if the significance value (p) > 0.05, the data were considered normally distributed. For inferential statistical analysis, the paired samples t-test was used to test the research hypotheses. This test is appropriate for comparing the means of two related measurements (pre-test and post-test) from the same group of subjects. The significance level (alpha) set for decision-making is $\alpha = 0.05$. The Null Hypothesis (H_0) will be rejected if the resulting Sig. (2-tailed) value is less than 0.05.

RESEARCH RESULTS

The results are presented systematically to answer the research questions.

Descriptive Statistics and Score Distribution

The descriptive analysis shows clear changes in teachers' digital competency scores after participating in the training.

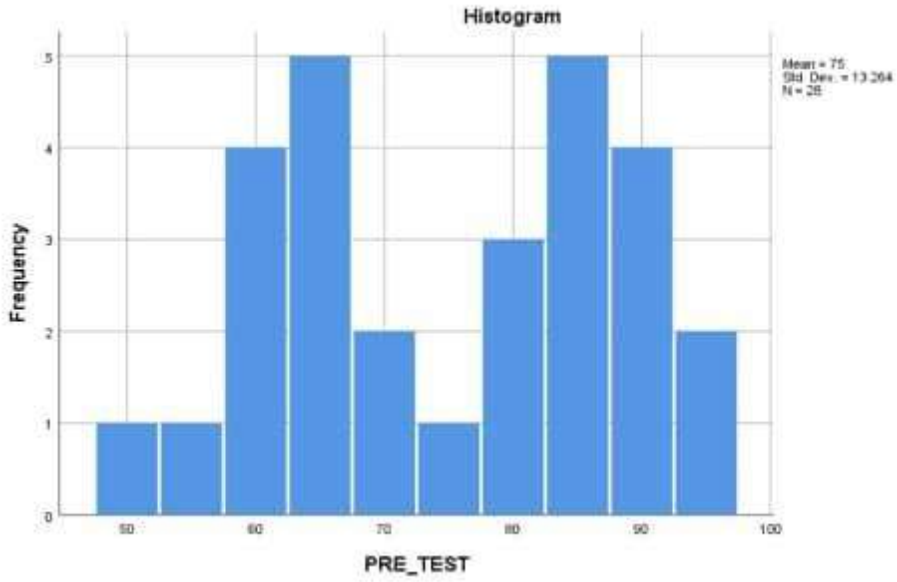

Figure 1. Pre-Test Histogram

The pre-test histogram shows a fairly wide distribution of scores, with the highest frequencies occurring in the 65-70 and 85-90 ranges. There was significant variation in competency before training.

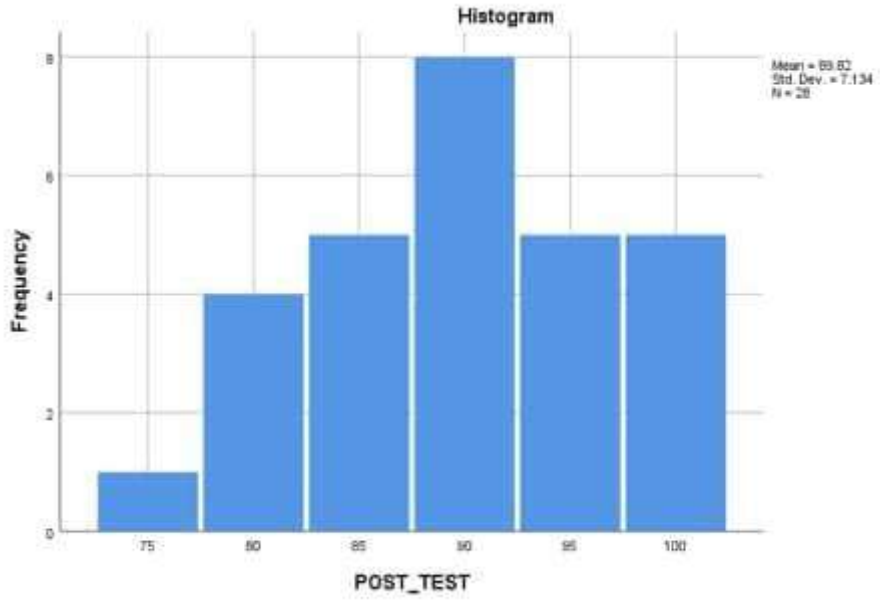

Figure 2. Post-Test Histogram

In contrast, the post-test histogram shows a shift in the distribution to the right (higher scores). The majority of participants (8 people) scored around 90, and the distribution of scores was generally more concentrated in the high values.

Table 1. Comparison of Descriptive Statistics of Pre-Test and Post-Test Scores

Category	Mean	N	Standard Deviation
Pre-Test	75	28	13.264
Post-Test	89.82	28	7.134

Source: SPSS Data Processing

The average score increased substantially by 14.82 points. The standard deviation also decreased by nearly half, from 13,264 to 7,134. These data indicate that the score distribution after training became more concentrated around a higher mean, indicating homogenization of competency. The minimum score on the post-test (75) was equivalent to the average score on the pre-test, indicating that even participants with the lowest competency experienced significant progress. Data visualization using histograms confirmed these findings. The pre-test histogram showed a broad, bimodal distribution, with participants concentrated in the mid-score (60-70) and high-score (80-90) ranges. In contrast, the post-test histogram showed a clear shift to the right (left-skewed distribution), with the majority of participants (22 out of 28, or 78.6%) scoring 85 or higher.

Table 2. Normality Test Results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRE_TEST	.167	28	.043	.928	28	.054
POST_TEST	.153	28	.093	.931	28	.065

a. Lilliefors Significance Correction

The results of the inferential analysis using the Paired Samples T-Test are presented in detail in Table 3.

Table 3. Paired Samples T-Test Results

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE_TEST	75.00	28	13.264	2.507
	POST_TEST	89.82	28	7.134	1.348

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE_TEST & POST_TEST	28	.088	.656

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE_TEST - POST_TEST	-14.821	14.497	2.740	-20.443	-9.200	-5.410	27	.000

These results show a significance value ($p < 0.001$). This value is far below the threshold of $\alpha = 0.05$. Therefore, the null hypothesis (H_0), which states there is no significant difference between the pre-test and post-test scores, is convincingly rejected. The 95% confidence interval (95% CI) for the mean difference lies between -20.443 and -9.200, which does not cross zero, further strengthening the conclusion that the observed improvement is statistically significant. Thus, it can be concluded that the Participatory LMS Training program has a very significant positive impact on teachers' digital competency.

DISCUSSION

Interpretation of the Success of Training Interventions

The key findings of this study provide strong empirical evidence that a participatory and collaboratively designed teacher training model significantly outperforms conventional training models. The average score increase of 14.82 points is not simply a number; it represents a shift in teachers' capabilities in integrating technology into their pedagogical practices. Several key elements of the training design, aligned with contemporary learning theories, contribute to this success. First, the practice-based

and authentic approach directly targets the development of TPACK. Rather than simply learning about the LMS, teachers use it for real-world tasks, such as designing lessons and providing feedback. This process requires teachers to consider aspects of technology, pedagogy, and content simultaneously, fostering knowledge synthesis that is at the heart of TPACK (Mishra & Koehler, 2009). Second, the collaborative element of the training created an ad hoc Community of Practice (CoP). In this CoP, teachers learn not only from the facilitator but also from their peers through group discussions and projects (Lave & Wenger, 1991). These interactions are valuable because they enable social scaffolding, allowing more advanced teachers to help their struggling colleagues. This not only accelerates the learning process but also builds confidence and a sense of professional community that can continue even after the training is completed. This finding highlights the importance of participatory and collaborative approaches in designing effective digital competency development programs for teachers.

The Meaning Behind the Decrease in Standard Deviation

One of the most significant findings, in addition to the average improvement, was the dramatic decrease in the standard deviation. This indicates that the training successfully bridged the competency gap among participants. Before the training, there was a wide variation in proficiency levels, reflecting the reality in many schools where there are a few “tech champions” while the majority lag behind. The training significantly raised the minimum competency level (the lowest score rose from 50 to 75), and the competencies were more equitably distributed. These results have important practical implications. Disparities in teacher competency often hinder the implementation of technology at the school level. With more uniform competency standards, schools will more easily implement comprehensive technology policies, facilitate collaboration among teachers, and ensure that all students receive technology-enriched learning experiences, regardless of their teachers.

Analyzing Anomalous and Outlier Findings

Although the trend is very positive, critical analysis requires examining data anomalies. Two participants’ scores decreased after the training (Participant 16, from 95 to 80, and Participant 20, from 80 to 75). Although the number is small and does not affect the overall statistical results, this phenomenon should not be ignored. Several hypotheses can be proposed. First, there may be external factors, such as fatigue or personal issues, affecting performance post-test. Second, the results could indicate a "regression to the mean" effect or even test fatigue. Third, and most pedagogically relevant, the data may indicate that a "one-size-fits-all" approach, even within a participatory framework, may not be entirely appropriate for every individual. These teachers may have unique needs or learning styles that were not addressed in training, or they may face conceptual barriers. This highlights the importance of personalized mentoring elements in future PDP programs.

The validity of these findings must be considered in light of the study's limitations. First, the lack of a control group makes it impossible to completely rule out the influence of other confounding variables, such as teachers' self-directed learning initiatives or the Hawthorne effect (where participants change their behavior due to awareness of being observed). Second, the limited sample size of 28 teachers from a suburban context limits the ability to generalize these findings to the entire teacher population in Indonesia. Third, this study only measured short-term impacts. There is no data yet on long-term retention of knowledge and skills or the extent to which these new competencies are actually transferred into daily classroom practice.

Given these limitations, future research could explore various avenues. Replicating this study with a quasi-experimental design involving a control group is highly recommended. Furthermore, a longitudinal study tracking teachers' classroom skills implementation over a semester or more would offer more details about the actual impact of the training. Finally, complementing quantitative data with qualitative

approaches (case studies, in-depth interviews, classroom observations) could help explain the "why" and "how" of the training, as well as uncover the nuances behind anomalous cases.

CONCLUSION AND SUGGESTIONS

This research provides strong and convincing empirical evidence that a teacher training program designed with participatory, collaborative, and authentic practice-based principles within an LMS platform is significantly effective in improving teachers' digital competency. This intervention not only increased the overall competency average but also reduced the capability gap among teachers. This creates a stronger foundation for digital transformation at the school level. The implications of these findings are clear. For policymakers and education administrators, it is time to shift from passive and sporadic professional development models to investing in programs that are sustainable, interactive, and rooted in communities of practice. For school principals, the results emphasize the importance of building a collaborative learning culture among teaching staff, where technology is not considered a burden but a tool for shared pedagogical innovation. Theoretically, this research affirms the relevance of the TPACK framework as a goal and CoP theory as a process in designing impactful teacher professional development in the 21st century. Ultimately, investing in teachers' digital competency represents a direct investment in the quality of learning and the future of students.

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