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Research Article

DIGITAL ACCESS, ONLINE TRAINING, AND TEACHING MOTIVATION: THE MEDIATING ROLE OF TECHNOLOGY SELF-EFFICACY

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Abstract
This study investigates the effects of digital access and online training on teaching motivation, with technology self-efficacy as a mediating variable. Grounded in Social Cognitive Theory, the study integrates structural and psychological factors to explain teacher motivation in digital learning contexts. A quantitative explanatory survey was conducted involving 300 senior high school teachers in Tangerang Regency, Indonesia, selected using proportional random sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with 5,000 bootstrap resamples. The findings indicate that digital access ($\beta = 0.491$, $p < 0.001$) and online training ($\beta = 0.523$, $p < 0.001$) significantly influence technology self-efficacy. Technology self-efficacy, in turn, significantly affects teaching motivation ($\beta = 0.251$, $p < 0.001$). However, the direct effects of digital access ($\beta = 0.131$, $p = 0.057$) and online training ($\beta = 0.106$, $p = 0.081$) on teaching motivation are not significant. Mediation analysis reveals that technology self-efficacy fully mediates these relationships. This study contributes to the literature by demonstrating that structural factors alone are insufficient to enhance teacher motivation unless internalized through efficacy beliefs. The findings provide practical implications for designing teacher development programs that prioritize mastery-based training and confidence-building strategies.

Keywords: Digital Access, Online Training, Technology Self-Efficacy, Teaching Motivation

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INTRODUCTION

Digital transformation in education has become a global priority, characterized by the rapid integration of digital technologies into teaching and learning processes (Scherer et al., 2021; Tondeur et al., 2017). Teachers, as the primary agents of educational change, are expected to utilize technology to create innovative and engaging learning environments aligned with twenty-first-century demands (Bond et al., 2020; König et al., 2020; OECD, 2021; Trust & Whalen, 2020). However, in Indonesia, disparities

in digital access remain substantial. Empirical evidence indicates persistent interprovincial and urban–rural gaps in both technological infrastructure and the effective use of digital learning platforms (Lee et al., 2024; Ramadhanti & Astuti, 2024; van Deursen & van Dijk, 2019; Zulaikha et al., 2024). Limited device availability, unstable internet connectivity, and inadequate infrastructure continue to constrain instructional practices and may undermine teachers' motivation (Hidayah, 2022; Zulaikha et al., 2024).

Alongside infrastructure challenges, online professional development (PD) has expanded significantly as a strategy to enhance teacher competence in digitally mediated environments. Although online training offers flexibility and broader access, its effectiveness varies depending on instructional design quality, interactivity, contextual relevance, and technical support (Bragg et al., 2021; Darling-Hammond et al., 2017; Huang et al., 2024; Philipsen et al., 2019). Studies have demonstrated that technology-oriented interventions—such as computational thinking–based e-modules—can improve instructional quality (Aprianti, 2024). Nevertheless, participation in online training does not automatically translate into increased teaching motivation, suggesting that the relationship between structural support and motivation is not straightforward (Ertmer et al., 2021; F. Liu et al., 2020).

From a theoretical perspective, Social Cognitive Theory emphasizes the role of self-efficacy as a key determinant of motivation and behavior. Technology self-efficacy—defined as teachers' beliefs in their capability to effectively use digital technologies—emerges as a critical psychological factor in digital learning contexts. Prior research consistently shows that technology-related self-efficacy is positively associated with technology integration competence, work engagement, and reduced burnout (Gómez-Trigueros et al., 2024; X. Liu et al., 2020; Pan & Chen, 2021; Zeng et al., 2022). Teachers with higher technology self-efficacy are more likely to adopt innovative pedagogical strategies and demonstrate stronger teaching motivation, whereas those with lower efficacy are more susceptible to resistance and motivational decline (Sulistiani & Dewi, 2024; Yang & Du, 2024).

Although prior studies acknowledge the importance of digital access, online training, and technology self-efficacy, these variables are often examined in isolation. Few studies integrate structural factors (digital access and online training) with psychological mechanisms (technology self-efficacy) within a single analytical framework to explain teaching motivation, particularly in the Indonesian secondary education context. Moreover, empirical evidence on the mediating role of technology self-efficacy in linking digital access and online training to teaching motivation remains limited (Skaalvik & Skaalvik, 2021; Xie et al., 2020).

Therefore, a critical gap exists in understanding how structural support translates into teaching motivation through internal psychological processes. Without addressing this mechanism, policies that focus solely on infrastructure provision or training participation may fail to produce meaningful improvements in teacher motivation. In response to this gap, this study aims to examine the direct and indirect effects of digital access and online training on teaching motivation through technology self-efficacy among senior high school teachers in Tangerang Regency. By integrating structural and psychological determinants within a unified predictive model, this study provides a more comprehensive and policy-relevant perspective on strengthening teacher motivation in digital education contexts.

Accordingly, the research questions guiding this study are:

1. How does digital access influence the teaching motivation of senior high school teachers in Tangerang Regency?
2. How does online training influence the teaching motivation of senior high school teachers?
3. Does technology self-efficacy mediate the relationships between digital access, online training, and teaching motivation?

Theoretical Framework and Hypothesis Development

Grounded in social cognitive theory, self-efficacy plays a central role in shaping motivation and behavior. Digital access and online training are structural supports that may enhance teachers' confidence in using technology, which subsequently influences their teaching motivation.

Social Cognitive Theory and Technology Self-Efficacy

This study is grounded in Social Cognitive Theory (SCT) proposed by Bandura (1997), which posits that human functioning results from reciprocal interactions among environmental factors, personal cognitive processes, and behavioral outcomes. Central to SCT is self-efficacy, defined as individuals' beliefs in their capabilities to organize and execute courses of action required to manage prospective

situations (Bandura, 1997; Schunk & DiBenedetto, 2020; Usher & Pajares, 2008). Self-efficacy influences motivation, persistence, resilience, and performance across diverse domains (Schunk & DiBenedetto, 2020).

According to SCT, environmental supports such as access to resources and structured learning opportunities shape individuals' efficacy beliefs. These beliefs subsequently regulate effort investment, goal setting, emotional regulation, and task persistence (Bandura, 1997; Schunk & DiBenedetto, 2020; Usher & Pajares, 2008). In educational contexts, teacher efficacy has been consistently linked to instructional quality, student outcomes, and professional commitment (Tschannen-Moran & Woolfolk Hoy, 2001).

Within digital learning environments, technology self-efficacy refers to teachers' confidence in their ability to effectively integrate digital tools into instructional practice (Yang & Du, 2024; Zeng et al., 2022). Prior empirical studies demonstrate that teachers with higher technological self-efficacy are more likely to adopt innovative instructional practices, integrate ICT meaningfully, and exhibit stronger professional engagement (Howard et al., 2021; Instefjord & Munthe, 2017; Teo, 2009; Tondeur et al., 2017). Moreover, technology-related efficacy has been associated with greater readiness for digital transformation in education (Scherer et al., 2021).

SCT further identifies four primary sources of efficacy beliefs: mastery experiences, vicarious experiences, social persuasion, and physiological or affective states (Bandura, 1997; Pajares, 2002; Tschannen-Moran & Woolfolk Hoy, 2001). Digital access and online training may serve as environmental enablers of mastery experiences and social persuasion, thereby strengthening teachers' technology self-efficacy. In turn, heightened efficacy beliefs may operate as a motivational driver that converts structural support into sustained teaching engagement. Accordingly, technology self-efficacy is conceptualized in this study as a psychological mechanism linking structural factors (digital access and online training) with motivational outcomes (teaching motivation).

Digital Access and Technology Self-Efficacy

Digital access encompasses the availability of technological devices, internet connectivity, digital learning platforms, and institutional infrastructure that enable teachers to implement technology-enhanced instruction. From a social cognitive perspective, access to digital tools provides repeated opportunities for direct engagement, constituting mastery experiences—the strongest source of efficacy beliefs (Bandura, 1997). Adequate infrastructure reduces barriers to experimentation and promotes frequent technology use. Repeated successful experiences with digital tools reinforce perceptions of competence and strengthen efficacy beliefs. Conversely, limited access constrains opportunities for skill development and may undermine confidence in technology integration.

Empirical research supports this theoretical linkage. Studies indicate that institutional ICT support and infrastructure are positively associated with teachers' perceived technological competence and self-efficacy (Teo, 2009; Tondeur et al., 2017). In contexts where digital inequality persists, improvements in infrastructure are likely to enhance teachers' technology self-efficacy by enabling consistent and successful interaction with digital tools (Scherer et al., 2021; van Deursen & van Dijk, 2019). Based on this reasoning, the following hypothesis is proposed:

H1: Digital access positively influences technology self-efficacy.

Online Training and Technology Self-Efficacy

Online professional development (PD) has emerged as a key strategy for enhancing teachers' digital competence. Effective PD programs provide structured instruction, guided practice, collaborative learning, and feedback components aligned with the four sources of efficacy formation within SCT (Bandura, 1997; Tschannen-Moran & Woolfolk Hoy, 2001). High-quality online training may strengthen technology self-efficacy in several ways. First, guided practice fosters mastery experiences. Second, peer modeling and collaborative discussion enable vicarious learning. Third, feedback and institutional encouragement function as social persuasion. Finally, well-designed training can reduce anxiety associated with digital challenges, thereby positively influencing affective states (Schunk & DiBenedetto, 2020).

Empirical studies confirm that sustained professional development significantly predicts teachers' technological self-efficacy and ICT integration (Philipsen et al., 2019; Tondeur et al., 2012). Teachers who participate in structured and context-relevant digital training programs report higher levels of confidence and readiness to apply technology in instructional settings (Scherer et al., 2021). However,

participation alone is insufficient; the quality, duration, and practical relevance of training determine its efficacy-enhancing potential (Tondeur et al., 2012). When training aligns with teachers' instructional needs and provides opportunities for authentic application, it is more likely to strengthen technological confidence (Darling-Hammond et al., 2017; Trust & Whalen, 2020). Therefore, online training is expected to function as a significant antecedent of technology self-efficacy.

H2: Online training positively influences technology self-efficacy.

Technology Self-Efficacy and Teaching Motivation

Within SCT, self-efficacy is a primary determinant of motivational processes. Individuals with strong efficacy beliefs set more challenging goals, exert sustained effort, and demonstrate greater resilience (Bandura, 1997). In educational contexts, teacher efficacy is strongly associated with work engagement, commitment, and reduced burnout (Klassen & Tze, 2014). Teaching motivation encompasses intrinsic and extrinsic drivers influencing enthusiasm, commitment, and persistence in instructional activities. When teachers perceive themselves as competent in digital instruction, they experience greater autonomy, mastery, and professional satisfaction—factors that reinforce motivational engagement (Tschannen-Moran & Woolfolk Hoy, 2001).

Empirical evidence indicates that technology self-efficacy predicts higher levels of instructional innovation and work engagement (X. Liu et al., 2020; Pan & Chen, 2021; Scherer et al., 2021; Teo, 2009). Conversely, low efficacy beliefs are linked to avoidance behaviors and resistance to technological change. Consistent with SCT and prior empirical findings, technology self-efficacy is expected to positively predict teaching motivation.

H3: Technology self-efficacy positively influences teaching motivation

Direct Effects of Digital Access and Online Training on Teaching Motivation

Although SCT emphasizes mediation through cognitive processes, environmental factors may also exert direct influences on motivation. Improved digital access may reduce instructional constraints, enhance efficiency, and increase job satisfaction, potentially strengthening motivation. Similarly, participation in professional development may directly enhance motivation by signaling institutional support and opportunities for growth.

Research on organizational support suggests that perceived structural support can directly enhance employee motivation and engagement (Klassen & Tze, 2014). However, the translation of structural improvements into sustained motivation may depend on internalized competence beliefs. To examine both structural and psychological pathways, the following hypotheses are proposed:

H4: Digital access positively influences teaching motivation.

H5: Online training positively influences teaching motivation.

Mediating Role of Technology Self-Efficacy

SCT posits that environmental influences are filtered through cognitive processes before shaping behavior (Bandura, 1997). Technology self-efficacy may therefore function as a mediating mechanism transforming structural support into motivational outcomes. Digital access and online training create opportunities for competence development. However, their impact on motivation is likely to occur primarily when teachers internalize these supports as increased confidence. Prior research consistently demonstrates that self-efficacy mediates the relationship between contextual support and behavioral outcomes (Schunk & DiBenedetto, 2020; Tondeur et al., 2017).

In technology integration contexts, structural resources often exert indirect effects through efficacy beliefs rather than direct motivational effects (Scherer et al., 2021; X. Zhao et al., 2010). Accordingly, technology self-efficacy is conceptualized as a psychological bridge linking digital access and online training to teaching motivation.

H6: Technology self-efficacy mediates the relationship between digital access and teaching motivation.

H7: Technology self-efficacy mediates the relationship between online training and teaching motivation.

RESEARCH METHOD

Contains the type of research, time and place of research, targets/objectives, research subjects, procedures, instruments and data analysis techniques as well as other matters related to the method of research. targets/objectives, research subjects, procedures, data and instruments, and data collection techniques, as well as data analysis techniques and other matters related to the method of research can be written in sub-chapters, with sub-headings. Sub-subheadings do not need to be notated, but are written in lowercase with a capital letter, TNR-11 bold, left aligned. As an example can be seen below.

Research Design and Analytical Approach

To examine the proposed structural relationships, this study employed Partial Least Squares Structural Equation Modeling (PLS-SEM). PLS-SEM was selected because the study aims to predict teaching motivation and investigate mediation effects within a theoretically bounded model. This approach is particularly appropriate for predictive research involving multiple latent constructs and reflective indicators, especially when variance explanation and model complexity are prioritized (Hair et al., 2022; Sarstedt et al., 2022).

All statistical analyses were conducted using RStudio (version 2026.01.0-392) with R (version 4.5.2). The PLS-SEM analysis was implemented using the appropriate R package for variance-based structural equation modeling (e.g., seminr / cSEM / plspm). The use of open-source, script-based statistical software enhances methodological transparency, reproducibility, and analytical rigor, computational transparency, as all estimation procedures can be independently replicated. Both measurement and structural models were estimated simultaneously following recommended PLS-SEM procedures.

Population and Sampel

The population of this study comprises all senior high school (SMA or equivalent) teachers in Tangerang Regency who were actively teaching during the 2025/2026 academic year. A proportional random sampling technique was employed to ensure adequate representation of teachers from both public and private schools. Proportional random sampling was implemented by first categorizing schools into public and private strata, followed by determining proportional representation based on the total number of teachers in each category. Respondents were then randomly selected within each stratum using school-level teacher lists.

The sample size was determined based on SEM recommendations suggesting a minimum of 200–250 respondents to ensure stable and reliable parameter estimation (Sarstedt et al., 2022). Accordingly, this study involved 300 respondents, which also satisfies the sample size requirement calculated using the Slovin formula with a 5% margin of error. The sample size of 300 exceeds the minimum requirement for PLS-SEM and satisfies the statistical power criteria recommended for detecting medium effect sizes, thereby ensuring robustness and reliability of the model estimation.

Ethical Considerations

The study was conducted in accordance with ethical standards for human research. Participation was voluntary, responses were confidential, and informed consent was obtained electronically or in writing. The protocol was approved by the Research Ethics Committee of Universitas Muhammadiyah Banten (020/I.5.EC/LPPM-UMB/X/2025). Informed consent was obtained electronically prior to participants' involvement in the study. At the beginning of the online questionnaire, participants were presented with an information sheet describing the study objectives, procedures, voluntary nature of participation, estimated completion time, confidentiality assurance, and the right to withdraw at any time without penalty. Participants could proceed to the questionnaire only after selecting the consent agreement option indicating their willingness to participate.

For respondents completing the printed questionnaire, the same information was provided in written form, and consent was indicated by signing the consent statement before responding to the survey items. No personally identifiable information was required, and responses were stored in anonymized form to ensure data confidentiality and privacy protection.

Research Variables and Operational Definitions

This study involves four main variables: Digital Access (X1) : The availability of devices, internet connectivity, and infrastructure support that teachers can utilize in the teaching and learning process (Zulaikha et al., 2024). Online Training (X2) : Teachers' experiences in participating in online professional development, including material quality, interactivity, and technical support (Kebritchi et al., 2017).

Technology Self-Efficacy (M) : Teachers' beliefs in their ability to effectively use digital technology for instructional purposes (Dwiastuti et al., 2024). Teaching Motivation (Y) : Teachers' intrinsic and extrinsic drives to carry out instructional activities (Han & Wang, 2021).

Research Model

The research model illustrates the direct effects of digital access and online training on teaching motivation, as well as their indirect effects mediated by technology self-efficacy. The model was analyzed using path analysis within a PLS-SEM framework.

All variables were measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), with items adapted from established instruments in prior studies. The structural relationships among variables are depicted in the path diagram (Figure 1).

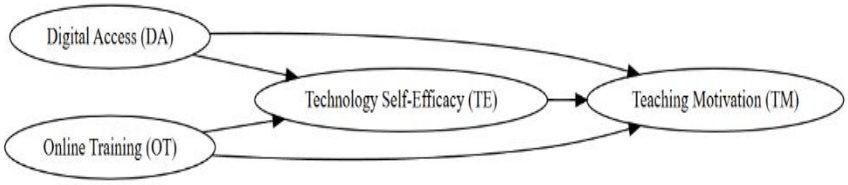

Figure 1. path analysis model

Notes:
X1 → Y: Direct effect of digital access on teaching motivation
X2 → Y: Direct effect of online training on teaching motivation
X1 → M: Effect of digital access on technology self-efficacy
X2 → M: Effect of online training on technology self-efficacy
M → Y: Mediating effect of technology self-efficacy on teaching motivation

Research Instrument

All measurement items were adapted from validated instruments in prior studies and adjusted to the Indonesian educational context. A pilot test was conducted to ensure clarity and contextual relevance. The research instrument consisted of a closed-ended questionnaire comprising four sections corresponding to the study variables. Prior to the main data collection, the instrument underwent several procedures to ensure its quality. Content validity was evaluated through expert judgment involving specialists in education and educational technology. The instrument was then pilot tested with 30 respondents outside the main study sample. Furthermore, construct validity and reliability were assessed using PLS-SEM. The instrument was considered reliable if Cronbach's Alpha and Composite Reliability (CR) values exceeded 0.70, and if the Average Variance Extracted (AVE) values were greater than 0.50 (Hair et al., 2022; Tavakol & Dennick, 2011).

Table 1. Variable operational

Variable	Code	Indicator	Source
Digital Access	DA1	Availability of digital devices	(Zulaikha et al., 2024), adapted
	DA2	Internet connectivity stability	
	DA3	Accessibility of digital learning platforms	
	DA4	Access to digital learning resources	
	DA5	ICT facility support in schools	
Online Training	OT1	Training satisfaction	(Kebritchi et al., 2017), adapted
	OT2	Relevance of training materials	

Variable	Code	Indicator	Source
	OT3	Knowledge improvement from training	
	OT4	Skill acquisition in educational technology	
	OT5	Implementation of training outcomes	
	OT6	Increased confidence after training	
Technology Self-Efficacy	TE1	Confidence in using digital tools	(Dwiastuti et al., 2024), adapted
	TE2	Vicarious experience from colleagues	
	TE3	Social support influence	
	TE4	Emotional regulation when facing technology issues	
	TE5	Self-directed learning confidence	
	TE6	Positive reinforcement effect	
Teaching Motivation	TM1	Autonomy in teaching	(Han & Wang, 2021), adapted
	TM2	Perceived teaching competence	
	TM3	Relatedness with students	
	TM4	Enjoyment in teaching	
	TM5	Continuous self-development effort	
	TM6	Achievement-driven enthusiasm	

Data Collection Techniques

The data collection process was guided by an instrument grid that maps each variable to its indicators and measurement items, ensuring construct validity and alignment with the research objectives. Primary data were collected between September 2025 and January 2026 through online questionnaires (Google Forms) and printed questionnaires, depending on school conditions and accessibility. Secondary data were obtained from local education office reports, scholarly articles, and school documents. This combination of data sources was employed to ensure that the collected data were both representative and accurate (Creswell & Poth, 2018). For transparency and replication purposes, the questionnaire used in this study is publicly accessible at: https://forms.gle/LWtHTQCH1xi3wWrz6.

Data Analysis Techniques

Data analysis was conducted using RStudio (2026.01.0-392) with R 4.5.2, following contemporary PLS-SEM guidelines (Hair et al., 2022). The analytical procedure began with descriptive statistics to summarize respondents' demographic characteristics and examine the distributional properties of the study variables. The measurement model (outer model) was evaluated by assessing indicator reliability through outer loadings, with values of 0.70 or higher considered acceptable. Internal consistency reliability was examined using Cronbach's Alpha and Composite Reliability ($\geq$0.70), while convergent validity was assessed using the Average Variance Extracted (AVE) with a threshold of 0.50. Discriminant validity was evaluated using the Heterotrait–Monotrait ratio (HTMT), applying a criterion below 0.85.

The structural model (inner model) was assessed by examining collinearity using the Variance Inflation Factor (VIF <5.0) and evaluating structural relationships through path coefficients (β). The coefficient of determination (R^2) was used to determine the explanatory power of the model, and effect sizes (f^2) were examined to assess the magnitude of relationships between constructs. Predictive relevance (Q^2) was evaluated when applicable. Hypothesis testing and mediation analysis were performed using a bootstrapping procedure with 5,000 resamples, with mediation effects assessed based on the significance of indirect paths and the Variance Accounted For (VAF) criterion. This study adopts a two-step approach in PLS-SEM analysis, consisting of measurement model evaluation and structural model assessment, to ensure both reliability and predictive accuracy of the proposed model.

Statistical Analysis

Statistical analysis was performed using PLS-SEM to examine both direct and indirect relationships among variables. Bootstrapping with 5,000 resamples was applied to assess the significance

of path coefficients. This approach is appropriate for predictive modeling and mediation analysis involving latent constructs.

RESULTS AND DISCUSSION

The results are presented to address the research questions by examining both measurement and structural models using PLS-SEM.

Descriptive Statistics

Descriptive statistics indicate that respondents reported relatively high levels of Digital Access (DA), Online Training (OT), Technology Self-Efficacy (TE), and Technology Motivation (TM). The mean scores ranged from 3.95 to 4.20, suggesting that participants moderately agreed to strongly agreed with the statements.

Table 2. Descriptive statistics of research variables

Construct	Mean	SD	Min	Max
DA	3.95	0.64	1	5
OT	3.98	0.60	3	5
TE	4.09	0.55	2	5
TM	4.20	0.56	2	5

These findings suggest that psychological readiness for technology integration appears relatively strong, despite possible structural constraints.

Measurement Model Evaluation

The measurement model was evaluated by examining indicator reliability, internal consistency, convergent validity, and discriminant validity. Common method bias was assessed via Harman's single-factor test, showing the first factor explained less than the recommended 50% of variance. Full collinearity VIF values were all below 3.3.

Although several outer loadings are high, this reflects conceptual homogeneity of the constructs rather than item redundancy, as indicators were adapted from validated instruments and represent closely related facets of each construct. This pattern is consistent with reflective constructs capturing closely related perceptions rather than formative dimensions.

Table 3. Indicator reliability

Construct	Item	Loading
DA	DA1	0.953
DA	DA2	0.950
DA	DA3	0.954
DA	DA4	0.956
DA	DA5	0.957
OT	OT1	0.956
OT	OT2	0.953
OT	OT3	0.961
OT	OT4	0.961
OT	OT5	0.958
OT	OT6	0.952
TE	TE1	0.953
TE	TE2	0.958
TE	TE3	0.959
TE	TE4	0.947
TE	TE5	0.944
TE	TE6	0.947
TM	TM1	0.807
TM	TM2	0.813
TM	TM3	0.852

Construct	Item	Loading
TM	TM4	0.792
TM	TM5	0.823
TM	TM6	0.769

Table 4. Construct reliability and convergent validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
DA	0.975	0.981	0.910
OT	0.982	0.985	0.916
TE	0.979	0.983	0.905
TM	0.895	0.919	0.656

All constructs meet the recommended thresholds for reliability (Cronbach's alpha and CR > 0.70) and convergent validity (AVE > 0.50).

Table 5. Discriminant validity (fornell–larcker criterion)

Construct	DA	OT	TE	TM
DA	0.954			
OT	-0.059	0.957		
TE	0.461	0.494	0.951	
TM	0.240	0.223	0.364	0.810

Discriminant validity is supported, as the square root of AVE for each construct exceeds inter-construct correlations.

Structural Model Evaluation

The structural model was tested using bootstrapping (5,000 resamples).

Table 6. R^2 and adjusted R^2 values

Endogenous Construct	R^2	Adjusted R^2
TE	0.484	0.481
TM	0.146	0.138

Table 7. Direct effects (bootstrapping results)

Path	β	T	p	Decision
DA → TE	0.491	11.811	<0.001	Supported
OT → TE	0.523	14.099	<0.001	Supported
DA → TM	0.131	1.905	0.057	Not Supported
OT → TM	0.106	1.746	0.081	Not Supported
TE → TM	0.251	3.645	<0.001	Supported

Digital access (DA) and online training (OT) significantly influence technology self-efficacy (TE), whereas only TE significantly predicts teaching motivation (TM). The structural model with standardized path coefficients is illustrated in Figure 2.

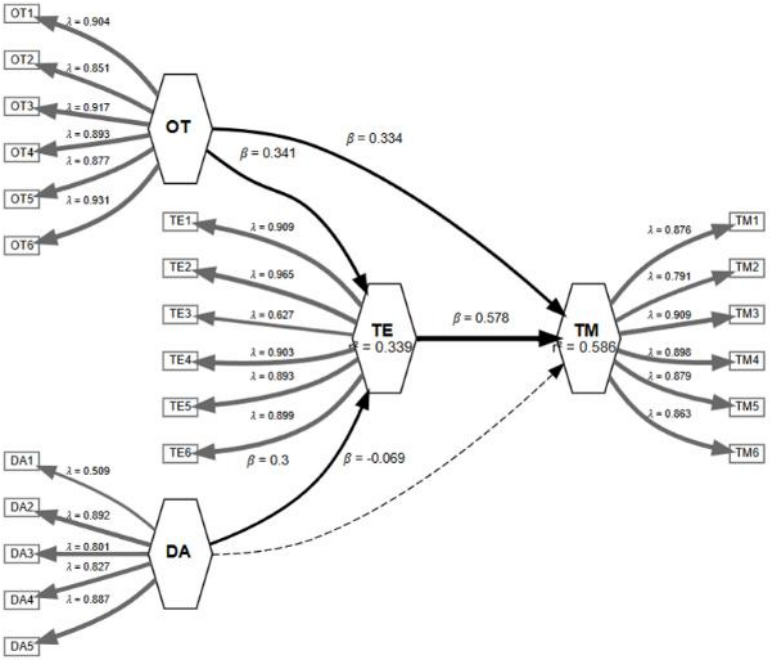

Figure 2. Structural model results (β and R^2 values)

Mediation Analysis

Table 8. Indirect effects (Mediation via technology self-efficacy)

Indirect Path	β	t	p	Result
DA → TE → TM	0.123	3.505	<0.001	Significant
OT → TE → TM	0.131	3.473	<0.001	Significant

These results indicate a full mediation pattern: technology self-efficacy fully mediates the effect of digital access and online training on teaching motivation. This mediation perspective aligns with contemporary predictive SEM research emphasizing psychological mechanisms as primary explanatory pathways linking contextual resources to behavioral outcomes. These findings are consistent with previous studies indicating that self-efficacy plays a central role in technology integration and teacher motivation (Howard et al., 2021; X. Liu et al., 2020; Scherer et al., 2021; Teo, 2009).

Summary of Hypothesis Testing

Table 9 presents the results of hypothesis testing following the theoretical ordering proposed in the conceptual framework.

Table 9. Hypotheses testing results

Hypothesis	Path	β	t	p	Decision	Effect Size
H1	DA → TE	0.491	11.811	<0.001	Supported	Medium
H2	OT → TE	0.523	14.099	<0.001	Supported	Medium
H3	TE → TM	0.251	3.645	<0.001	Supported	Small
H4	DA → TM	0.131	1.905	0.057	Not Supported	Small
H5	OT → TM	0.106	1.746	0.081	Not Supported	Small

To complement the path coefficient analysis, effect sizes (f^2) were examined to assess the relative contribution of each predictor. The results indicate that Digital Access and Online Training exhibit small effects on Technology Self-Efficacy. Digital Access shows a negligible direct effect on Teaching Motivation, whereas Online Training demonstrates a small effect. Technology Self-Efficacy exhibits a large effect on Teaching Motivation, highlighting its important role within the structural model.

Table 10. Effect size (f^2)

Path	f^2	Effect
DA → TE	0.08	Small
OT → TE	0.10	Small
DA → TM	0.006	Negligible
OT → TM	0.131	Small
TE → TM	0.521	Large

Predictive Relevance (Q^2)

Predictive relevance was assessed using the blindfolding procedure. Positive Q^2 values for Technology Self-Efficacy and Teaching Motivation indicate that the model demonstrates adequate predictive relevance.

Table 11. Predictive relevance (Q^2) of endogenous constructs

Endogenous Construct	Q^2	Interpretation
Technology Self-Efficacy (TE)	0.182	Moderate predictive relevance
Teaching Motivation (TM)	0.301	Moderate predictive relevance

Robustness and Model Evaluation

To ensure the robustness of the findings, this study adopted a predictive-oriented PLS-SEM approach, which is particularly suitable for explaining variance and generating predictions in educational research contexts. The model demonstrates adequate explanatory power, as indicated by meaningful R^2, effect size (f^2), and predictive relevance (Q^2) values across endogenous constructs. Furthermore, the mediating role of Technology Self-Efficacy is theoretically grounded in technology adoption and motivation frameworks, supporting its inclusion as a central explanatory mechanism linking Digital Access and Online Training to Teaching Motivation.

The significant indirect effects further reinforce the stability of the structural relationships and provide additional evidence of model robustness. Consistent with the predictive orientation of PLS-SEM, the positive Q^2 values indicate that the model exhibits out-of-sample predictive capability, suggesting that the proposed framework is not only explanatory but also practically useful for anticipating teaching motivation outcomes.

These findings reinforce Social Cognitive Theory by confirming that environmental resources do not directly translate into motivational outcomes without cognitive mediation. The indirect-only mediation observed in this study highlights that self-efficacy functions as a central psychological mechanism that transforms structural support into motivation. This finding aligns with prior research emphasizing that perceived competence, rather than resource availability, is the primary driver of teacher engagement in digital environments. This study examined how digital access and online training influence teaching motivation through the mediating role of technology self-efficacy. The findings reveal three principal insights. First, digital access and online training significantly enhance teachers' technology self-efficacy. Second, technology self-efficacy positively predicts teaching motivation. Third, the direct effects of digital access and online training on teaching motivation are non-significant, indicating an indirect-only mediation mechanism.

Consistent with Social Cognitive Theory (SCT), the results show that environmental factors such as digital access and training do not directly translate into motivational outcomes unless internalized as increased perceived competence. SCT posits that environmental influences shape behavior primarily through self-referent cognitive mechanisms, particularly self-efficacy beliefs (Bandura, 1997). This study confirms that technological experiences and support conditions improve self-efficacy, which in turn strengthens motivational outcomes, aligning with prior research on mediating effects of self-efficacy in technology adoption contexts (Pan & Chen, 2021; Ryan & Deci, 2020; Venkatesh et al., 2012; Y. Zhao et al., 2021).

Theoretical Implications

The findings extend prior research on technology integration and teacher motivation by clarifying that infrastructure and professional development operate as enabling conditions, whereas technology self-efficacy serves as the active psychological driver. Teachers who feel confident in their ICT capabilities demonstrate higher motivational attitudes toward integrating these technologies into their practice

(Aprianti & Mursyidah, 2025; Chen & Tsai, 2020). The non-significant direct paths suggest that structural support alone is insufficient; rather, self-efficacy beliefs must be strengthened to convert external resources into motivational energy. This aligns with recent studies showing that teacher motivation is more strongly associated with perceived competence than with mere access to digital resources (Philipsen et al., 2019; Ryan & Deci, 2020).

The moderate R^2 value for technology self-efficacy (0.484) indicates that digital access and online training are substantial predictors of efficacy formation, yet not exhaustive. The lower R^2 value for teaching motivation (0.146) suggests that motivation is a multifaceted construct influenced by additional psychological, organizational, and contextual factors beyond digital variables, consistent with research emphasizing the complex determinants of teacher motivation (Klassen & Tze, 2014; Sarstedt et al., 2022).

The relatively modest R^2 value for teaching motivation (0.146) reflects the multifactorial nature of motivation, which is shaped by various individual, organizational, and contextual factors. As this study adopts an exploratory predictive PLS-SEM approach with a limited set of theoretically grounded predictors, lower explained variance is expected. Similar SEM-based motivation studies report comparable R^2 values, indicating that this result reflects the complexity of motivational processes rather than model inadequacy.

Theoretically, this study contributes by integrating structural and psychological perspectives to explain teaching motivation in digital education contexts. It reinforces Social Cognitive Theory by showing that environmental inputs, such as access to digital resources and professional development, are filtered through self-efficacy beliefs before influencing motivational outcomes. This study offers novelty by integrating structural and psychological determinants within a single predictive model, providing empirical evidence of full mediation in a developing country context. This contribution extends prior research that has largely examined these variables in isolation.

Explaining the Indirect-Only Mediation Pattern

The absence of significant direct effects from digital access and online training to teaching motivation indicates that teachers do not become more motivated simply because infrastructure or training opportunities exist. Motivation increases only when such support strengthens teachers' confidence in using technology effectively. This highlights a critical distinction between structural provision and psychological empowerment: access and training may reduce external barriers, but without perceived capability to use technology successfully, motivation does not follow (Venkatesh et al., 2012). This study therefore shifts the focus from resource provision to efficacy formation as the primary mechanism explaining motivational outcomes in digital teaching.

Contextual Interpretation

In contexts where digital infrastructure and training opportunities may vary in quality, teachers may rely more on personal competence beliefs than institutional conditions to maintain high teaching motivation. The relatively high reported teaching motivation despite moderate direct access or training suggests that psychological readiness, resilience, and professional identity can buffer infrastructural limitations (Ryan & Deci, 2020). This underscores the importance of cognitive factors in educational change processes, particularly in digital transformation contexts. These results suggest that the mechanism identified in this study may be applicable to similar educational contexts characterized by digital inequality.

Practical Implications

The findings suggest that policy interventions should move beyond hardware distribution and one-off workshops, focusing instead on confidence-building strategies that strengthen teachers' technology self-efficacy. Professional development should emphasize mastery-based training, iterative hands-on practice, peer modeling, and sustained mentoring systems. Such approaches foster repeated success experiences that educators interpret as competence, thereby transforming structural investments into sustained motivational gains and improved teaching performance (Klassen & Tze, 2014; Philipsen et al., 2019).

Limitations and Future Research

Several limitations should be acknowledged. First, the cross-sectional design restricts causal inference. Longitudinal or experimental studies are recommended to confirm temporal sequencing in the

mediation model. Second, reliance on self-reported measures may introduce common method bias. Future research could incorporate objective indicators of actual technology use, classroom observations, or performance analytics. Third, the relatively low explained variance for teaching motivation suggests that additional predictors, such as leadership support, intrinsic values, or organizational climate, should be included in future models. Finally, cultural and contextual factors may influence generalizability, warranting replication across diverse educational systems (Podsakoff et al., 2012).

CONCLUSION

This study concludes that digital access and online training do not directly influence teaching motivation but operate through technology self-efficacy as a full mediator. These findings highlight the importance of psychological empowerment in digital education, indicating that teachers' motivation is primarily driven by their confidence in using technology rather than the mere availability of resources or training. Practically, educational policies should prioritize sustained, mastery-based training and confidence-building strategies to enhance teacher motivation in digital learning environments.

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AUTHOR CONTRIBUTIONS

Siti Nahriah Aprianti led the research by developing the conceptual framework, designing the methodology, and conducting software implementation and formal data analysis. She was responsible for investigation, data curation, project administration, and funding acquisition, as well as preparing the original draft and managing the review and editing process of the manuscript. Himmatul Mursyidah contributed to the methodological design, validation procedures, and research investigation. She also participated in the manuscript refinement through the writing review and editing process to ensure the academic quality and clarity of the study. Warni contributed to data collection and supported the investigation process of the study. All authors have read and approved the final version of the manuscript.

CONFLICTS OF INTEREST

No potential conflict of interest was reported by the author(s).

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