

Digital Literacy and Teacher Innovative Behavior: The Partial Mediating Role of Psychological Empowerment

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Abstract: This study aims to examine the effect of digital literacy on teacher innovative behavior, with psychological empowerment as a mediating variable. A quantitative approach with a survey design was employed. The participants consisted of 178 teachers from private junior high schools in the Eastern region of Bogor Regency, Indonesia, selected using multistage random sampling. Data were collected through a structured questionnaire using a five-point Likert scale and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results indicate that digital literacy has a positive and significant effect on both psychological empowerment and teacher innovative behavior, although its direct effect on innovative behavior is relatively small. Psychological empowerment has a strong and significant effect on innovative behavior, confirming its role as a significant indirect pathway through which digital literacy enhances teacher innovative behavior. These findings highlight that digital literacy contributes to teacher innovation both directly and indirectly by strengthening teachers' psychological empowerment. The study provides theoretical and practical implications for promoting teacher innovation through the integration of digital competence and psychological empowerment in educational settings.

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INTRODUCTION

The rapid advancement of digital technology has significantly transformed the educational landscape, requiring teachers to continuously adapt and innovate in their instructional practices. In the digital era, teachers are expected not only to deliver knowledge but also to design meaningful learning experiences, integrate digital tools, and respond to diverse student needs. Consequently, teacher innovative behavior (i.e., the process through which teachers generate, promote, and implement new ideas in their professional practice rather than merely producing innovation outcomes) has become a critical factor in improving educational quality and sustaining effective teaching practices (Li & Yu, 2022a; Sofwan et al., 2024; Wu et al., 2022). Innovative behavior refers to the intentional generation, promotion, and implementation of new ideas within a professional context. In education, this includes developing creative teaching strategies, integrating digital technologies, and adapting instructional methods to enhance student engagement and learning outcomes. However, despite its importance, many teachers still face challenges in demonstrating innovative behavior due to limited competencies, institutional constraints, and insufficient technological support (Albahiri & Alhaj, 2023; Stumbrienė et al., 2024; Zhang & Wang, 2025).



One of the key factors influencing teacher innovative behavior is digital literacy. Digital literacy encompasses the ability to access, evaluate, create, and communicate information using digital technologies. Teachers with high levels of digital literacy are more capable of exploring innovative teaching methods, utilizing digital platforms effectively, and engaging in continuous professional development (Kerkhoff & Makubuya, 2022; Robandi et al., 2025; Yang, 2026). Furthermore, digital literacy has been identified as a critical component of teachers' professional competence in the context of digital transformation in education (Temirkhanova et al., 2024).

However, digital literacy alone may not be sufficient to drive innovative behavior. Recent studies suggest that the relationship between digital competence and innovation is often indirect and influenced by internal psychological factors (Huu, 2023). In this context, psychological empowerment plays a crucial role.

Psychological empowerment refers to an individual's intrinsic motivation characterized by a sense of meaning, competence, self-determination, and impact. Drawing on Self Determination Theory and Social Cognitive Theory, digital literacy can enhance teachers' perceived competence and autonomy, which in turn strengthens their psychological empowerment. Teachers who feel empowered are more likely to take initiative, experiment with new ideas, and implement innovative practices (Kim & Beehr, 2020; Spreitzer, 1995; Huang & Liu, 2024).

Empirical studies have also shown that psychological empowerment serves as a key mechanism linking individual capabilities to innovative outcomes. Empowered teachers tend to demonstrate higher levels of creativity, proactive behavior, and instructional innovation (Mokhlis & Abdullah, 2025; Supriyanto et al., 2023). This suggests that innovation in education is not solely determined by technical skills but also by teachers' internal psychological readiness.

Although previous research has examined digital literacy and teacher performance, limited attention has been given to the mediating role of psychological empowerment in explaining teacher innovative behavior, particularly in developing country contexts. This represents a critical gap in the literature, as understanding the psychological mechanisms underlying innovation is essential for designing effective interventions and professional development programs.

Therefore, this study aims to examine the effect of digital literacy on teacher innovative behavior and to investigate the mediating role of psychological empowerment. The findings are expected to contribute both theoretically and practically to efforts aimed at enhancing teacher innovation in the digital era.

METHOD

This study employed a quantitative research approach using a survey design to examine the relationships between digital literacy, psychological empowerment, and teacher innovative behavior. A causal research design was adopted to analyze both direct and indirect effects, with psychological empowerment positioned as a mediating variable.



The study was conducted among teachers of private junior high schools (SMP Swasta) with foundation status (GTY) in the Eastern region of Bogor Regency, Indonesia. The total population consisted of 1,779 teachers distributed across 129 schools in seven districts. A multistage random sampling technique was applied. In the first stage, four districts were selected, followed by the selection of 23 schools in the second stage. Based on this procedure, the reachable population consisted of 321 teachers. The sample size was determined using the Taro Yamane formula and proportional random sampling, resulting in 178 respondents. Although the Taro Yamane formula is commonly applied under the assumption of simple random sampling, this study employed a multistage random sampling design to improve the representativeness of the selected schools and teachers. Given the complex sampling design, the effective sample size may be lower than the nominal sample size due to the design effect. However, Partial Least Squares Structural Equation Modeling (PLS-SEM) is considered robust for analyzing complex models with moderate sample sizes and does not require multivariate normality assumptions (Sarstedt et al., 2021). Therefore, the sample size was considered adequate for testing the proposed research model.

Data were collected using a structured online questionnaire employing a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). All measurement instruments were adapted from previously validated scales and pilot-tested to ensure clarity and contextual relevance before the main survey. The questionnaire measured three constructs: digital literacy, psychological empowerment, and teacher innovative behavior. Digital literacy refers to teachers' ability to access, evaluate, create, and utilize digital information effectively (Marín & Castaneda, 2023; Nguyen & Habók, 2024). Psychological empowerment reflects intrinsic motivation characterized by meaning, competence, self-determination, and impact. The construct was adapted from Spreitzer's validated psychological empowerment scale (Spreitzer, 1995) and contextualized for educational settings (Oliveira et al., 2023). Teacher innovative behavior refers to the ability to generate, promote, and implement new ideas in teaching practices (Li & Yu, 2022b).

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the assistance of SmartPLS. This method is suitable for predictive analysis and complex models involving mediation (Hair & Alamer, 2022). The analysis consisted of two stages: evaluation of the measurement model (validity and reliability) and evaluation of the structural model (hypothesis testing, coefficient of determination, effect size, predictive relevance, and mediation analysis using bootstrapping).

The stages of the research process were carried out systematically, starting from problem identification to drawing conclusions. These stages include problem identification, literature review and instrument development, instrument validation, sampling determination, data collection, data processing, data analysis, and conclusion.

The overall research procedure is illustrated in Figure 1.



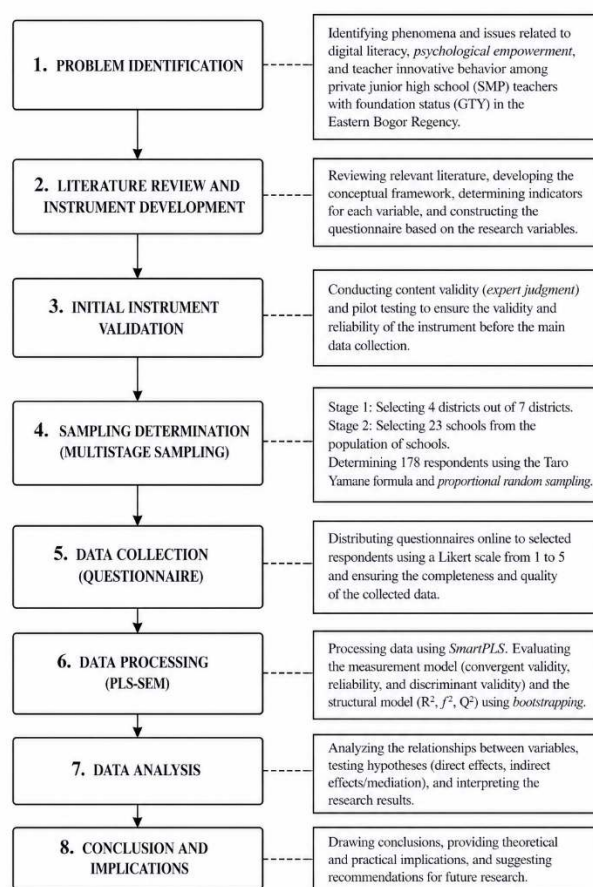


Figure 1 Research Procedure Flowchart

RESULT AND DISCUSSION

Result

The results of this study are presented based on the analysis of the structural model using Partial Least Squares Structural Equation Modeling (PLS-SEM).

The coefficient of determination (R^2) shows that digital literacy explains 16.5% of the variance in psychological empowerment ($R^2 = 0.165$). Meanwhile, digital literacy and psychological empowerment jointly explain 42.4% of the variance in teacher innovative behavior ($R^2 = 0.424$), indicating moderate explanatory power.

Table 1 Coefficient of Determination (R^2)

	R-square	R-square adjusted
X4 (Psychological Empowerment)	0.165	0.160
Y (Innovative Behavior)	0.424	0.417

The effect size (f^2) analysis indicates that digital literacy has a moderate effect on psychological empowerment ($f^2 = 0.198$), a statistically significant but modest practical effect ($f^2 = 0.044$), and psychological empowerment has a large effect on innovative behavior ($f^2 = 0.455$). This suggests that psychological empowerment is the most influential variable in the model.

Table 2 Effect Size (f^2)

Relationship	f^2	Effect Size
X1 (Digital Literacy) $\rightarrow$ X2 (Psychological Empowerment)	0.198	Medium
X1 (Digital Literacy) $\rightarrow$ Y (Innovative Behavior)	0.044	Small
X2 (Psychological Empowerment) $\rightarrow$ Y (Innovative Behavior)	0.455	Large

The predictive relevance (Q^2) values indicate that digital literacy has a value of 0.000, psychological empowerment has a value of 0.097, and teacher innovative behavior has a value of 0.311.

The Q^2 value of digital literacy is 0.000 because it is an exogenous variable and is not predicted by other variables in the model. Meanwhile, psychological empowerment shows a small predictive relevance, and teacher innovative behavior demonstrates a moderate predictive relevance.

These results indicate that the model has acceptable predictive capability, particularly in predicting teacher innovative behavior.

Table 3

	SSO	SSE	$Q^2 (=1-SSE/SSO)$
X1 (Digital Literacy)	1.424.000	1.424.000	0.000
X2 (Psychological Empowerment)	1.424.000	1.286.491	0.097
Y (Innovative Behavior)	890.000	613.562	0.311

The results of hypothesis testing indicate that all proposed relationships are statistically significant. Digital literacy has a positive and significant effect on psychological empowerment ($\beta = 0.406$, $p < 0.001$) and on teacher innovative behavior ($\beta = 0.174$, $p = 0.022$). Psychological empowerment also has a significant positive effect on innovative behavior ($\beta = 0.560$, $p < 0.001$).

Furthermore, the indirect effect of digital literacy on innovative behavior through psychological empowerment is significant ($\beta = 0.228$, $p < 0.001$), indicating that psychological empowerment acts as a partial mediator.

No	Relationship	Coefficient	T-Statistics	P-Values	Result
1	Digital Literacy $\rightarrow$ Psychological Empowerment	0.406	5.658	0.000	Supported
2	Digital Literacy $\rightarrow$ Innovative Behavior	0.174	2.286	0.022	Supported
3	Psychological Empowerment $\rightarrow$ Innovative Behavior	0.560	5.978	0.000	Supported
4	Digital Literacy $\rightarrow$ Psychological Empowerment $\rightarrow$ Innovative Behavior	0.228	3.800	0.000	Supported

The goodness of fit (GoF) value of the model is 0.402, which falls into the large category. This indicates that the model has a good overall fit and is suitable for explaining the relationships among variables.



To further illustrate the relationships among variables, the structural model is presented in Figure 2.

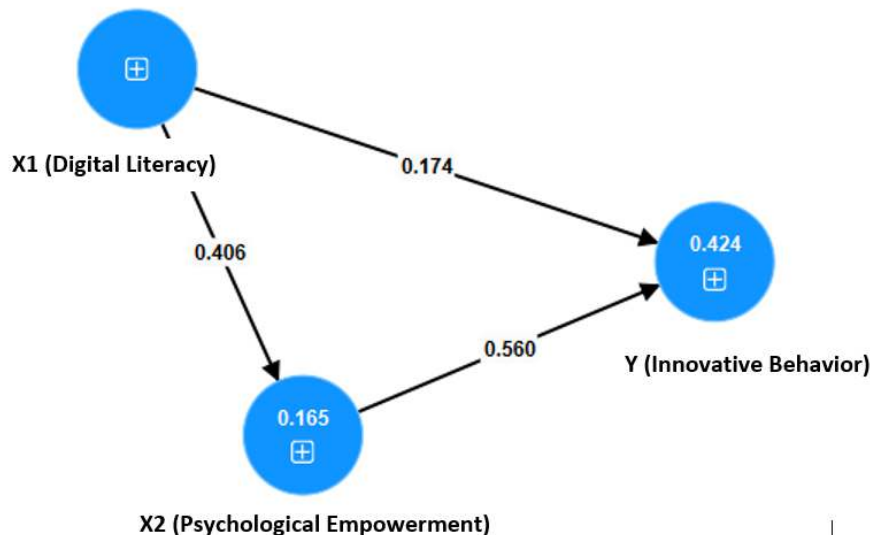


Figure 2 Structural Model of the Study

Based on the empirical findings, the following discussion provides a deeper interpretation of the results by linking them to relevant theories and previous research.

Discussion

The findings of this study provide important insights into the mechanisms underlying teacher innovative behavior in the digital era. First, digital literacy was found to have a positive and significant effect on teacher innovative behavior ($\beta = 0.174$, $p = 0.022$), although the effect size is relatively small ($f^2 = 0.044$). This indicates that digital literacy contributes to innovation, but its direct influence is limited. In practice, possessing digital skills alone does not automatically translate into innovative teaching practices. This result is consistent with prior studies showing that digital competence facilitates innovation, yet requires supporting psychological factors to become impactful (Li & Yu, 2022b; Nguyen & Habók, 2024). From the perspective of Social Cognitive Theory, capability is a necessary condition for action, but not sufficient without internal drive.

Second, digital literacy has a strong and significant effect on psychological empowerment ($\beta = 0.406$, $p < 0.001$; $f^2 = 0.198$). This finding suggests that teachers who are more digitally competent tend to feel more confident, autonomous, and capable of influencing their work. Digital literacy likely enhances teachers' self-efficacy by increasing their confidence in effectively using digital technologies to accomplish instructional tasks (Bandura & Wessels, 1997). Higher self-efficacy, in turn, reinforces teachers' perceived competence, which corresponds to the competence dimension of Self-Determination Theory. As teachers perceive themselves as more competent and autonomous in using digital technologies, they are more likely to experience psychological empowerment. Therefore, digital literacy should be viewed not only as a technical competence but also as a psychological resource that strengthens intrinsic motivation and promotes proactive behavior.

Third, psychological empowerment was found to have the strongest influence on teacher innovative behavior ($\beta = 0.560$, $p < 0.001$; $f^2 = 0.455$). This indicates that internal psychological factors play a more critical role than technical competencies in driving innovation. Teachers who feel empowered are more likely to initiate new ideas, experiment with instructional strategies, and implement creative solutions in their classrooms. This finding supports previous research emphasizing that empowerment enhances proactive and innovative behaviors (Kim & Beehr, 2020; Spreitzer, 1995). It also reinforces the argument that innovation in education is largely driven by internal readiness rather than external capability alone.

Fourth, the mediation analysis reveals that psychological empowerment significantly mediates the relationship between digital literacy and innovative behavior ($\beta = 0.228$, $p < 0.001$). Since both direct and indirect effects are significant, the mediation is partial. This finding is particularly important because it demonstrates that digital literacy influences innovative behavior not only directly but also indirectly through psychological empowerment. In other words, digital literacy becomes more meaningful when it enhances teachers' sense of empowerment.

This result provides a deeper explanation of the mechanism linking digital competence to innovation. It confirms that innovation is not merely a function of skill acquisition but also depends on how those skills are internalized and translated into motivation and action. Teachers may have adequate digital skills, but without feeling empowered, they may be less likely to apply those skills in innovative ways.

From a theoretical perspective, this study extends existing literature by integrating digital literacy and psychological empowerment into a single explanatory model of teacher innovative behavior. It highlights the importance of combining technological and psychological perspectives to better understand innovation in educational contexts.

From a practical perspective, the findings suggest that efforts to enhance teacher innovation should not focus solely on improving digital skills through training programs. Educational institutions should also create supportive environments that foster psychological empowerment, such as providing autonomy, recognizing teacher contributions, and encouraging experimentation in teaching practices. By strengthening both digital competence and psychological empowerment, schools can more effectively promote innovative behavior among teachers.

CONCLUSION

This study concludes that digital literacy and psychological empowerment are significant determinants of teacher innovative behavior. However, the findings show that the direct effect of digital literacy on innovative behavior is relatively small, whereas psychological empowerment has a substantially stronger influence. This indicates that innovation in teaching is not primarily driven by technical competence alone, but by the extent to which teachers feel empowered to act on their capabilities.

The study further demonstrates that psychological empowerment partially mediates the relationship between digital literacy and innovative behavior. This suggests that digital literacy



becomes more impactful when it enhances teachers' sense of competence, autonomy, and influence. In other words, digital literacy provides a foundational enabler for teacher innovation; however, its contribution becomes more substantial when teachers experience psychological empowerment, enabling them to translate digital competencies into innovative teaching practices.

Theoretically, this study contributes by integrating technological and psychological perspectives into a unified model of teacher innovative behavior. It provides empirical evidence that bridges digital literacy and psychological empowerment, offering a more comprehensive explanation of how innovation emerges in educational contexts.

Practically, the findings imply that efforts to promote teacher innovation should move beyond a sole focus on digital training. Educational institutions should design interventions that simultaneously strengthen psychological empowerment, such as increasing teacher autonomy, encouraging experimentation, and recognizing innovative practices. Policies that only emphasize digital competence without addressing psychological factors may produce limited impact on innovation.

This study is limited by its focus on private junior high school teachers in a specific regional context, which may restrict the generalizability of the findings. Future research is recommended to expand the sample scope, incorporate longitudinal designs, and explore additional mediating or moderating variables, such as organizational support or leadership style, to further understand the dynamics of teacher innovation.

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