The influence of principals' intellectual stimulation, digital literacy, and self-efficacy on teachers' innovative behaviors

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Abstract

This research employed a quantitative method to analyze the direct and indirect effects of principals' intellectual stimulation, digital literacy, and self-efficacy on teachers' innovative behavior. Data were collected from 85 public elementary school teachers in West Pasaman Regency through a questionnaire and analyzed using SEMPLS. The results indicated a direct positive effect of the principals' intellectual stimulation (5.8%), digital literacy (52.8%), and self-efficacy (26.7%) on teachers' innovative behavior. In addition, principals' intellectual stimulation (28.4%) and digital literacy (64.9%) also positively affected self-efficacy. The indirect pathway, through self-efficacy, showed that principals' intellectual stimulation contributed 7.6% to teachers' innovative behavior, and digital literacy contributed 17.3% indirectly. These findings confirm that the principals' intellectual stimulation, digital literacy, and self-efficacy are crucial factors that can encourage teachers' innovative behavior. The findings indicate that the principal's intellectual stimulation, digital literacy, and self-efficacy are three factors that can influence teachers' innovative behavior.

Keywords

Digital literacy, innovative behavior, intellectual stimulation, self-efficacy

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Introduction

Teachers are a key element in the education system, playing a central role in shaping the character and competence of the nation's next generation. Law of the Republic of Indonesia Number 14 of 2005 concerning Teachers and Lecturers affirms that teachers are professional educators whose primary duties are to educate, teach, guide, direct, train, assess, and evaluate students. In carrying out their duties, teachers are required not only to master pedagogical knowledge and material substance but also to present an effective, creative, and adaptive learning process to the changing times (Christodoulou & Angeli, 2022).

In today's digital era, the challenges teachers face is increasingly complex. Advances in technology and information have shifted the learning paradigm and demanded a transformation in teaching approaches. Teachers are no longer simply conveyors of information; they must also become learning facilitators capable of empowering students to think critically, creatively, and independently. Therefore, innovative behavior is a necessity for teachers. Rasheed (2023) emphasised that innovation in education is crucial to addressing global challenges and the increasingly diverse needs of students.

Teachers' innovative behaviors include the ability to create, promote, and implement new ideas in learning contexts. According to Hardianto et al. (2021), innovative behavior consists of three main stages: idea generation, promotion, and implementation. Innovative teachers are not only capable of generating new ideas but also of transforming them into concrete and effective learning strategies. In this case, teacher innovation includes modifying teaching methods, developing digital learning media, and developing learning strategies tailored to student needs.

Almazroa and Alotaibi (2023) stated that innovative teacher behavior is a proactive response to the challenges of 21st century education. By implementing a creative and flexible approach, teachers can develop critical thinking, communication, collaboration, and creativity (the 4Cs) skills in students. This increases the effectiveness of learning and prepares students to face the challenges of the workplace and future life.

However, the portrait of educational innovation in Indonesia still requires attention. According to the 2024 Global Innovation Index (GII) report released by WIPO, Indonesia ranks 54th out of 132 countries with a score of 30.6. This ranking still lags far behind other ASEAN countries such as Singapore (4th), Malaysia (33rd), Thailand (41st), and Vietnam (44th). Despite a seven-place improvement from the previous year, this achievement demonstrates the need to improve the quality of human resources, including teachers, to strengthen the national innovation ecosystem.

Locally, this situation is particularly evident in West Pasaman Regency. Based on an initial survey conducted in 11 public elementary schools representing each subdistrict, data showed that teachers' innovative behavior is still suboptimal, particularly in implementing ideas. Although some teachers demonstrate the ability to generate learning ideas, many have not been able to translate them into practical classroom practice. This aligns with De Jong and Den Hartog (2010), which stated that implementing ideas is a key dimension of innovative behavior because it reflects the process of actualising creativity in the workplace.

This phenomenon indicates various barriers preventing teachers from innovating. Teachers tend to be passive when exploring new approaches, lack confidence in sharing ideas, and are reluctant to implement them. A lack of evaluation of learning practices also hinders continuous improvement efforts. This situation undoubtedly has implications for the decline of the learning process and the quality of graduates.

Several internal and external factors influence teachers' innovative behavior, according to various previous studies. The principal's leadership style, particularly transformational leadership, is a dominant external factor. Intellectual stimulation, as one dimension of transformational leadership, is crucial in encouraging teachers to think creatively and explore new solutions in learning (Sholeh, 2021). Pangestu and Karwan (2021) found that principals who consistently provide intellectual challenges, discuss new ideas, and provide constructive feedback can encourage teachers to be more innovative.

However, in some elementary schools, intellectual stimulation from the principal remains low. A lack of academic discussion forums, minimal appreciation for teacher creativity, and weak leadership in encouraging collaboration and pedagogical reflection are obstacles to creating an innovative school culture. Another internal factor that influences innovative behavior is self-efficacy. Schunk and DiBenedetto (2021) stated that self-efficacy refers to an individual's belief in their ability to complete specific tasks. Teachers with high self-efficacy tend to be more confident in trying new learning methods, overcoming obstacles in the classroom, and taking risks in implementing innovative approaches. Conversely, low self-efficacy makes teachers reluctant to innovate and more comfortable remaining in the zone of routine.

Conversely, digital literacy plays a crucial role in teachers' ability to innovate. Digitally literate teachers tend to be more adaptable to technological changes, able to access various learning resources, and effectively apply digital media in the teaching and learning process (Falloon, 2020). Digital literacy enables interactive, engaging, and contextual learning. However, challenges such as limited infrastructure, a lack of training, and low technology utilisation remain significant barriers in the field (Bingimlas, 2009).

In addition to these factors, social support, organisational culture, emotional intelligence, and professional education contribute to teachers' innovative behavior (Shafait & Huang, 2023). Strong support from colleagues, a favourable work climate, and opportunities for continuous professional development can strengthen teachers' motivations to innovate. Considering these various factors, this research focuses on the influence of the principals' intellectual stimulation, digital literacy, and self-efficacy on the innovative behavior of public elementary school teachers in West Pasaman Regency. This research is crucial to provide a deeper understanding of the determinants of teacher innovative behavior and a basis for designing effective interventions to improve the quality of learning at the elementary school level.

Methodology

Research Design

This quantitative research design used a survey approach to examine the causal relationship between primary intellectual stimulation, digital literacy, self-efficacy, and teacher innovative behavior. The survey design was chosen because it allows for systematic data collection from several respondents to obtain a representative picture of the phenomenon under research. This research sample consisted of 85 public elementary school teachers in West Pasaman Regency who were selected using a multistage random sampling technique to ensure representation from various sub-districts. Using this design, the researcher can measure relevant variables and statistically analyze relationships between them. In addition, this design used questionnaires as the main instrument to obtain quantitative data to be analyzed objectively using the structural equation modelling (SEM) method based on partial least squares (PLS). This approach was suitable for comprehensively testing the conceptual model and research hypotheses and providing an in-depth understanding of the factors influencing teachers' innovative behavior in elementary schools.

Data collection and analysis

Data in this research were collected using a questionnaire instrument designed based on indicators for each research variable: principal intellectual stimulation, digital literacy, self-efficacy, and innovative teacher behavior. Each item in the questionnaire was measured using a five-point Likert scale: Always (5), Often (4), Sometimes (3), Rarely (2), and Never (1). The scores reflect the frequency with which respondents respond to statements related to their behavior or perceptions regarding each variable indicator. Before use, the questionnaire instrument was tested for validity and reliability to ensure accurate and reliable data.

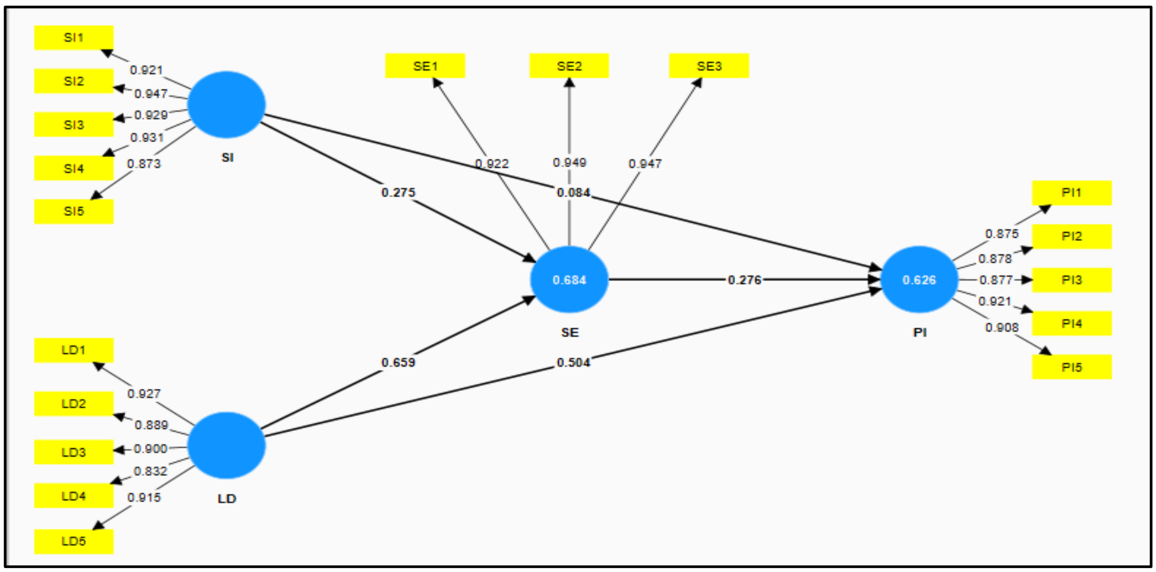
Data analysis was conducted using the variance-based Structural Equation Modelling (SEM) method through SmartPLS 4 software. The analysis process included testing the measurement model to ensure the validity and reliability of the variable constructs, using indicators such as outer loading, Average Variance Extracted (AVE), Composite Reliability, and Cronbach's Alpha. Next, a structural model test was conducted to examine the relationship between variables by looking at the R-square value, path coefficient, T-statistic value, and p-value significance. This approach allows for comprehensive and in-depth hypothesis testing. It is suitable for use with data that does not meet the assumption of normality, so that the research results can provide a valid picture of the influence of principal intellectual stimulation, digital literacy, and self-efficacy on teacher innovative behavior.

Findings

Validity test

The indicator validity test using the PLS Algorithm procedure with SmartPLS 4 produced the calculated R value as shown in Figure 1.

Figure 1. *Results of the PLS algorithm procedure*



Based on the PLS-SEM model output results, all constructs in this research showed high factor loading values above 0.7. Indicators in the Intellectual Stimulation (SI) construct had loading values between 0.891 and 0.949, while the Digital Literacy (LD) indicator was between 0.827 and 0.931. Indicators for the Self-Efficacy (SE) construct had loading values of 0.920 to 0.952, and the Innovative Behavior (PI) indicator showed loading values between 0.840 and 0.917. All of these values indicate that each indicator has a substantial contribution to its respective construct.

Convergent validity

Convergent validity is a form of construct validity that measures the extent to which indicators within a variable correlate with each other. This validity demonstrates that the constructs' items truly reflect the same concept. Testing is performed by examining factor loadings, Average Variance Extracted (AVE), and composite reliability. A favourable factor loading is generally above 0.7, while the AVE is at least 0.5. If these values are met, the construct is considered to have excellent convergent validity.

Table 1. *Loading factor values*

	X1 (SI)	X2 (LD)	Z (SE)	Y (PI)
SI1	0.918			
SI2	0.949			
SI3	0.929			
SI4	0.936			
SI5	0.891			
LD1		0.931		
LD2		0.893		
LD3		0.894		
LD4		0.827		
LD5		0.918		
SE1			0.920	
SE2			0.952	
SE3			0.948	
PI1				0.840
PI2				0.876
PI3				0.884
PI4				0.917
PI5				0.896

Table 2. *Average Variance Extracted (AVE) value*

	Average variance extracted (AVE)
X1 (SI)	0.856
X2 (LD)	0.798
Z (SE)	0.883
Y (PI)	0.780

a. Discriminant validity

The discriminant validity test assesses the degree to which a construct differs from other constructs. The square root of the AVE value for each construct must be higher than the correlation between that construct and other constructs (Fornell-Larcker Criterion). Discriminant validity values are shown in Table 3.

Table 3. *Fornell-Larcker criterion values*

	X1 (SI)	X2 (LD)	Z (SE)	Y (PI)
X1 (SI)	0.925			
X2 (LD)	0.465	0.893		
Z (SE)	0.586	0.781	0.940	
Y (PI)	0.460	0.764	0.713	0.883

Indicator reliability test

a. Cronbach's alpha reliability

Table 5 shows the Cronbach's alpha reliability values. Based on SmartPLS 4 calculations, the Cronbach's alpha value for variable X1 is 0.958, for variable X2 is 0.936, for variable Z is 0.934, and for variable Y is 0.929. All four variables meet the high confidence score criteria > 0.6.

Table 4. *Cronbach's alpha reliability Value*

	Cronbach's alpha
X1 (SI)	0.958
X2 (LD)	0.936
Z (SE)	0.934
Y (PI)	0.929

b. Composite reliability

The composite reliability values are shown in Table 6. Based on the SmartPLS 4 calculation results, the composite reliability value for variable X1 is 0.958, variable X2 is 0.938, variable X3 is 0.934, and variable Y is 0.940. All four variables have a high reliability score, namely, >0.7.

Table 5. *Composite reliability values*

	Composite reliability (rho_a)
X1 (SI)	0.961
X2 (LD)	0.939
Z (SE)	0.935
Y (PI)	0.931

a. Multicollinearity assumption test

The assumption tests used in SEM-PLS analysis are simpler than those used in other applications. SmartPLS does not require data to meet standard or linear requirements, but before hypothesis testing, SmartPLS must first perform a multicollinearity test by considering the internal VIF collinearity statistic. The internal VIF collinearity statistics are shown in Table 6.

Table 6. *Inner VIF collinearity statistics*

	X1 (SI)	X2 (LD)	Z (SE)	Y (PI)
X1 (SI)			1.277	1.522
X2 (LD)			1.277	2.561
Z (SE)				3.052
Y (PI)				

Based on Table 6, the VIF value of X1 for Z is 1.277. The VIF value of X2 for Z is 1.277. The VIF value of X1 against Y is 1.522. The VIF value of X2 against Y is 2.561. The VIF value of Z from Y is 3.052. For each variable, a VIF value of less than 5.0 indicates that there is no multicollinearity between the variables.

Structural Model Analysis

a. *Inner model feasibility analysis using R-square*

The coefficient of determination (R-squared) measures the influence of independent variables on the dependent variable in a relationship model. A model is considered strong if the R-squared value is > 0.75, moderate if the value is in the range of 0.50 < R-squared < 0.75, and weak if it is in the range of 0.25 < R-squared < 0.5. Based on the R-squared analysis results in Table 7, it can be determined that Intellectual Stimulation (X1), Digital Literacy (X2), and Self-efficacy (Z) jointly influence Innovative Behavior (Y) by 0.620, while the adjusted R-squared value is 0.606. Therefore, it can be concluded that all exogenous constructs (X1 and X2) and the mediator (Z) simultaneously influence Y by 0.620, or 62%. Because the R-square is 0.50 < R-square < 0.75, the influence of exogenous constructs X1, X2, and Z on Y is moderate.

The R-square values for Intellectual Stimulation (X1) and Digital Literacy (X2) jointly contribute to Self-Efficacy (Z) with an R-square value of 0.672 and an adjusted R-square of 0.664. This explains why all exogenous constructs (X1 and X2) simultaneously influence Z by 0.672, or 67.2%. The R-square value falls within the range of 0.50 < R-square < 0.75, indicating that the influence of all exogenous constructs X1 and X2 on Z is moderate.

Table 7. *Coefficient of determination R-square*

	R-square	R-square adjusted
Z (SE)	0.672	0.664
Y (PI)	0.620	0.606

b. *Feasibility analysis with standardized root mean residual and non-fit index SmartPLS 4*

In addition to interpreting model fit through the R-square value, model fit can be determined through the standardized mean residuals (SRMR) and non-fit index (NFI) values obtained through the SmartPLS 4 startup process. The SRMR is considered fit if the SRMR is <0.100 and the NFI is >0.80, indicating a satisfactory model fit. The SRMR and NFI values calculated using SmartPLS 4 are presented in Table 8.

Table 8. *SRMR and NFI values*

	Saturated model	Estimated model
SRMR	0.070	0.070
NFI	0.824	0.824

Table 8 shows an SRMR value of 0.070 < 0.100, confirming that the model meets the feasibility criteria. Furthermore, the NFI value of 0.824 indicates that the model meets satisfactory criteria.

c. Feasibility analysis with predictive relevance q2

Predictive relevance (Q2) is a testing step that uses the blindfolding method. The goal is to obtain results that indicate a predictive relationship between the dependent variable construct used in the model and the independent variable construct (Henseler & Sarstedt, 2013). If the ΔQ2 value exceeds 0, it can be determined that a particular dependent structure in the model has an estimate that aligns with the predicted results.

Table 9. *Q2 predictive relevance values*

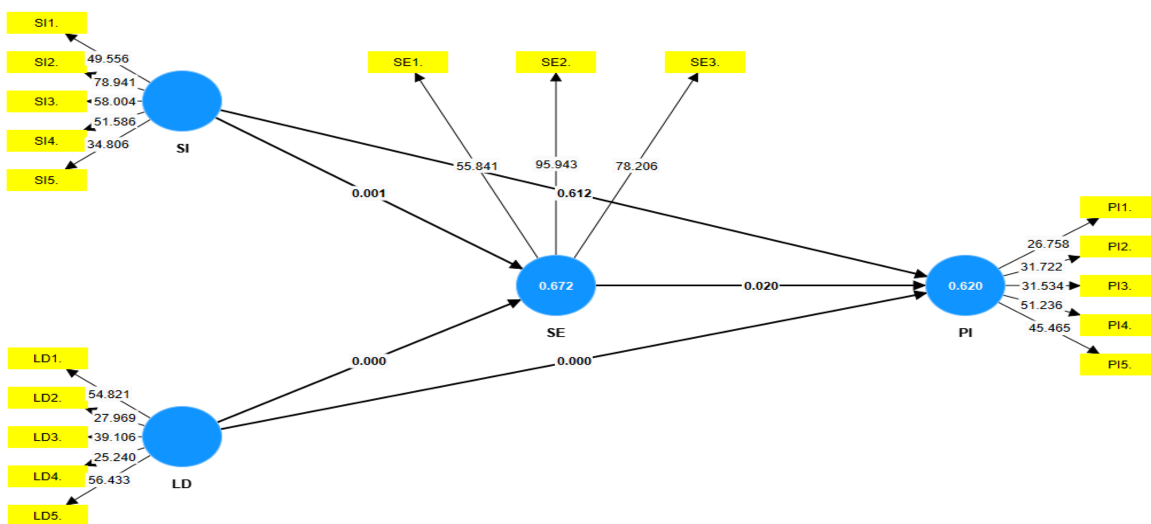
	SSO	SSE	Q^2 (=1-SSE/SSO)
X1 (SI)	425.000	425.000	
X2 (LD)	425.000	425.000	
Z (SE)	255.000	105.243	0.587
Y (PI)	425.000	226.954	0.466

Based on Table 9, the Q2 value for independent variables X1 and X2 with respect to variable Z is 0.587>0, indicating that X1 and X2 have strong predictive relevance for Z. Meanwhile, the Q2 value for X1 and X2 with respect to Y is 0.466, indicating strong predictive relevance.

Hypothesis Testing

The SEM PLS hypothesis testing was performed using SmartPLS 4 with the bootstrapping procedure. The bootstrapping procedure produces P values and t-tests. P-values and t-tests are used to examine the direct and indirect effects of the relationship model. The t-test values for the effects between variables resulting from the bootstrapping procedure are shown in Figure 2.

Figure 2. *Bootstrapping procedure results*



a. Direct effect analysis

In the bootstrapping model, there are direct effects of X1 on Y, X2 on Y, Z on Y, X1 on Z, and X2 on Z. SmartPLS 4 analyzes whether there is a direct effect between variables. Since the tolerance level of error is 5% or 0.05, a variable is considered to have an effect when the t-value exceeds 1.96. It is reported as having a significant effect when the P-value is < 0.5. The bootstrapping results indicate that X2→Y, Z→Y, X1→Z, and X2→Z have a significant direct effect. Meanwhile, variable X1 does not have a significant direct effect on Y. Furthermore, the P-value obtained is positive, thus concluding a positive direct effect. A relevant positive relationship is that the greater the value of the independent variable, the greater the value of the dependent variable being studied. The P-value and t-score appear in SmartPLS 4 Table 10.

Table 10. *SmartPLS 4 bootstrapping direct effect*

Direct relationship	Original sample (O)	T statistics (|O/STDEV|)	P values	Conclusion
X1(SI) → Y (PI)	0.058	0.507	0.612	There is no significant effect
X2 (LD → Y (PI)	0.528	3.889	0.000	There is a significant effect
Z (SE) → Y (PI)	0.267	2.321	0.020	There is a significant effect
X1 (SI) → Z (SE)	0.284	3.222	0.001	There is a significant effect
X2 (LD) → Z (SE)	0.649	9.442	0.000	There is a significant effect

b. Indirect effect analysis

In the indirect effect relationship model analyzed using SmartPLS 4, a variable is declared to have an indirect effect if its t-value is > 1.96. The effect is considered significant if its P-value is < 0.5. The indirect relationship between Intellectual Stimulation (IS) and Innovative Behavior (PI) through Self-Efficacy (SE) is not statistically significant at the 0.05 level, with a p-value of 0.061 > 0.05. However, this value is close enough to the significance limit to be considered significant or trending towards significance.

The indirect relationship between Digital Literacy (LD) and Innovative Behavior (PI) through Self-Efficacy (SE) is statistically significant at the 0.05 level (p = 0.024 < 0.05). This indicates that self-efficacy significantly mediates the influence of digital literacy on teachers' innovative behavior. The calculated t- and p-values for the indirect effect are presented in Table 11.

Table 11. *SmartPLS bootstraping 4 indirect effects*

Indirect relationship	Original sample (O)	T statistics (|O/STDEV|)	P values	Conclusion
SI → SE → PI	0.076	1.874	0.061	There is no significant effect
LD → SE → PI	0.173	2.257	0.024	There is significant effect

Discussions

The direct effect of the principal's intellectual stimulation on teacher innovative behaviors

The analysis results indicate that the direct effect of the principal's intellectual stimulation on teacher innovative behavior is not significant (coefficient = 0.058; T-statistic = 0.507; p = 0.612). This finding indicates that, statistically, intellectual stimulation cannot directly encourage teachers to display innovative behavior. This contradicts the findings of Sholeh (2021), which stated that transformational leadership, specifically intellectual stimulation, can increase teacher creativity and innovation. This discrepancy may be caused by the principal's low internalization of the message, a conservative work culture, or a lack of follow-up on the intellectual stimulation provided.

Another possibility could be a disparity in the principals' and teachers' perceptions of the provided intellectual stimulation. If stimulation is limited to verbal direction without concrete support or training, teachers are less likely to follow up on it through learning innovations. Furthermore, the effects of intellectual stimulation can be long-term, meaning behavioral changes are not immediately apparent. Innovative behavior requires internalization, motivational reinforcement, and the creation of a supportive work environment, necessitating a sustained approach from the principal.

The direct effect of digital literacy on teachers' innovative behavior

The results indicate that digital literacy has a positive and significant effect on teachers' innovative behavior (coefficient = 0.528; T-statistic = 3.889; p = 0.000). This indicates that the higher a teacher's digital literacy, the higher their tendency to engage in innovative behavior. This finding supports Caena and Redecker (2019), which stated that digital competence provides teachers with the space and flexibility to implement new, creative, and effective learning methods. Mastery of technology opens up greater opportunities for teachers to create adaptive and meaningful learning. Digital literacy enables teachers to explore interactive learning media, access global learning resources, and utilize digital platforms for collaboration and evaluation. This encourages a more participatory and innovative learning transformation. Teachers with high digital literacy also demonstrate an open attitude to changes and developments in educational technology. This mental and technical readiness is an important foundation for designing and implementing innovative learning approaches relevant to today's digital generation.

The direct effect of self-efficacy on teacher innovative behavior

Self-efficacy positively and significantly influences teacher innovative behavior (coefficient = 0.267; T-statistic = 2.321; p = 0.020). This indicates that teachers who are confident in their abilities are more likely to demonstrate innovative behavior in teaching. These results align with Çelik (2013), who stated that self-efficacy strongly predicts teacher innovativeness. Teachers confident in their abilities are more willing to try new things, take pedagogical risks, and implement innovation in the learning process. Self-efficacy has a strong psychological influence on teachers' intrinsic motivation to explore different learning methods. Self-confidence is the main driving force in overcoming obstacles and uncertainty when innovating. In practice, teachers with high self-efficacy tend to be more reflective, open to feedback, and firmly committed to continuous improvement. They do not give up easily when faced with obstacles and instead seek innovative solutions independently.

The direct effect of principal intellectual stimulation on self-efficacy

The principal's intellectual stimulation significantly influences teacher self-efficacy (coefficient = 0.284; T-statistic = 3.222; p = 0.001). Principals who provide intellectual challenges, encourage critical thinking, and support teachers' ideas can increase teachers' confidence in their abilities. This finding supports the research of Zainal and Mohd Matore (2021), which stated that transformational leadership positively impacts self-efficacy. Teachers feel more valued and motivated to develop themselves when the principal supports their initiatives and exploration of ideas.

Leadership that encourages intellectual dialogue, pedagogical reflection, and collective learning contributes to forming teachers' professional identity. The sense of competence that arises from the recognition of teachers' ideas and achievements has a direct impact on increased self-efficacy. In the elementary school context, the principal's role as a professional facilitator significantly influences teachers' psychological well-being. When teachers feel intellectually and emotionally supported, they are more likely to take initiative and innovate.

Direct effect of digital literacy on teacher self-efficacy

Digital literacy directly affects teacher self-efficacy (coefficient = 0.649; T-statistic = 9.442; p = 0.000). Digitally literate teachers feel more confident in managing technology-based learning. These results align with Bingimlas (2009), who showed that digital literacy training can increase teachers' confidence in integrating ICT into learning. Teachers with strong digital skills have a high sense of control and confidence in the effectiveness of the learning they design.

Technological skills make teachers feel competent and relevant to current demands. Self-confidence grows as their ability to access, manage, and create meaningful digital content for learning improves. Successful experiences using technology to solve learning problems are key to strengthening self-efficacy. When teachers see the positive impact of ICT use on student learning outcomes, they become more confident in continuing to innovate.

Indirect effect of principal intellectual stimulation on innovative behavior through self-efficacy

The indirect effect of intellectual stimulation on teacher innovative behavior through self-efficacy showed a positive trend but was not yet statistically significant (coefficient = 0.076; T-statistic = 1.874; p = 0.061). However, substantively, these results indicate that intellectual stimulation can increase teacher innovation by strengthening teacher self-efficacy. These results align with Iqbal et al. (2023), who stated that self-efficacy can mediate the relationship between transformational leadership and innovative behavior. This indicates that the principal's role in fostering teacher efficacy remains crucial as a psychological foundation for developing innovative teachers.

This mediation role indicates that an indirect approach through psychological empowerment is more effective in fostering innovative behavior than a direct, instructional approach. This highlights the importance of fostering self-confidence and allowing teachers to experiment without fear of failure. When self-efficacy increases, teachers are more prepared and comfortable facing innovation challenges.

Indirect effect of digital literacy on innovative behavior occurs through self-efficacy

Digital literacy significantly indirectly affects teachers' innovative behavior through self-efficacy (coefficient = 0.173; T-statistic = 2.257; p = 0.024). This indicates that digital literacy provides technical skills and builds self-confidence that leads to innovative behavior. This finding is supported by Kusyanti et al. (2024), who found that digital literacy enhances teacher creativity through self-efficacy. Creativity, mediated by self-efficacy, is an important foundation for innovative behavior in the learning context.

Self-efficacy serves as a psychological bridge connecting digital competence with implementing learning innovations. Teachers who believe in their abilities can better utilize technology optimally and creatively. The implication is that digital literacy training is aimed at technical mastery and must also be accompanied by developing a positive mindset and self-confidence in its use. This strategy will produce teachers who are not only skilled but also creative and innovative.

Conclusion

Based on the research results, digital literacy and self-efficacy significantly influence teachers' innovative behavior, while the principal's intellectual stimulation did not have a significant direct effect. Statistically, the direct effect of intellectual stimulation on innovative behavior showed an original sample value of 0.058, a t-statistic of 0.507, and a p-value of 0.612, indicating an insignificant relationship. Conversely, digital literacy strongly and significantly affected innovative behavior, with an original sample value of 0.528, a t-statistic of 3.889, and a p-value of 0.000. Self-efficacy also had a significant effect, with an original sample value of 0.267, a t-statistic of 2.321, and a p-value of 0.020.

Furthermore, intellectual stimulation and digital literacy significantly influenced teacher self-efficacy. The effect of intellectual stimulation on self-efficacy recorded an original sample value of 0.284, a t-statistic of 3.222, and a p-value of 0.001. Meanwhile, digital literacy on self-efficacy shows a powerful influence, with an original sample of 0.649, a t-statistic of 9.442, and a p-value of 0.000. Digital literacy also has a significant indirect effect on innovative behavior through self-efficacy, with an original sample value of 0.173, a t-statistic of 2.257, and a p-value of 0.024. Meanwhile, the indirect effect of intellectual stimulation on innovative behavior through self-efficacy is insignificant, with an original sample value of 0.076, a t-statistic of 1.874, and a p-value of 0.061.

These results confirm that improving digital literacy and self-efficacy is vital for developing innovative teacher behavior. Principals' intellectual stimulation plays a significant role in building self-efficacy, but it is not strong enough to directly encourage teacher innovation without the support of other factors.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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