

EMPIRICAL PAPER

Academic Supervision and Digital Platform Adoption as Predictors of Elementary School Teacher Competence: A PLS-SEM Study from Rural Indonesia

Wahyu Pitaloka Dwilestari^{1*}, Ahmad Hariyadi¹, Gunawan Setiadi¹, Ayomide Ogo-oluwa Ogunleye²

Affiliations

¹Muria Kudus University, Jawa Tengah, Indonesia

²Lagos State University, Ojo, Nigeria

ORCID Identifiers

Ahmad Hariyadi
[0000-0001-8344-6718](https://orcid.org/0000-0001-8344-6718)

Gunawan Setiadi
[0000-0003-2845-9852](https://orcid.org/0000-0003-2845-9852)

Ayomide Ogo-oluwa
Ogunleye
[0009-0006-0073-8234](https://orcid.org/0009-0006-0073-8234)

DOI

[10.65820/ejes-2vol2-issue2-2026](https://doi.org/10.65820/ejes-2vol2-issue2-2026)

Abstract

Purpose: Improving teacher competence in the digital era requires understanding how managerial interventions and technology adoption interact within school systems. This study examines the individual and combined effects of academic supervision and the use of the Ruang GTK (Teachers and Education Personnel) digital platform on the pedagogical, professional, personality, and social competencies of elementary school teachers in Tayu District, Pati Regency, Indonesia.

Methods: A quantitative cross-sectional design was employed using Partial Least Squares Structural Equation Modelling (PLS-SEM). Data were collected from elementary school teachers, with academic supervision and Ruang GTK platform adoption modelled as predictors of teacher competence.

Results: Academic supervision had a strong and statistically significant influence on teacher competence ($\beta = 0.671$, $f^2 = 0.533$), demonstrating its central role in professional development. The Ruang GTK platform also had a significant but smaller effect ($f^2 = 0.077$), indicating that its contribution is moderated by contextual and infrastructural factors. Together, both predictors explained 81.7% of the variance in teacher competence ($R^2 = 0.817$), providing robust support for the Hybrid Professional Development model.

Novelty and Contribution: The study advances existing literature by conceptualising managerial supervision and digital learning platforms as complementary rather than independent drivers of teacher competence. It highlights academic supervision as the primary mechanism for competence development, with digital platforms strengthening professional learning when integrated into effective supervisory practices.

Social and Practical Implications: The findings support the Hybrid Professional Development framework and suggest that policymakers and school leaders should prioritise high-quality clinical supervision while embedding Ruang GTK into supervisory feedback and coaching processes to maximise teacher competence in digitally supported educational environments.

Keywords: Academic Supervision; Digital Platform Adoption; Teacher Competence; PLS-SEM; Educational Leadership

*Corresponding author

E-mail address: 202403056@std.umk.ac.id

How to cite this article:

Dwilestari, W. P., Hariyadi, A., Setiadi, G., & Ogunleye, A. O. (2026). Academic supervision and digital platform adoption as predictors of elementary school teacher competence: A PLS-SEM study from rural Indonesia. *Elicit Journal of Education Studies*, 2(2), 12-26. <https://doi.org/10.65820/ejes-2vol2-issue2-2026>

1 Introduction

Teacher professional competence occupies a central position in international educational quality frameworks. UNESCO's (2023) Global Education Monitoring Report identifies teacher quality as the most consequential school-level determinant of student learning outcomes, a finding echoed in the OECD's empirical work on teacher knowledge and competence development (Révai & Guerriero, 2017). In the contemporary knowledge economy, this imperative has intensified: teachers are now expected not only to demonstrate mastery of subject matter and pedagogy but also to navigate an increasingly complex digital learning environment that demands continuous professional renewal. The intersection of managerial oversight, specifically academic supervision by school principals, and technology-mediated professional development has therefore emerged as a critical concern for education systems worldwide, particularly in rapidly developing economies where systemic transformation is both urgent and logistically challenging.

In Indonesia, this imperative is codified in the National Education System Law (No. 20/2003) and operationalised through Permendiknas No. 16/2007, which establishes four interdependent competency domains: pedagogical, professional, personality, and social, as the national standard for teacher qualification. The Indonesian government's Merdeka Belajar (Freedom to Learn) policy, launched in 2019 and progressively implemented through the Merdeka Kurikulum framework, has substantially raised the bar for teacher adaptive competence, requiring educators to function as reflective, student-centred professionals capable of differentiating instruction to meet individual learning needs (Aji & Putra, 2021).

Indonesia provides a particularly salient context for examining these dynamics. With approximately 3.4 million teachers serving over 53 million students across more than 500,000 schools, the Indonesian education system is the fourth largest in the world (OECD, 2024). Despite notable reform momentum, structural challenges in teacher competency persist. Data from the Programme for International Student Assessment (PISA) 2022 revealed that more than three-quarters of 15-year-old Indonesian students did not meet minimum proficiency levels in mathematics and reading, a pattern that, while shaped by multiple determinants, reflects the cumulative effect of uneven teacher quality across regions (OECD, 2023). At the elementary school level, where foundational competencies are established, the consequences of instructional inadequacy are particularly consequential: gaps formed in early schooling compound over time and disproportionately affect students from socioeconomically disadvantaged backgrounds. Compounding this challenge, assessment data collected in 2024 found that many Indonesian teachers continue to exhibit significant limitations in pedagogical, literacy, and numeracy competencies, highlighting the persistence of a teacher quality gap that administrative and policy interventions have yet to close (Alfaruqi & Nurwahidah, 2025).

Two policy instruments have been positioned as central drivers of this competence transformation. The first is academic supervision, the structured, cyclical process through which school principals assess, guide, and develop teachers' professional practice through clinical observation, feedback, and follow-up coaching (Johannesson, 2022). Academic supervision in Indonesia stems from developmental supervision theory. This theory designates the supervisor as a facilitator of professional growth, adapting interventions to each teacher's developmental stage instead of using uniform methods (Johannesson, 2022). The second is the Ruang GTK (Guru dan Tenaga Kependidikan) platform, a national digital ecosystem launched by the Ministry of Education, Culture, Research, and Technology as the successor to the Merdeka Mengajar (PMM) platform, designed to provide teachers with self-directed access to professional learning materials, community networks, and reflective tools aligned with the Merdeka Kurikulum (Amin, 2025; Sulandra et al., 2023).

Academic supervision by school principals has long been theorised as a primary mechanism for improving teacher competency in institutional settings. Drawing on foundational frameworks advanced by Glickman, Gordon, and Ross-Gordon (2001) and Sergiovanni (1987), academic supervision is understood not as a hierarchical surveillance function but as a collaborative, instructionally focused process through which supervisors observe classroom practice, provide feedback, and engage teachers in professional reflection. Empirical literature has substantiated the positive effects of this function across diverse educational contexts. Studies conducted in Indonesian elementary schools have found that academic supervision carried out by principals significantly and positively influences teachers' pedagogical performance, with evidence suggesting that the quality of supervision explains a meaningful proportion of variance in teacher productivity and classroom effectiveness (Sunaryo, 2020; Shintawati et al., 2025). A systematic review of research on supervision in Indonesian schools further confirmed that principals' supervisory competence consistently

predicts improvements in both pedagogical and professional competencies among classroom teachers (Rasdiana et al., 2024). Despite these positive findings, a persistent concern in the literature is the gap between the formal mandate for academic supervision and its actual implementation quality, with many schools characterised by infrequent, superficial, or compliance-driven observation practices that yield little instructional growth (Lorensius et al., 2022). The managerial dimension of principals' role, encompassing planning, organising, directing, and evaluating educational resources, provides the organisational scaffolding within which effective supervision can or cannot take place, yet research that integrates managerial oversight and academic supervision within a unified analytical model remains underdeveloped, particularly at the elementary school level (Muttaqin et al., 2023).

Additionally, despite substantial policy investment in both instruments, a critical gap between policy intent and implementation persists, particularly in rural and peri-urban elementary school settings. Field observations in Tayu District, Pati Regency, a predominantly rural sub-district of Central Java, indicate that academic supervision practices are frequently administrative rather than developmental in character, and that Ruang GTK engagement remains episodic rather than routine. Teachers report time constraints, limited digital infrastructure, and low intrinsic motivation to engage independently with platform content as recurring barriers to competence development. This gap suggests that the effectiveness of these instruments is neither automatic nor uniform; it is conditioned by local organisational, cultural, and infrastructural factors that policy implementation models rarely adequately address.

Theoretically, the coexistence of these two instruments raises an underexplored question: how do managerial intervention (academic supervision) and self-directed digital adoption (Ruang GTK) interact simultaneously to shape teacher competence? The existing literature addresses these variables largely in isolation. Studies on academic supervision, including Prastania and Sanoto (2021) and Asbari et al. (2019), consistently document its positive influence on professional competence, but rarely examine supervision alongside digital platform variables in a single integrated model. Research on digital platform adoption in teacher development (Galimov et al., 2024; Amin, 2025) focuses predominantly on platform-level outcomes and rarely situates digital adoption within the broader managerial ecology of school leadership. The intersection of supervision theory and technology acceptance theory, specifically the Technology Acceptance Model (TAM; Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2012), has received limited empirical attention in elementary school contexts in developing countries.

Three specific research gaps motivate this study. First, no published study has simultaneously modelled academic supervision and digital platform use as predictors of the full four-domain teacher competency construct in Indonesian elementary education. Second, the relative magnitude of each predictor's contribution, and its practical significance as assessed through effect size analysis, has not been empirically established. Third, there is an absence of contextually grounded evidence from rural elementary school settings in Indonesia, where the sociocultural, infrastructural, and organisational conditions governing supervision and technology adoption differ substantially from urban centres where prior research has been predominantly conducted (Amin, 2025).

This study addresses these gaps through a quantitative ex post facto design employing PLS-SEM, applied to a proportionally sampled population of 143 elementary school teachers across 27 schools in Tayu District. The study answers three research questions:

- i. Does academic supervision significantly predict teacher competence in this context?
- ii. Does Ruang GTK platform use significantly predict teacher competence?
- iii. What is the combined explanatory power of both predictors?

Beyond these empirical questions, the study advances a Hybrid Professional Development model proposing that managerial oversight and digital empowerment function as complementary mechanisms, rather than alternative or competing interventions, in the architecture of teacher competence development in Indonesian elementary education.

2 Literature Review

2.1 Academic Supervision and Teacher Competence Development

Academic supervision is theorised within Johannesson's (2022) Developmental Supervision framework as a differentiated, clinically structured process through which supervisors, typically school principals, assess teachers'

professional practice and provide targeted developmental support calibrated to each teacher's level of professional maturity. The framework's core premise is that supervisory effectiveness depends not on the uniformity of the supervisory approach but on its responsiveness to each teacher's developmental stage and contextual needs. This positions academic supervision as a relational, adaptive managerial function rather than a compliance-monitoring mechanism.

Empirical evidence for academic supervision's positive effects on teacher competence is substantial and consistent across educational contexts. Prastania and Sanoto (2021) documented a strong positive correlation between structured academic supervision and professional competence in Indonesian elementary teachers, attributing the relationship to supervisors' capacity to translate observation data into actionable developmental feedback. Asbari et al. (2019) demonstrated that supervision combined with knowledge transfer activities significantly enhanced teachers' innovative instructional practices. These findings are consistent with the broader educational supervision literature, which identifies clinical observation cycles, feedback quality, and post-observation coaching as the most potent supervisory mechanisms for professional development (Johannesson, 2022).

However, the literature also identifies conditions under which academic supervision may be less effective: when supervisory interactions are primarily evaluative and administrative in character, when follow-up actions are inconsistent, or when supervision is decoupled from teachers' classroom learning contexts (Tampubolon, 2020). In rural Indonesian elementary schools, these risk conditions are structurally prevalent, making the examination of supervision effectiveness in this specific context analytically important.

2.2 Digital Platform Adoption and Teacher Professional Development

The adoption of digital tools for teacher professional development has been theorised through two complementary frameworks. One is the Technology Acceptance Model (TAM; Davis, 1989), which posits that technology adoption is primarily predicted by users' perceptions of usefulness and ease of use, both of which shape behavioural intention to use a system. The other is the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2012), which extends TAM by incorporating social influence, facilitating conditions, and hedonic motivation as additional predictors of use behaviour, making it better suited to organisational adoption contexts such as school-based platform use.

Applied to teacher professional development contexts, these frameworks have been productively employed to understand conditions under which digital platforms generate professional learning outcomes. Galimov et al. (2024) examined digital platforms for teacher professional development and found that perceived usefulness and system quality were the primary predictors of sustained engagement, while infrastructural conditions moderated the relationship between intention and actual use, a finding with direct relevance to rural Indonesian contexts where internet connectivity and device access are variable. Amin (2025) documented that Ruang GTK platforms use significantly predicted professional competence gains among elementary teachers in urban Makassar, but observed that rural uptake lagged substantially, partly due to lower perceived usefulness and greater facilitating condition barriers.

A recurring finding across this literature is that digital platforms produce more modest professional development effects when they operate as standalone interventions disconnected from school-level managerial support structures. The platform's potential to accelerate professional learning is most fully realised when its content is integrated into teachers' routine reflective and supervisory cycles rather than treated as an additional, discretionary activity (Galimov et al., 2024). This insight provides the conceptual bridge between the supervision and platform literature, which motivates the integrated model tested in this study.

2.3 The Hybrid Professional Development Model: Theoretical Positioning

The Hybrid Professional Development model proposed in this study integrates developmental supervision theory (Johannesson, 2022) with the UTAUT framework (Venkatesh et al., 2012) to theorise a two-mechanism architecture for teacher competence development. In this model, academic supervision should constitute the managerial-relational mechanism: it provides externally structured developmental scaffolding, observation-based feedback, and institutionalised accountability for professional growth. The Ruang GTK platform constitutes the digital-agentic

mechanism: it provides self-directed access to professional learning resources, enabling teachers to extend professional development beyond scheduled supervisory interactions.

The theoretical claim is not that these mechanisms are equivalent in their developmental impact; indeed, the empirical literature suggests supervision effects are typically larger, but that they are complementary rather than substitutable. Supervision without digital extension may produce professional growth that is bounded by the frequency and depth of supervisory interactions; digital access without supervisory integration may produce engagement that is episodic and insufficiently connected to classroom practice change. The model therefore predicts that teacher competence development is optimised when both mechanisms are present and active, and particularly when supervisory practice explicitly integrates digital platform content into the observational and coaching cycle. This integration hypothesis, while theoretically grounded, has not previously been empirically tested in an elementary school context in Indonesia.

3 Method

3.1 Research Design

This study employs a quantitative, ex post facto correlational design because the researcher did not manipulate the independent variables (academic supervision and platform adoption) but instead examined their naturally occurring influence on teacher competence through retrospective measurement (Creswell & Poth, 2016). The ex post facto design is epistemologically appropriate for examining established organisational phenomena where experimental manipulation is neither feasible nor ethically justifiable. The structural relationships between constructs were estimated using Partial Least Squares Structural Equation Modelling (PLS-SEM), implemented through SmartPLS version 3.0.

PLS-SEM was selected over covariance-based SEM (CB-SEM) for three methodological reasons: (1) its suitability for theory development research where predictive accuracy is prioritised; (2) its robustness to non-normal data distributions common in educational survey research; and (3) its capacity to handle models with large indicator sets without requiring prohibitively large sample sizes (Hair et al., 2021). These characteristics make PLS-SEM particularly well-suited to the present study's three-construct model with 62 retained indicators.

3.2 Population, Sampling, and Sample Size

The target population comprised all teachers (civil servants and non-civil servants) in public elementary schools in Tayu District, Pati Regency, Central Java, Indonesia, totalling 223 teachers across 27 educational units. Sample size was determined using the Slovin formula with a 5% margin of error, yielding a required sample of 143 respondents. Participants were selected using proportional random sampling, with each school's representation weighted by its share of the total teacher population. This procedure ensured proportional representation across schools of varying sizes, supporting the external validity of the findings within the district (Hair et al., 2021).

Of the 143 questionnaires distributed, all were returned and retained for analysis following item-level data cleaning. The achieved sample size exceeds the minimum PLS-SEM requirement of ten times the maximum number of paths directed at any construct, thereby satisfying the power requirements for the structural model estimated (Hair et al., 2021).

3.3 Instrumentation and Operationalisation

Data were collected using a self-administered, closed-ended questionnaire comprising items measured on a five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). The instrument was developed deductively from established theoretical frameworks and underwent content validity assessment by subject matter experts and a pilot reliability test before field administration. Following measurement model analysis in PLS-SEM, 26 items were deleted due to cross-loading or insufficient factor loading (< 0.70), yielding a final instrument of 62 indicators distributed across three constructs.

Academic Supervision (X_1) was operationalised based on Glickman et al.'s (2001) Developmental Supervision framework, with indicators covering the full clinical supervision cycle: pre-observation planning, classroom

observation techniques, post-observation feedback quality, follow-up coaching, and supervisory principle adherence. The Ruang GTK Platform Use (X_2) was operationalised through an integration of TAM (Davis, 1989) and UTAUT (Venkatesh et al., 2012), with indicators addressing perceived usefulness, perceived ease of use, behavioural intention to use, facilitating conditions, and actual impact on professional work efficiency. Teacher Competence (Y) was operationalised as an endogenous latent variable measured across the four competency domains mandated by Permendiknas No. 16/2007: pedagogical, professional, personality, and social competence.

Table 1 Construct Operationalisation and Indicator Distribution

Construct	Dimensions	Retained Items	Theoretical Basis
Academic Supervision (X_1)	Supervision steps, principles, models	22 items	Glickman et al. (2001)
GTK Platform Use (X_2)	Usefulness, ease of use, intention, conditions, impact	14 items	Davis (1989); Venkatesh et al. (2012)
Teacher Competence (Y)	Pedagogical, professional, personality, social	26 items	Permendiknas No. 16/2007; Révai & Guerriero (2017)

3.4 Data Analysis

Analysis proceeded through a systematic two-stage PLS-SEM procedure following Hair et al. (2021). Stage 1 (Measurement Model) assessed convergent validity through factor loadings (threshold ≥ 0.70) and Average Variance Extracted ($AVE \geq 0.50$); discriminant validity through the Fornell–Larcker criterion ($\sqrt{AVE}$ of each construct exceeding its inter-construct correlations) and Heterotrait-Monotrait Ratio ($HTMT < 0.90$; Henseler et al., 2015); and construct reliability through Cronbach's alpha and Composite Reliability (both ≥ 0.70). Stage 2 (Structural Model) assessed path coefficients (β), T-statistics and p-values derived from 5,000-subsample bootstrapping, the coefficient of determination (R^2), and effect sizes (f^2) categorised as small (0.02), medium (0.15), or large (0.35) following Cohen's conventions as applied in Hair et al. (2021).

4 Findings

4.1 Measurement Model Results

All retained indicators demonstrated factor loadings above the 0.70 threshold, with the majority exceeding 0.80, indicating strong convergent validity at the indicator level. AVE values exceeded the 0.50 criterion for all three constructs: Academic Supervision ($AVE = 0.742$), GTK Platform Use ($AVE = 0.772$), and Teacher Competence ($AVE = 0.686$), confirming that each construct captures a majority of its indicators' variance.

Outer Model Test Results

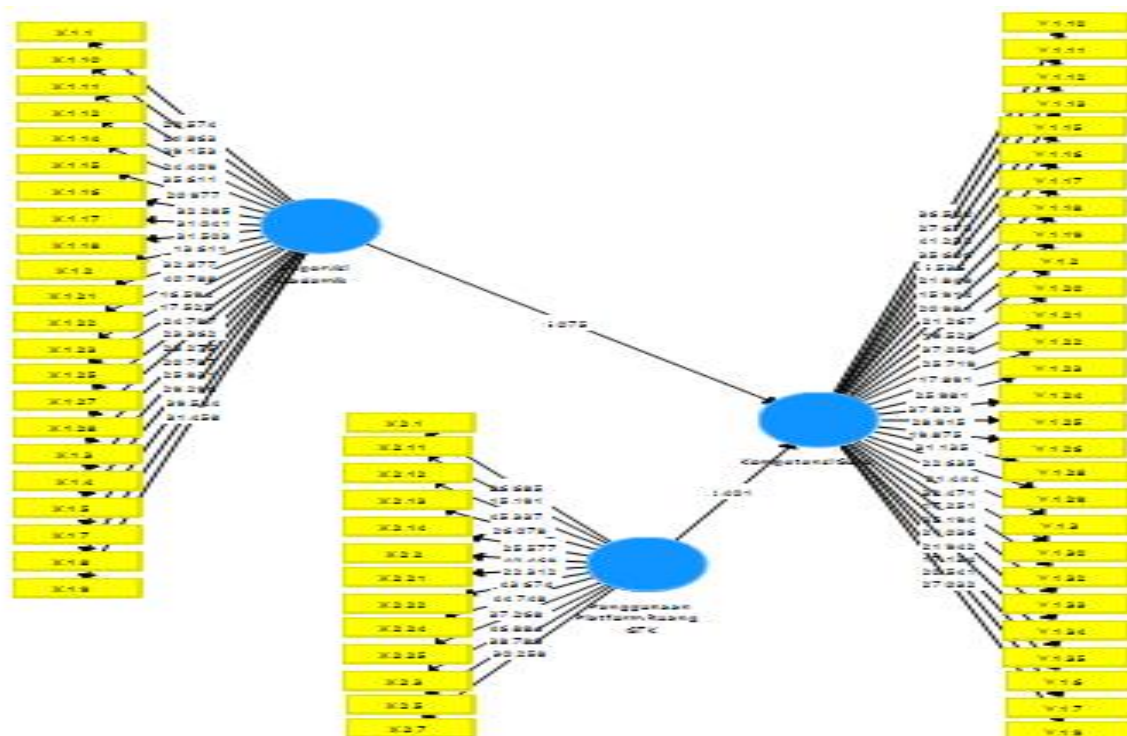


Figure 1 Outer Loading Results

Validity Test

Based on the results of discriminant validity testing through cross-loading values, all indicators in each construct have the highest loading value in the construct being measured compared to other constructs. This shows that each indicator is able to clearly distinguish constructs and does not overlap in measurement.

The indicators in the Academic Supervision, Use of the GTK Platform, and Teacher Competence constructs were each proven to more strongly reflect their own construct compared to other constructs. Thus, it can be concluded that all indicators have met the criteria for discriminant validity, so that the measurement model (outer model) is declared valid and feasible to proceed to the next stage of analysis. Table 2 Outer Loading Results of Convergent Validity Test

Table 2 Outer Loading Results of Convergent Validity Test

	Academic Supervision	Use of the GTK Room Platform	Teacher Competency	Description
X.1.1	0,824	0,653	0,718	Valid
X.1.10	0,841	0,781	0,765	Valid
X.1.11	0,900	0,774	0,800	Valid
X.1.12	0,864	0,717	0,769	Valid
X.1.14	0,881	0,717	0,750	Valid
X.1.15	0,849	0,746	0,756	Valid
X.1.16	0,882	0,808	0,790	Valid
X.1.17	0,855	0,782	0,759	Valid
X.1.18	0,875	0,777	0,805	Valid
X.1.2	0,784	0,694	0,713	Valid
X.1.21	0,884	0,810	0,788	Valid
X.1.22	0,909	0,800	0,828	Valid

	Academic Supervision	Use of the GTK Room Platform	Teacher Competency	Description
X.1.23	0,820	0,829	0,730	Valid
X.1.25	0,828	0,798	0,767	Valid
X.1.27	0,865	0,788	0,786	Valid
X.1.28	0,853	0,776	0,775	Valid
X.1.3	0,873	0,756	0,795	Valid
X.1.4	0,843	0,751	0,771	Valid
X.1.5	0,857	0,731	0,780	Valid
X.1.7	0,865	0,698	0,736	Valid
X.1.8	0,902	0,797	0,792	Valid
X.1.9	0,883	0,768	0,785	Valid
X.2.1	0,805	0,874	0,762	Valid
X.2.11	0,714	0,745	0,696	Valid
X.2.12	0,803	0,912	0,780	Valid
X.2.13	0,813	0,895	0,750	Valid
X.2.14	0,724	0,866	0,664	Valid
X.2.2	0,804	0,900	0,741	Valid
X.2.21	0,701	0,854	0,719	Valid
X.2.22	0,742	0,899	0,733	Valid
X.2.24	0,795	0,897	0,757	Valid
X.2.25	0,829	0,892	0,814	Valid
X.2.3	0,814	0,918	0,771	Valid
X.2.5	0,769	0,886	0,737	Valid
X.2.7	0,773	0,874	0,743	Valid
Y.1.10	0,784	0,721	0,881	Valid
Y.1.11	0,779	0,734	0,847	Valid
Y.1.12	0,830	0,784	0,892	Valid
Y.1.13	0,784	0,774	0,874	Valid
Y.1.15	0,619	0,588	0,708	Valid
Y.1.16	0,761	0,744	0,831	Valid
Y.1.17	0,638	0,574	0,785	Valid
Y.1.18	0,653	0,712	0,789	Valid
Y.1.19	0,676	0,715	0,776	Valid
Y.1.2	0,816	0,768	0,784	Valid
Y.1.20	0,717	0,667	0,877	Valid
Y.1.21	0,739	0,717	0,843	Valid
Y.1.22	0,683	0,693	0,819	Valid
Y.1.23	0,767	0,762	0,843	Valid
Y.1.24	0,774	0,684	0,885	Valid
Y.1.25	0,696	0,641	0,843	Valid
Y.1.26	0,686	0,613	0,807	Valid
Y.1.28	0,706	0,602	0,843	Valid
Y.1.29	0,703	0,622	0,832	Valid
Y.1.3	0,803	0,823	0,786	Valid
Y.1.30	0,747	0,717	0,868	Valid
Y.1.32	0,710	0,638	0,833	Valid
Y.1.33	0,786	0,715	0,881	Valid

	Academic Supervision	Use of the GTK Room Platform	Teacher Competency	Description
Y.1.34	0,769	0,747	0,824	Valid
Y.1.35	0,713	0,717	0,784	Valid
Y.1.6	0,755	0,703	0,761	Valid
Y.1.7	0,768	0,684	0,815	Valid
Y.1.9	0,805	0,697	0,840	Valid

The output of the Average Variance Extracted (AVE) estimation can be seen in the third table. A variable is considered valid if it has an Average Variance Extracted (AVE) value >0.5 . The following is a table of AVE values.

Table 3 Results of AVE Convergence Validity

	Average variance extracted (AVE)	Description
Academic Supervision	0,742	Valid
GTK Platform Usage	0,772	Valid
Teacher Competency	0,686	Valid

The AVE values for each variable are academic supervision 0.742; use of the Ruang GTK platform 0.772; and teacher competence 0.686. These three variables have values > 0.50 , which means that all three variables are categorised as valid.

Table 4 Discriminant Validity Test Results Based on Fornell Larcker

	Academic Supervision	GTK Platform Usage	Teacher Competency
SA	0,861		
RGTK	0,885	0,879	
KG	0,896	0,848	0,828

Discriminant validity testing in this study was conducted using the Fornell–Larcker criteria by comparing the square root of the Average Variance Extracted ($\sqrt{\text{AVE}}$) value of each construct with the correlation between constructs. The results of the analysis show that the $\sqrt{\text{AVE}}$ values for the Teacher Competence, Use of the GTK Platform, and Academic Supervision constructs are at an adequate level, so that each construct is able to explain the variance of its constituent indicators well.

However, the correlations between constructs show a fairly strong relationship, which is understandable because the three variables are conceptually related in the context of teacher professional development. Therefore, the evaluation of discriminant validity did not rely only on the Fornell–Larcker criteria, but was also reinforced through cross-loading testing. The results of this testing confirmed that the measurement model met the feasibility criteria and could proceed to the structural model analysis stage.

Reliability Test

The reliability test results, as shown in Table 5, indicate that Cronbach's alpha values for the academic supervision construct reached 0.983, GTK Platform usage reached 0.975, and teacher competency reached 0.983. According to established guidelines, Cronbach's alpha exceeding the minimum threshold of 0.70 indicate that all constructs in this study possess a very good level of internal consistency, and can therefore be considered reliable for further analysis.

Table 5 Cronbach's alpha values

	Cronbach's alpha	Description
Academic Supervision	0,983	Reliable
GTK Platform Usage	0,975	Reliable
Teacher Competency	0,983	Reliable

Based on the analysis results presented in Table 6, the Composite Reliability value for the academic supervision construct was recorded at 0.984, the use of the GTK Platform at 0.978, and teacher competence at 0.984. These values are above the minimum threshold of 0.70, as recommended in the literature, so it can be concluded that each construct in this study has a very good level of reliability and is suitable for further analysis.

Table 6 Composite reliability

	Composite reliability	Description
Academic Supervision	0.984	Reliable
GTK Platform Usage	0.978	Reliable

R-square (Coefficient of Determination)

The test results show an R-square value of 0.817 and an adjusted R-square of 0.814. This indicates that academic supervision and the simultaneous use of the Ruang GTK platform can largely explain teacher competence, while a small portion is influenced by factors outside the research model.

Table 7 R-square Results

	R-square	R-square adjusted
Teacher Competency	0.817	0.814

The relatively minor difference between the R-square and adjusted R-square values indicates that the model has been constructed proportionally and has a good level of accuracy. Referring to Hair et al.'s (2021) criteria, the R-square value falls into the strong category, so it can be concluded that the structural model has a high predictive ability in explaining variations in teacher competence.

Hypothesis Testing

Hypothesis testing through 5,000-subsample bootstrapping yielded the following results. Academic supervision demonstrated a large, statistically significant effect on teacher competence ($\beta = 0.671$, $T = 6.074$, $p < .001$, $f^2 = 0.533$). GTK Platform Use produced a smaller but statistically significant effect ($T = 2.402$, $p = .016$, $f^2 = 0.077$). Effect size $f^2 = 0.533$ for academic supervision classifies as large (> 0.35), while $f^2 = 0.077$ for GTK platform use classifies as small (between 0.02 and 0.15), following Cohen's conventions.

Table 8 Hypothesis Testing Results (Bootstrapping, 5,000 Subsamples)

Path	β	T-Stat	p-value	f^2	Decision
Academic Supervision → Teacher Competence	0.671	6.074	< .001	0.533 (Large)	H1 Supported
GTK Platform Use → Teacher Competence	—*	2.402	.016	0.077 (Small)	H2 Supported

5 Discussion

5.1 The Dominant Role of Academic Supervision

The finding that academic supervision exerts a large, statistically dominant effect on teacher competence ($\beta = 0.671$, $f^2 = 0.533$) is theoretically consistent with, but empirically more precise than, prior scholarship. Prastania and Sanoto (2021) and Asbari et al. (2019) both documented positive supervision–competence relationships in Indonesian elementary school contexts, but did not employ PLS-SEM's capacity to estimate effect sizes alongside path significance. The large f^2 value obtained in this study extends these findings by demonstrating that academic supervision is not merely significant but substantively powerful, a distinction with important practical implications for where principals should invest their managerial time and energy.

The magnitude of this effect is consistent with Glickman et al.'s (2001) and Johannesson's (2022) theoretical prediction that developmental supervision, when implemented as a complete clinical cycle from pre-observation planning through post-observation coaching, produces qualitatively different professional growth outcomes than a supervisory practice that is primarily evaluative. In Tayu District, the supervision practices reported by teachers were characterised by their clinical completeness and follow-through orientation, suggesting that the strong effect observed may partly reflect a locally strong implementation quality rather than a universal property of any supervisory activity. This contextual interpretation aligns with Tampubolon's (2020) observation that corrective, observation-anchored supervision generates more substantial competence improvements than administrative walk-throughs.

It is also analytically significant that the effect of supervision spans all four competency domains, pedagogical, professional, personality, and social, rather than being confined to instructional technique. This breadth is consistent with the developmental supervision model's holistic conception of professional growth, which encompasses professional identity, interpersonal capacity, and reflective disposition alongside technical pedagogical skills. The four-domain operationalisation of teacher competence in this study, grounded in Permendiknas No. 16/2007 and Révai and Guerriero's (2017) OECD frameworks, thus captures a richer developmental surface than studies that operationalise competence solely through professional or pedagogical indicators.

5.2 The Modest but Meaningful Role of Digital Platform Adoption

The Ruang GTK platform's statistically significant but small effect ($f^2 = 0.077$) requires careful theoretical interpretation rather than dismissal. Within the TAM framework (Davis, 1989), effect magnitude is theorised to be moderated by perceptions of usefulness and ease of use: when users perceive a system as genuinely useful and accessible, adoption intensity increases and learning outcomes strengthen. The small effect size observed in this study is consistent with Amin's (2025) observation that GTK platform uptake in rural contexts lags behind urban engagement, suggesting that the platform's potential may not yet be fully actualised in Tayu District due to facilitating condition barriers, unreliable internet connectivity, limited device access, and insufficient time for self-directed exploration, which compress realised usefulness below potential usefulness.

Galimov et al. (2024) similarly found that digital professional development platforms generated smaller effects in infrastructure-constrained settings, but that these effects were not trivial: even modest levels of platform engagement were associated with measurable professional learning gains, particularly in access to new pedagogical knowledge and peer network participation. The present finding is analogous: the small but significant $f^2 = 0.077$ suggests that Ruang GTK is beginning to register as a meaningful professional development resource for Tayu District teachers, but that substantial barriers constrain its full impact.

The theoretical implication is that the platform's effect size may be conditionally suppressed by the absence of supervisory integration. If principals do not explicitly reference GTK platform content in their observational feedback and coaching cycles, teachers have limited extrinsic motivation to engage with the platform between supervisory interactions. This suppression hypothesis explains not only the small f^2 but also the large difference in effect magnitudes between the two predictors. It is not that digital platforms are inherently less powerful than supervision; it is that platform effectiveness is partly contingent on the managerial scaffolding that connects digital learning to classroom practice.

5.3 The Combined Model and the Hybrid Professional Development Framework

The combined model's R^2 of 0.817 is particularly noteworthy. In educational survey research, R^2 values above 0.67 are classified as strong by Hair et al. (2021), and values above 0.80 are exceptional. The explanation of 81.7% of variance in teacher competence by two predictors: one managerial and one technological, provides strong empirical support for the Hybrid Professional Development model's central claim that these mechanisms jointly account for the large majority of teacher competence variance in this context.

This finding has theoretical implications beyond the Indonesian context. The model aligns with a growing body of international evidence suggesting that effective teacher professional development requires the integration of school-level organisational support (equivalent to the supervision mechanism) with teacher-owned, technology-mediated learning (equivalent to the digital platform mechanism). Neither mechanism alone is sufficient for maximal competence development; their combination generates a synergistic effect, as evidenced by the R^2 value of 0.817.

It is important to note, however, that the current study's design, cross-sectional and correlational, does not permit causal inference. The structural relationships observed are consistent with the Hybrid Professional Development model's predictions, but longitudinal and experimental evidence would be required to establish the causal architecture of the model with confidence.

6 Conclusions

This study provides the first PLS-SEM-based empirical test of academic supervision and digital platform adoption as simultaneous predictors of four-domain teacher competence in Indonesian elementary education. The central empirical finding, that academic supervision exerts a large, dominant effect ($f^2 = 0.533$) while Ruang GTK platform use exerts a small but significant effect ($f^2 = 0.077$), and that together they explain 81.7% of teacher competence variance, carries both theoretical and practical significance.

Theoretically, the findings support the Hybrid Professional Development model's core proposition that managerial oversight and digital empowerment function as complementary mechanisms in teacher competence development: supervision provides the relational, structured developmental scaffolding that platforms alone cannot replicate, while platforms extend professional learning capacity beyond the boundaries of supervisory interactions. The large effect size differential between mechanisms does not indicate that digital platforms are ineffective; rather, it suggests that their effectiveness is contingent on managerial integration, which appears to be absent or insufficient in the rural Indonesian elementary school context examined in this study.

Practically, this study directs the most productive investment of professional development resources toward the quality of principals' clinical supervision practice, and argues that Ruang GTK platform uptake will generate stronger competence returns when deliberately embedded in supervisory feedback cycles rather than operated as a standalone, teacher-autonomous resource. For educational policymakers in Indonesia and comparable developing-country contexts, the study's message is clear: digital infrastructure and teacher professional development platforms are necessary but not sufficient conditions for competence improvement. The managerial variable, how school principals lead, structure, and sustain teacher professional development through academically grounded supervision, remains the primary determinant of whether digital resources translate into meaningful classroom practice change.

Implications

Theoretical Implications

This study makes three theoretical contributions. First, it provides the first empirically estimated, effect-size-differentiated model of academic supervision and digital platform adoption as simultaneous predictors of the full four-domain teacher competence construct in Indonesian elementary education. The large effect size differential ($f^2 = 0.533$ vs. 0.077) challenges policy assumptions that treat digital platforms and supervisory practice as equivalent levers for competence improvement and provides a quantitative basis for theoretical differentiation between managerial and technological mechanisms. Second, the Hybrid Professional Development model advances theory by proposing a complementarity architecture, rather than a substitution or competition architecture, for understanding supervision–technology interactions between teacher development systems. Third, the study extends the application

of TAM and UTAUT to rural developing-country elementary education contexts, identifying infrastructure and supervisory integration as moderating conditions undertheorised in the existing TAM/UTAUT literature.

Practical Implications

For school principals in Tayu District and comparable rural Indonesian settings, the study's findings argue strongly for investment in the quality of supervisory practice rather than expansion of its administrative coverage. The clinical completeness of the supervisory cycle, pre-observation planning, structured observation, evidence-based feedback, and follow-up coaching appears to drive the large competence effect observed, suggesting that sporadic or primarily administrative supervision cannot generate equivalent developmental impact. Principals should be equipped with supervisory competencies aligned with Johannesson's (2022) developmental model through targeted in-service training programmes.

For GTK platform integration, the practical implication is that platform uptake cannot be driven by access provision alone; it requires deliberate supervisory scaffolding. Principals should explicitly reference GTK platform content in post-observation coaching conversations, assign teachers platform-based learning tasks aligned with their developmental feedback, and monitor platform engagement as a component of the professional development cycle. This integration strategy, operationalising the Hybrid Professional Development model at the school level, is theoretically predicted and empirically motivated by the current study's finding that supervisory quality dominates competence prediction.

Policy Implications

At the district and provincial policy levels, the findings suggest two priority investments. First, principal professional development programmes should prioritise clinical supervision capacity, not merely supervisory frequency or documentation compliance. The impact differential observed in this study, namely a large effect for supervision and a small effect for platform use, implies that the marginal return on investment in principal supervisory quality exceeds the marginal return on digital infrastructure expansion alone. Second, the Ruang GTK platform's policy infrastructure should include explicit guidance for integrating platform content into school-level supervisory cycles, rather than positioning the platform solely as a teacher-autonomous resource. Regional education authorities (*dinas pendidikan*) and the Ministry of Education should develop implementation guides that operationalise the Hybrid Professional Development model, specifying how supervisory interactions can systematically draw on GTK platform content to create a reinforcing professional development loop.

Limitation

This study is geographically bounded to Tayu District, Pati Regency, limiting the direct transferability of its quantitative findings to other country contexts. The district's sociocultural profile, rural, predominantly public-school, with specific infrastructure constraints, may generate competence dynamics that differ from urban, private, or more digitally resourced settings. Also, reliance on self-reported data collected via Likert-scale questionnaires introduces the possibility of common method bias, a known limitation in survey-based PLS-SEM research. Procedural remedies, including the separation of predictor and criterion measurement across questionnaire sections, were implemented; however, Harman's single-factor test or confirmatory factor analysis for common method variance was not reported in the original study and should be conducted in future replications.

Future Research Directions

Four research directions emerge from the current study's findings and limitations. First, longitudinal panel studies tracking the same teachers across multiple supervisory and platform engagement cycles would enable researchers to assess whether the effect size differential observed cross-sectionally is stable over time, or whether platform effects strengthen as digital literacy accumulates and facilitating conditions improve. Second, comparative multi-district studies contrasting rural and urban contexts would empirically test the suppression hypothesis advanced in the discussion section: specifically, whether supervisory integration of GTK platform content moderates the platform's

effect on competence in ways that increase its f^2 above the small-effect range. Third, intervention studies, in which principals are trained in clinical supervision models and explicitly coached to integrate GTK content into supervisory feedback cycles, would provide causal evidence for the Hybrid Professional Development model's integration hypothesis. Fourth, qualitative research examining how teachers experience the interplay between supervisory feedback and platform engagement would complement the current study's quantitative findings with mechanistic process evidence, clarifying why and how supervisory scaffolding conditions the platform's professional development impact.

Conflict of Interest

The authors declare that there is no conflict of interest.

Acknowledgement

The authors express their sincere appreciation to the reviewers and the Editorial Board of the *Elicit Journal of Education Studies (EJES)* for their thoughtful evaluation, constructive suggestions, and professional guidance, which significantly enhanced the quality of this manuscript.

Declaration of Use of Generative AI

The author declares that generative AI tools were used only for language editing, clarity, and structural refinement. They were not used otherwise. Therefore, the authors take full responsibility for the accuracy, originality, and integrity of the manuscript.

Funding

This research received no funding.

References

- Aji, R. H. S. (2021). Role Model Implementasi Kurikulum Merdeka Belajar Kampus Merdeka Pada Program Studi Non-Agama. <https://doi.org/10.15408/sjsbs.v8i6.23821>
- Alfaruqi, A. Z., & Nurwahidah, N. (2025). Reflection on Indonesia's PISA scores and the 2024 madrasah teacher competency assessment results: challenges in enhancing teacher competence. *Jurnal Pendidikan IPS*, 15(1), 11-19. <https://doi.org/10.37630/jpi.v15i1.2559>
- Amin, A. A., Yusuf, F., & Pada, A. (2025). Pengaruh Pemanfaatan Platform Ruang GTK (Guru dan Tenaga Kependidikan) Terhadap Kompetensi Profesional Guru Sekolah Dasar di Kecamatan Ujung Tanah, Kota Makassar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 10(01), 321-337. <https://doi.org/10.58230/27454312.3778>
- Asbari, M., Wijayanti, L. M., Hyun, C. C., Purwanto, A., & Santoso, P. B. (2019). Effect of Tacit and Explicit Knowledge Sharing on Teacher Innovation Capability. *Dinamika Pendidikan*, 14(2), 227-243. <https://doi.org/10.15294/dp.v14i2.22732>
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications. <https://doi.org/10.4135/9781529629866>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. <https://doi.org/10.2307/249008>
- Galimov, A., Sheymardanov, S., Nasibullov, R., & Yarullin, I. (2023, February). Digital platform for teachers' professional development. In *International Congress on Information and Communication Technology* (pp. 883-890). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-99-3043-2_73
- Glickman, C. D., Gordon, S. P., & Ross-Gordon, J. M. (2001). *Supervision and instructional leadership: A developmental approach*. Allyn & Bacon/Longman Publishing, a Pearson Education Company, 1760 Gould Street, Needham Heights, MA 02494. Website: <http://www.abacon.com>.

- Hair Jr, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). An introduction to structural equation modeling. In *Partial least squares structural equation modeling (PLS-SEM) using R: a workbook* (pp. 1-29). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-80519-7_1
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, 43(1), 115-135. <https://doi.org/10.1007/s11747-014-0403-8>
- Johannesson, P. (2022). Development of professional learning communities through action research: Understanding professional learning in practice. *Educational Action Research*, 30(3), 411-426. <https://doi.org/10.1080/09650792.2020.1854100>
- Lorensius, L., Anggal, N., & Lugan, S. (2022). Academic supervision in the improvement of teachers' professional competencies: Effective practices on the emergence. *EduLine: Journal of Education and Learning Innovation*, 2(2), 99-107. <https://doi.org/10.35877/454ri.eduline805>
- Muttaqin, I., Tursina, N., Sudrajat, A., Yuliza, U., Novianto, N., Ramadhan, F. F., & Kurnanto, M. E. (2023). The effect of academic supervision, managerial competence, and teacher empowerment on teacher performance: the mediating role of teacher commitment. *F1000Research*, 12, 743. <https://doi.org/10.12688/f1000research.128502.2>
- OECD. (2024). *Transforming education in Indonesia: Examining the landscape of current reforms (OECD Education Policy Perspectives, No. 88)*. OECD Publishing.
- Prastania, M. S., & Sanoto, H. (2021). Korelasi antara supervisi akademik dengan kompetensi profesional guru di sekolah dasar. *Jurnal Basicedu*, 5(2), 861-868. <https://doi.org/10.31004/basicedu.v5i2.834>
- Rasdiana, Wiyono, B. B., Imron, A., Rahma, L., Arifah, N., Azhari, R., ... & Maharmawan, M. A. (2024). Elevating teachers' professional digital competence: synergies of principals' instructional e-supervision, technology leadership and digital culture for educational excellence in digital-savvy era. *Education Sciences*, 14(3), 266. <https://doi.org/10.3390/educsci14030266>
- Révai, N., & Guerriero, S. (2017). Knowledge dynamics in the teaching profession. *Pedagogical knowledge and the changing nature of the teaching profession*, 37-71. <https://doi.org/10.1787/9789264270695-en>
- Sergiovanni, T. J. (1987). *The principalship: A reflective practice perspective*. Publication Sales, Allyn and Bacon, Longwood Division, 7 Wells Avenue, Newton, MA 02159 (Order No. H88511; \$34.95).
- Shintawati, S., Hanafi, M. S., & Hendrayana, A. (2025). The Effect of Principal Academic Supervision, Teacher Competence, and Work Environment on Elementary School Teacher Productivity. *Jurnal Pendidikan Indonesia Gemilang*, 5(2), 115-125. <https://doi.org/10.53889/jpig.v5i2.675>
- Sulandra, I. W., Masaong, A. K., & Marhawati, B. (2023). Supervisi Akademik Dalam Penguatan Budaya Mutu Di Sekolah Dasar Negeri. *Innovative: Journal Of Social Science Research*, 3(2), 7134-7145. <https://j-innovative.org/index.php/Innovative/article/view/1190>
- Sunaryo, Y. (2020). Academic supervision of school principals and teacher performance: A literature review. *International Journal Pedagogy of Social Studies*, 5(2), 17-34.
- Tampubolon, J. (2020). Supervisi korektif untuk menemukan kekurangan-kekurangan guru kelas dalam melaksanakan pembelajaran di SD Negeri 173105 Tarutung. *Attractive: Innovative Education Journal*, 2(2), 133-140. <https://doi.org/10.51278/aj.v2i2.55>
- UNESCO. (2023). *Global Education Monitoring Report 2023: Technology in education: A tool on whose terms?* UNESCO Publishing. https://www.unesco.at/fileadmin/Redaktion/Bildung/2023GEM-Report_Tech_in_Ed_long.pdf