



Evaluation of Digital Literacy and Training in Shaping Self-Efficacy towards Teachers' Digital Competence in High Schools

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Article Info

Article history:

Received Jul 05, 2025
Revised Sep 15, 2025
Accepted Oct 16, 2025
OnlineFirst Oct 30, 2025

Keywords:

Digital Literacy
Evaluation
High Schools
Self-Efficacy
Teachers' Digital Competence

ABSTRACT

Purpose of the study: This study aims to evaluate the role of digital literacy and training in shaping teachers' self-efficacy and in contributing to the development of digital competencies among high school teachers.

Methodology: A quantitative research design was used, employing a correlational survey. Data were collected from 100 high school teachers in East Java through an online questionnaire. Structural Equation Modeling (SEM) analysis was performed using SmartPLS 4.0 software to evaluate measurement validity, structural paths, and mediation effects.

Main Findings: Digital literacy, training, and self-efficacy have a significant, positive influence on teachers' digital competence. Both digital literacy and training also significantly influence teachers' self-efficacy, although the influence is relatively small. In addition, self-efficacy partially mediates the relationship between digital literacy and training in digital competence, underscoring its strategic role in improving teachers' ability to integrate technology into education.

Novelty/Originality of this study: This study offers a new perspective by identifying self-efficacy as a psychological bridge between external support (training) and internal competency development. It enriches current knowledge by integrating personal belief systems into the digital competency framework and provides practical implications for designing more effective teacher professional development programs.

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1. INTRODUCTION

The development of digital technology has become the main catalyst in the transformation of the education system from the era of the Industrial Revolution 4.0 to the era of Society 5.0. Globalization and advances in information and communication technology (ICT) have forced educational institutions to adapt to a more flexible, collaborative, and digital-based learning paradigm [1]. This situation has been exacerbated by the COVID-19 pandemic, which has accelerated the adoption of technology in distance learning and hybrid learning [2], [3]. In this context, teachers play a central role in the learning process and are required to have strong digital competencies to effectively integrate technology into educational activities [4], [5].

The effort to improve teachers' ability to utilize technology or teacher digital competence (TDC) is part of a global commitment to achieve Sustainable Development Goal (SDG) 4, which is to ensure inclusive and equitable quality education and support lifelong learning opportunities for all. According to UNESCO 2018, the use of digital technologies such as Learning Management Systems (LMS), e-learning, and artificial intelligence

(AI)-based tools is an important component of global educational transformation [6]. Additionally, various digital platforms like Zoom, Google Meet, Canva, PowerPoint, Google Forms, Quizizz, educational videos, and e-books are now being utilized by teachers to support interactive and flexible online learning [7]-[11]. The use of these media enhances teachers' digital competencies and promotes inclusive, creative, and learner-centered learning. Therefore, strengthening teachers' digital competencies has become a strategic agenda in improving the quality of national education.

Despite this global shift, the Indonesian education system continues to face significant challenges in digital integration. Based on the Indonesian Digital Society Index (IMDI) released by the Ministry of Communication and Digital Affairs (Kemkomdigi) in 2022-2023, the overall index score only reached 37.8 out of a maximum scale of 100 [12]. Additionally, according to the Indonesia Digital Literacy Index 2022, released by the Ministry of Communication and Information Technology in collaboration with Katadata Insight Center, Indonesia's digital literacy score reached 3.54 (on scale from 1 to 5), categorized as "moderate" [13]. According to data presented by the Ministry of Education and Culture (Kemendikbud) during the launch of the Pembatik (ICT Training) program, around 60% of teachers in Indonesia continue to exhibit limited proficiency in ICT [14]. This digital gap reveals an urgent need to strengthen teachers' competencies through systematic training and sustained professional development. The urgency is even more pronounced as Indonesia moves toward implementing the *Merdeka Belajar* curriculum, which demands high adaptability and innovation from teachers in using digital tools.

Previous studies have shown that teachers' digital competencies in Indonesia, particularly at the secondary education level, still face various challenges. Low digital literacy, limited contextual training, and a lack of ongoing support are factors that hinder the optimization of teachers' digital competencies [15], [16]. Contextual and sustainable digital training can significantly enhance teachers' digital competencies, for example, with an average increase of 20% and 82% of teachers achieving post-training targets [17]. However, the lack of infrastructure, collaboration, and long-term mentoring limits the impact of such training in real-world practice [18], [19]. Meanwhile, teachers still face difficulties in accessing and effectively utilizing technology in learning, even after participating in training [20], [21]. This indicates that improvements in digital literacy and training do not automatically lead to a significant increase in teachers' digital competencies.

In this study, self-efficacy is a psychological variable that should be taken into account in explaining the complexity of improving teachers' digital competence. According to the social cognitive theory developed by Bandura, self-efficacy is an individual's belief in their ability to organize and carry out the actions necessary to achieve a certain performance [22], [23]. Teachers with high levels of self-efficacy are more confident in exploring, trying, and implementing digital technology in the learning process [24]. This means that self-efficacy can act as a mediating variable that bridges the influence of digital literacy and training on the achievement of digital competencies. In other words, the success of training programs and improvements in digital literacy will be more effective if accompanied by the strengthening of teachers' self-efficacy.

To theoretically explain this process, Cybernetic Theory provides a complementary framework. It conceptualizes teachers as self-regulating systems that process information (inputs) from digital experiences and training, adjust internal states (through self-efficacy), and generate behavioral outputs (competence development) based on feedback [25], [26]. In the learning system, teachers process information from training and digital experiences as input, but the success of competency transformation is greatly influenced by internal control in the form of self-efficacy [27]. In addition, the 2018 version of the UNESCO ICT Competency Framework for Teachers (ICT-CFT) provides a comprehensive conceptual foundation for the six areas of digital competency that teachers must possess, including (1) understanding ICT in education, (2) integration into the curriculum, (3) pedagogical practices, (4) digital skills, (5) learning organization, and (6) continuous professional development [28]. This framework guides how teachers transform digital inputs into pedagogical outcomes.

Previous studies have examined the influence of digital literacy and training on teachers' digital competence (TDC), but most have not explored in depth the mediating role of self-efficacy in this relationship. Therefore, this study is important to fill this empirical gap in Indonesia, particularly in East Java Province. This study aims to analyze the influence of digital literacy and training on teachers' digital competencies, with self-efficacy as the mediating variable. Based on the background explained above, the following are the research questions for this study: 1) How do digital literacy, training and self-efficacy affect the digital competence of high school teachers in East Java?; 2) How do digital literacy and training affect the self-efficacy of high school teachers in East Java?; 3) How is the role of self-efficacy as a mediator in the influence of digital literacy and training on the digital competence of high school teachers in East Java?

2. RESEARCH METHOD

This research uses a quantitative approach with a correlation method and explanatory survey design [29]. The purpose of this study is to analyse the influence of digital literacy and training on teachers' digital competence with self-efficacy as a mediating variable. This approach allows for the collection of numerical data

through structured questionnaires to measure the relationship between variables quantitatively. The research instruments were developed based on relevant theories and frameworks. The digital literacy variable (X_1) includes information and data literacy, communication, collaboration, digital content creation, security, and problem solving. The training variable (X_2) includes instructor quality, participant characteristics, methods, materials, practices, and training evaluation. Meanwhile, teacher self-efficacy (M) refers to confidence in managing the classroom, delivering material, facing challenges, using technology, motivating students, and adapting learning strategies. The variables of digital literacy, training, and digital competence are measured using a 5-point likert scale. Self-efficacy was measured using a situational psychological scale with five graded response options.

Prior to data collection, the research instruments underwent validation by experts to ensure content validity and conceptual accuracy. The three experts evaluated the clarity, relevance, and representativeness of the items, especially on the self-efficacy (optimism) scale. The validation process used Aiken's V index, and all items achieved coefficients above 0.80, indicating strong agreement among the experts regarding the content validity of the scale [30].

The research sample consisted of 100 high school and vocational school teachers in East Java Province, Indonesia. The sample size was determined using G*Power software with a significance level of 0.1 [31]. The sampling technique used was purposive sampling with the following criteria: (1) teachers who were actively teaching at those levels, (2) had participated in Information and Communication Technology (ICT) training, and (3) used digital devices in the learning process. Data collection was conducted through an online questionnaire using Google Forms in April 2025 and analysed in May 2025. Data analysis was performed using the Structural Equation Modelling–Partial Least Squares (SEM-PLS) method with the assistance of SmartPLS 4.0 software. The analysis consisted of two stages: a measurement model (outer model) to test the validity and reliability of the constructs, and a structural model (inner model) to test the relationships between variables and hypotheses. PLS-SEM was chosen because it is suitable for predictive research [32].

3. RESULTS AND DISCUSSION

This section explains the research findings based on the results of data analysis, starting from respondent characteristics, measurement model evaluation, structural model analysis, and hypothesis testing. The subsequent discussion interprets the implications of these findings, focusing on the influence of digital literacy, training, and self-efficacy on teachers' digital competencies, the impact of digital literacy and training on self-efficacy, and the mediating role of self-efficacy in shaping digital competencies. The results of the research and discussion are presented as follows:

Respondent Characteristics

The research sample was described based on three criteria, namely gender, age, and type of school. Details of the distribution of respondents are presented in Table 1.

Table 1. Respondent Characteristics

Categories	Subcategories	Frequency (n)	Percentage (%)
Gender	Male	31	31%
	Female	69	69%
Age	< 25 year	13	13%
	26 – 35 year	37	37%
	36 – 45 year	26	26%
	46 – 55 year	16	16%
	>56 year	8	8%
Types of Schools	Senior High School (SMA)	57	57%
	Vocational High School (SMK)	43	43%
Total		100	100%

After analysing the results of the survey, it was found that out of 100 participants, 31% were male teachers and 69% were female teachers. Regarding age range, 13% of respondents were under 25 years old, 37% were between 26 and 35 years old, 26% were aged between 36 and 45 years, 16% were between 46 and 55 years old, and 8% were over 56 years old. In terms of the type of school they worked in, 57% of respondents came from a Senior High School (SMA) educational background, while the remaining 43% had a background in Vocational High School (SMK). This information indicates a variation in respondent characteristics, in terms of gender, age, and type of schools.

Measurement Model

Testing of the reflective measurement model (outer model) was conducted to ensure the validity and consistency of the constructs used in the research. First, convergent validity was tested through the factor loading values of each indicator on its constructs. An indicator value is considered valid if it has a factor loading ≥ 0.70 , as this reflects a strong relationship and significant contribution to the construct [31]. These values are presented in Figure 1: Factor Loadings.

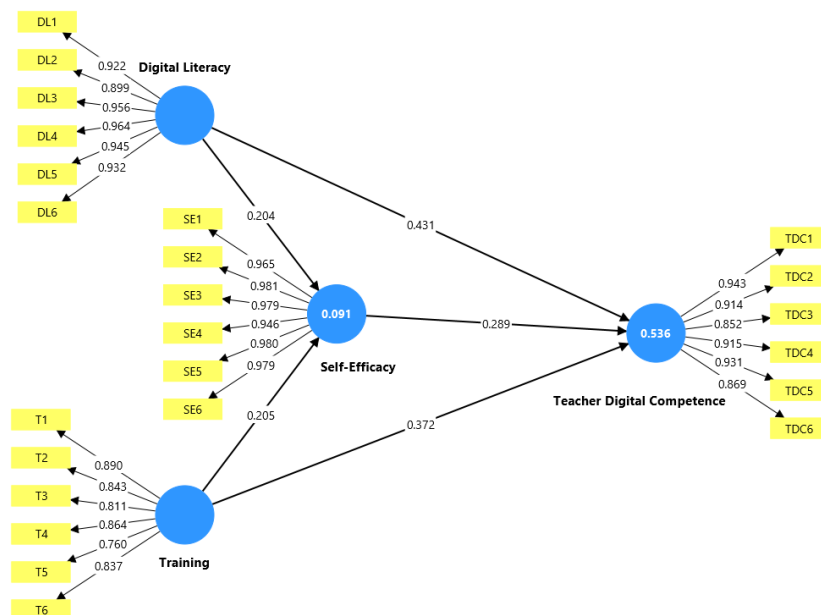


Figure 1. Loading Factors

Figure 1 above shows the results of the data analysis conducted using the Smart-PLS 4 application. All indicators from each variable show a loading factor value of more than 0.70. This means that the 24 indicators applied in this study meet the standards of convergent validity and can be considered good indicators in describing the construct of the analyzed variable [31].

Subsequently, the discriminant validity analysis is conducted using the Fornell-Larcker criterion, where the square root of the Average Variance Extracted (AVE) for each construct must be higher than the correlation value between that construct and other constructs. This indicates that each construct can be well distinguished from the others in the model [33]. The AVE values can be found in Table 2. The discriminant validity test for the variables in this study.

Table 2. Discriminant validity test of variables in research

	Digital Literacy	Self-Efficacy	Teacher Digital Competence	Training
Digital Literacy	0.937			
Self-Efficacy	0.221	0.972		
Teacher Digital Competence	0.525	0.467	0.905	
Training	0.081	0.221	0.471	0.835

Based on Table 2, there are results from the Fornell-Larcker discriminant validity test. The square root of AVE (shown on the diagonal) for each construct, namely Digital Literacy (0.937), Self-Confidence (0.972), Teacher Digital Competence (0.905), and Training (0.835), are all greater than the correlation values between the other constructs. This indicates that all constructs meet the standard of discriminant validity and reinforces that each construct has the ability to distinguish itself well compared to the other constructs [33].

Finally, the consistency of the structure is measured using Composite Reliability (CR) and Cronbach's Alpha to ensure the reliability of the measurement. Both indicators are used to evaluate the extent to which the indicators within a structure consistently measure similar concepts. A structure is considered reliable if it has a CR value ≥ 0.70 and a Cronbach's Alpha ≥ 0.70 [31]. The values of CR and Cronbach's Alpha are presented in Table 3. The reliability of internal consistency.

Table 3. The reliability of internal consistency

	Cronbach's alpha	Composite reliability
Digital Literacy	0.972	0.977
Self-Efficacy	0.988	0.990
Teacher Digital Competence	0.955	0.964
Training	0.913	0.932

As shown in Table 3, the reliability evaluation indicates that all constructs have a Cronbach's Alpha and Composite Reliability (CR) values above the minimum threshold of 0.70, which signifies the presence of internal consistency and a high level of reliability [31]. Therefore, it can be concluded that each construct in the model has met the necessary criteria for validity and reliability in the measurement process.

Model Structural

The structural model (inner model) is designed to assess the relationships between variables while considering indicators such as Path Coefficient, R^2 , F^2 , and Q^2 . First, path coefficient analysis is used to measure the strength and direction of the relationships among variables in the structural model. The path coefficient (β) indicates the extent to which one variable affects another variable [31]. Table 4 presents the results of the path analysis, followed by the presentation of the path coefficient values.

Table 4. Path Coefficient

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	Description
Digital Literacy -> Self-Efficacy	0.204	0.204	0.093	2.194	0.028	Significant
Digital Literacy ->Teacher Digital Competence	0.431	0.434	0.064	6.752	0.000	Significant
Self-Efficacy -> Teacher Digital Competence	0.289	0.284	0.069	4.175	0.000	Significant
Training -> Self-Efficacy	0.205	0.210	0.098	2.100	0.036	Significant
Training -> Teacher Digital Competence	0.372	0.378	0.071	5.254	0.000	Significant

The path analysis conducted in this study indicates that Digital Literacy has a positive impact on Self-Efficacy ($\beta = 0.204$) and Teacher Digital Competence ($\beta = 0.431$). On the other hand, Training also demonstrates a positive influence on Self-Efficacy ($\beta = 0.205$) as well as Teacher Digital Competence ($\beta = 0.372$). Furthermore, Self-Efficacy also contributes positively to enhancing Teacher Digital Competence ($\beta = 0.289$).

Second, the R-square value reflects how effectively the independent variables explain the dependent variable in a model. A model is categorized as weak if R^2 is less than 0.25, moderate if the value is between 0.50 to 0.75, and strong as a predictive model if it is greater than 0.75 [31]. The R square results can be seen in Table 5. The value of R^2 .

Table 5. The value of R^2

	R-square	R-square adjusted
Self-Efficacy	0.091	0.072
Teacher Digital Competence	0.536	0.522

Based on the analysis conducted, the R-square value for the Self-Efficacy construct is recorded at 0.091, indicating that the exogenous variables can only explain 9.1% of the variation in Self-Efficacy, while the remaining is influenced by other factors outside the model under study. On the other hand, the R-square value for the Teacher Digital Competence construct is 0.536, which suggests that 53.6% of the variation in teacher digital competence can be understood through the exogenous variables in the model. Thus, the Teacher Digital Competence construct demonstrates a moderate predictive capability, whereas Self-Efficacy shows a low predictive capability [31].

Third, f-square (f^2) is a measure of effect size that describes the extent to which one exogenous variable influences an endogenous variable within a structural model. The f^2 value is used to assess the strength of a variable's contribution, with the following general criteria: 0.02 (small), 0.15 (medium), and 0.35 (large) [31]. The F-square values are presented in Table 6.

Table 6. F^2 Value

	f-square
Digital Literacy -> Self-Efficacy	0.046
Digital Literacy -> Teacher Digital Competence	0.380
Self-Efficacy -> Teacher Digital Competence	0.164
Training -> Self-Efficacy	0.046
Training -> Teacher Digital Competence	0.283

The results of SEM-PLS indicate that digital literacy skills and training programs have a small impact on teachers' confidence ($f^2 = 0.046$). Meanwhile, digital literacy significantly influences teachers' digital competence ($f^2 = 0.380$), while training has a moderate influence ($f^2 = 0.283$), and self-efficacy also shows a moderate influence ($f^2 = 0.164$).

Lastly, the Q^2 value is used to assess the model's predictive ability. A Q^2 value above 0 is considered low, 0.25 is moderate, and 0.50 is high. If the Q^2 value exceeds 0, it indicates a relevance in the predictions, and the greater the value, the more effective the model is in making predictions [34]. The Q^2 value can be found in Table 7.

Table 7. Q^2 Value

	Q^2 predict	RMSE	MAE
Self-Efficacy	0.051	0.997	0.826
Teacher Digital Competence	0.435	0.766	0.605

The Q^2 predict results show that the model has relevant predictive capabilities, with a value of 0.051 for Self-Efficacy (small) and 0.435 for Teacher Digital Competence (medium).

Hypothesis Testing

This research tested seven hypotheses using SEM-PLS 4, consisting of five direct effects and two indirect effects, as shown in Figure 2: Results of Hypothesis Testing.

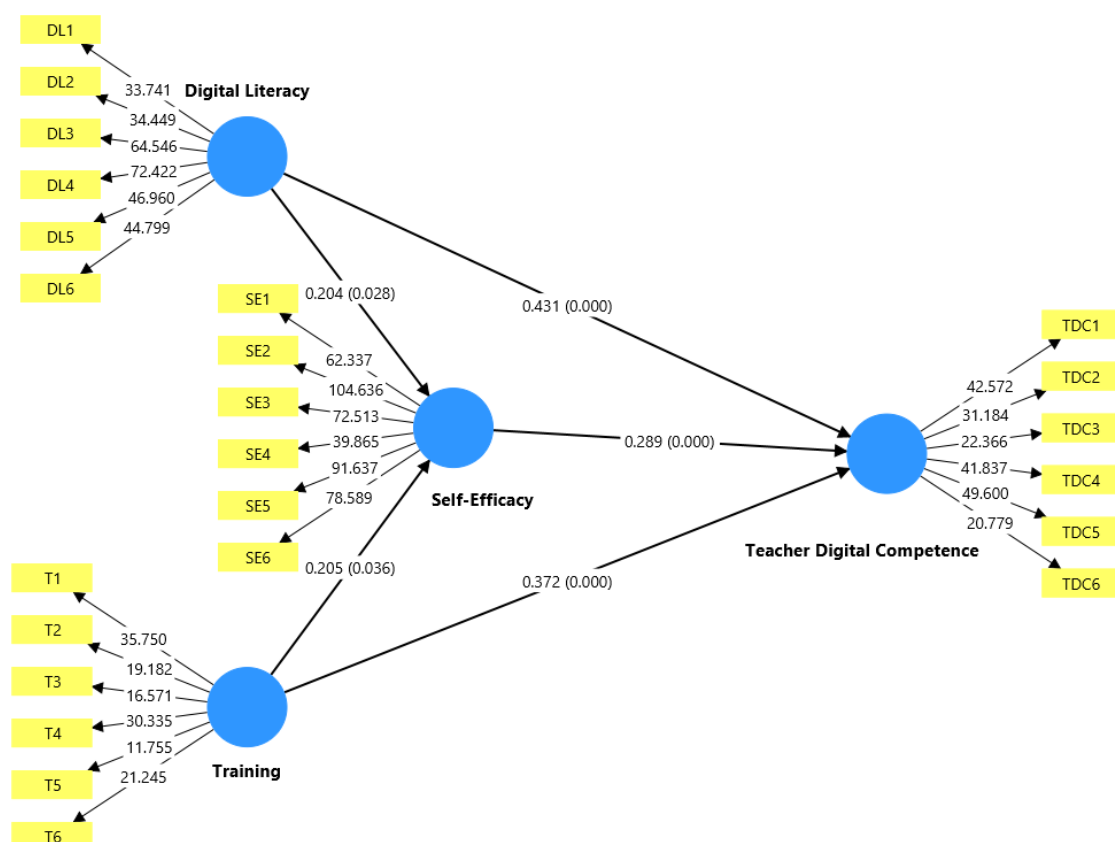


Figure 2. Results of Hypothesis Testing

Based on Figure 2, Hypothesis Testing Results above, the direct effect includes First Hypothesis (H_1), which states that digital literacy has a significant effect on self-efficacy with a t-value of 2.194 and a p-value of

0.028, indicating that teachers with better digital literacy tend to have higher self-efficacy. The Second Hypothesis (H₂) states that digital literacy also significantly influences teacher digital competence (t-value = 6.752; p-value = 0.000), meaning that digital literacy directly enhances teachers' digital competence. Third Hypothesis (H₃), the relationship between self-efficacy and teacher digital competence is also proven to be significant with a t-value of 4.175 and a p-value of 0.000, indicating that teachers who have confidence in their abilities tend to be more competent in the use of technology. Additionally, the fourth hypothesis (H₄) states that training significantly influences self-efficacy (t-value = 2.100; p-value = 0.036). Furthermore, Fifth Hypothesis (H₅) states that training also directly influences teacher digital competence (t-value = 5.254; p-value = 0.000). This indicates that training not only enhances teachers' self-efficacy but also directly contributes to the improvement of their digital competence.

In regard to indirect effects, Sixth Hypothesis (H₆) found that digital literacy indirectly influences teacher digital competence through self-efficacy, with a mediation effect of 0.059. This value is derived from the product of the path coefficients (0.204×0.289) and is significant because both direct paths are significant (t-value > 1.96; p < 0.05). Similarly, Seventh Hypothesis (H₇) states that training has an indirect effect on teacher digital competence through self-efficacy, with the same mediation effect of 0.059 (0.205×0.289). This finding indicates that self-efficacy acts as a partial mediator, reinforcing the influence of digital literacy and training on teacher digital competence.

The Effect of Digital Literacy, Training, and Self-Efficacy on Teachers' Digital Competence

Based on the analysis results, it can be seen that digital literacy, training, and self-efficacy significantly influence teachers' digital competence. Among these three variables, digital literacy has the greatest influence on teachers' digital competence ($\beta = 0.431$; $f^2 = 0.380$). These findings indicate that teachers' ability to access, evaluate, and utilize digital information greatly contributes to their mastery of learning technology. This is consistent with the findings of Temirkhanova et al, who emphasize that digital literacy is the main foundation for the effective application of educational technology in the classroom [35]. In addition, research by Rosliani also found that teachers with high digital literacy are more adaptable to digital learning platforms and capable of independently designing technology-based learning activities [36]. Support from the study by Cebi et al reinforces this finding, stating that good digital literacy strengthens the pedagogical integration of technology through improved problem-solving and innovation in the teaching-learning process [37].

Furthermore, training also contributes significantly to teachers' digital competence ($\beta = 0.372$; $f^2 = 0.283$). Practical and needs-based training has proven effective in improving teachers' skills in using digital learning platforms and applications. Aminuddin et al noted that practice-based digital training can increase teachers' competencies by up to 82% of the target [17]. Research by Shumeiko et al also highlights that continuous training plays an important role in building teachers' readiness for digital change, especially in the context of distance learning [38]. On the other hand, Ahmmed et al show that the effectiveness of training depends heavily on the quality of facilitators, relevant materials, and follow-up mentoring, so that training not only improves technical skills but also strengthens teachers' confidence in applying training outcomes in practice [39].

In addition, teachers' self-efficacy was also found to have a significant effect on digital competence ($\beta = 0.289$; $f^2 = 0.164$). Teachers who have high confidence in their ability to use technology tend to be more confident in adopting and adapting technology to support learning. This finding is consistent with Bandura's (1997) theory of self-efficacy, which states that a person's belief in their own abilities influences the amount of effort they put into facing challenges, including in the context of technology. Research by Cosby et al reinforces this by showing that teachers with high self-efficacy are more proactive in exploring various digital tools and demonstrate a positive attitude toward technological innovation [22]. Support also comes from the study by Hershkovitz et al, which found that self-efficacy has an important contribution to the success of ICT integration, as teachers who are confident in their abilities are more likely to try new approaches in teaching [40]. Meanwhile, research by Skrbinjek et al mentions that training that enhances teachers' self-efficacy has a positive impact on the application of more creative and adaptive technology [41].

Therefore, the results of this study reveal that digital literacy is the most dominant factor, followed by training and self-efficacy, in shaping teachers' digital competence. The three factors complement each other, reflecting the integration of cognitive aspects (digital knowledge), technical aspects (training in technology use), and psychological aspects (self-efficacy). The implications of these findings are the need for a teacher professional development approach that not only focuses on the transfer of technical skills but also on strengthening self-confidence and digital literacy as the main foundation for improving the quality of technology-based learning.

In addition, the optimism scale developed and validated in this study has valuable practical implications for the educational environment. This scale can serve as a diagnostic and development tool to identify teachers' positive attitudes and resilience toward digital transformation. Education policymakers and school leaders can use this scale to design targeted interventions, such as motivational workshops, mentoring programs, and peer-

to-peer coaching, aimed at fostering optimism and confidence in technology adoption. By assessing teachers' levels of optimism, schools can anticipate potential barriers, encourage a growth mindset, and increase readiness for sustainable digital integration. The practical application of this optimism scale not only supports the development of digital competencies but also creates a positive psychological climate that encourages continuous innovation in education.

The Influence of Digital Literacy and Training on Self-Efficacy

The research results show that digital literacy and training have a significant effect on teachers' self-efficacy ($\beta = 0.204$ and $\beta = 0.205$). Although the effect size values for both variables are relatively small ($f^2 = 0.046$ for each variable), these findings remain relevant in the context of digital education as they indicate that inputs such as digital knowledge and training experience genuinely shape teachers' perceptions of their ability to manage educational technology.

This finding can be explained in more depth using cybernetic theory, which views humans as self-regulating systems that work through three main components: input, information processing, and feedback. In this context, digital literacy and training serve as systemic inputs, which are then processed internally by teachers. However, as explained in this theory, the success of transforming information into effective action depends heavily on internal control mechanisms, namely self-efficacy. Teachers with high self-efficacy are better able to regulate, assess, and adapt their responses to various digital challenges, thereby achieving stability and competence in technology-based teaching [24], [42].

The research by Paetsch et al supports this approach, showing that good digital literacy provides greater control over technology, which in turn strengthens self-efficacy [43]. Within a cybernetic framework, teachers are not merely passive recipients of information but active agents who make adjustments and adaptations based on feedback obtained from the use of technology in learning. Kennedy & Cronjé also show that teachers with good access to digital information are more confident in dealing with technology-based classroom dynamics because they are able to interpret and adjust strategies based on evaluations of their interactions with technology [44].

On the other hand, training provides direct experience and real context, allowing teachers to test and improve their digital understanding in a supportive environment. Based on cybernetic theory, training can be seen as a medium that provides systemic simulation, where teachers receive immediate feedback on their actions, thereby improving their mindset and strengthening their self-efficacy. The study by Orakcı et al states that practice-based training gradually increases self-efficacy because it provides opportunities to test responses and obtain concrete feedback [45]. This is reinforced by Diamah et al, who emphasize that contextual and applied training contributes significantly to teachers' perceptions of their abilities, especially in responding to dynamic needs in the digital classroom [46].

This means that integrating cybernetic theory gives us a comprehensive understanding that self-efficacy isn't just the end result of knowledge and training, but a regulatory mechanism that lets teachers process input, evaluate results, and improve their skills through continuous feedback. This explains why improvements in digital literacy and training, despite their relatively limited direct impact, still play a crucial role in building teachers' confidence to navigate the digital transformation of education.

The Mediating Role of Self-Efficacy on Teachers' Digital Competence

The results of this study indicate that self-efficacy acts as a partial mediator in the relationship between digital literacy and training on teachers' digital competence, with a mediation effect value of 0.059 on each path. This means that the influence of digital literacy and training on digital competence becomes stronger when accompanied by an increase in self-efficacy. In Bandura's social cognitive theory, self-efficacy is defined as an individual's belief in their ability to organize and execute the actions necessary to achieve a specific outcome [22]. In this context, teachers with high self-efficacy not only master digital skills but also have the courage to try, adapt, and apply technology effectively in the learning process.

This finding is reinforced by a study by Getenet, which found that self-efficacy is an important psychological mechanism in bridging digital knowledge with effective learning practices [47]. Teachers who believe in their abilities are more likely to adopt technological innovations and design impactful digital learning strategies. A study by Woodcock & Tournaki also confirms that self-efficacy is a key factor in transforming digital potential into tangible pedagogical practices, as teachers who feel confident are more persistent in overcoming technological challenges [23].

Another study by Clipa et al shows that teachers with high self-efficacy are more active in utilizing technology such as Learning Management Systems (LMS), creating interactive media, and creatively using digital-based assessments [48]. They not only keep up with technological developments but also create learning experiences that are relevant to the needs of 21st-century students. This indicates that self-efficacy is not merely a result of literacy and training but serves as the primary driver in the implementation of educational technology.

From the perspective of UNESCO's ICT competency framework for teachers (2018), the development of teachers' digital competencies encompasses not only knowledge and skills, but also attitudes or beliefs towards technology [28]. UNESCO explicitly emphasizes the importance of building teachers' confidence through continuous training that supports ICT mastery and strengthens self-efficacy. In this regard, teacher professional development should include psychological strategies such as coaching, peer mentoring, experiential learning, and reflective support that enable teachers to build their confidence in using technology.

Another study supporting this approach by Ismail et al emphasizes that strengthening self-efficacy through reflective practice has a significant impact on teachers' readiness to integrate technology [49]. Meanwhile, Ghazali found that self-efficacy is a strong predictor of teachers' decisions to use technology routinely in teaching [50]. Thus, self-efficacy serves as an important psychological bridge between external inputs (training) and performance outcomes in the form of digital competence.

On the whole, these results indicate that interventions to improve teachers' digital competence cannot focus solely on technical aspects, but must also pay attention to strengthening affective and motivational aspects, particularly self-efficacy. Self-efficacy acts as an internal determinant that enables teachers to process information adaptively, experiment with new technologies, and persevere in the face of digital barriers. Therefore, the mediating role of self-efficacy indicates that the development of teachers' digital competencies must be based on a comprehensive approach that encompasses knowledge, skills, and beliefs about one's own abilities.

4. CONCLUSION

This study concludes that digital literacy and training significantly enhance teachers' digital competence, with self-efficacy partially mediating these relationships. Digital literacy emerged as the most influential factor, followed by training and self-efficacy, highlighting the interplay of cognitive, technical, and psychological dimensions in digital teaching. Although their direct effects on self-efficacy were modest, both remain essential for building teacher confidence. Therefore, teacher professional development should not only focus on technical skills but also intentionally cultivate self-efficacy through experiential learning, collaborative practice, and reflective support. Schools and policymakers are encouraged to implement sustained, context-based digital training programs integrated with self-efficacy building strategies such as mentoring and peer modeling.

The practical implications of this study emphasize the importance of measuring optimism and self-efficacy as part of teacher development programs to strengthen psychological well-being and resilience in digital educational environments. Therefore, professional development should integrate technical capacity building with reflective and motivational components to maintain teacher optimism in the face of technological change. While valuable, this study is limited by its regional scope and quantitative design. Future research is recommended to adopt mixed methods and a broader sample size to capture contextual nuances and validate explanatory-style optimism scales across diverse educational settings.

ACKNOWLEDGEMENTS

The author sincerely thanks LPDP, the Ministry of Finance of the Republic of Indonesia, for its generous financial support in funding his master's education and for its significant contribution in supporting the publication of this research paper.

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