

Digital Leadership and Teacher Professionalism in Islamic Schools: A Mediation Model of Student Digital Literacy

Rika Ariyani^{1*}, Nasril², Al Munip³, Miftah Hur Rahman Zh⁴, Maspan⁵, Darni⁶, Zahid Zufar At Thaariq⁷

¹Universitas Islam Mamba'ul Ulum, Jambi, Jambi, Indonesia

^{2,5,6}Universitas Syekh Maulana Qori Bangko, Merangin Regency, Jambi, Indonesia

³Institut Islam Al-Mujaddid Sabak, Tanjung Jabung Timur Regency, Jambi, Indonesia

⁴Universitas Darunnajah, South Jakarta, Jakarta, Indonesia

⁷Çukurova University, Sarıçam, Adana, Türkiye

*Corresponding author, Surel: rikaariyani857@gmail.com

Paper submitted: 8-March-2026; revised: 21-April-2026; accepted: 10-June-2026

Abstract

Global digital transformation has pushed Islamic schools to align religious values with modern competencies, which places a growing demand on digital leadership and ICT resource management. This study tested an integrative model of the direct and indirect effects of principals' digital leadership and ICT resource management on teacher professionalism and student digital literacy in Islamic schools. A quantitative cross-sectional survey was conducted among 377 full-time teachers from 25 private Islamic senior high schools (madrasah aliyah) across six provinces in Indonesia; 25 school principals were involved at the institutional consent stage but were not surveyed as respondents to avoid common-source bias. An 18-item instrument measuring four constructs on a five-point Likert scale was adapted from established frameworks and validated through expert review ($n = 3$) and a pilot test ($n = 30$). Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3. Digital leadership had a strong direct effect on ICT resource management ($\beta = 0.99$) and on teacher professionalism ($\beta = 0.99$). Teacher professionalism ($\beta = 0.54$) was a stronger direct predictor of student digital literacy than ICT resource management ($\beta = 0.46$) and served as a significant mediator. The study contributes a Value-Integrated Digital Leadership (VIDL) framework for faith-based schooling and argues that the effectiveness of digital leadership is bounded by its integration with Islamic values. Limitations include the cross-sectional single-country design and reliance on teacher self-report, which future longitudinal and multi-informant studies should address.

Keywords: digital leadership; teacher professionalism; ICT resource management; student digital literacy; Islamic schools

1. Introduction

Global digital transformation has reshaped educational practice and made technology integration a key determinant of institutional quality and student

preparedness for the twenty-first century (Kurniasih et al., 2025; Kuswandi et al., 2025; Zh et al., 2026). School leadership and the strategic management of Information and Communication Technology (ICT) resources now sit at the centre of this change (Ghavifekr & Wong, 2022; Schmitz et al., 2023). This is particularly relevant for Islamic schools, which carry a dual mandate to transmit religious values and to equip students with modern competencies (Sinaga et al., 2026). The phenomenon this study addresses is the relationship among four factors in that dual mandate: a principal's technology-driven leadership, ICT resource management, teacher professionalism, and student digital literacy.

Recent research has advanced the understanding of each of these factors separately. Digital leadership by principals has been linked to school improvement, in part through visionary support for ICT integration and through mechanisms such as Professional Learning Communities (AlAjmi, 2022; Rasdiana et al., 2024). Transformational leadership approaches have been shown to empower teachers and strengthen their beliefs and technical skills for more demanding pedagogical uses of technology (Schmitz et al., 2023). ICT resource management, including infrastructure, access, and support, has been established as a cornerstone of technology integration, with principals' leadership behaviours playing a critical role in building teacher ICT capacity (Thannimalai & Raman, 2018; Yang et al., 2025). Principals' digital leadership has also been associated with student ICT competence and digital citizenship, often through the mediation or moderation of teachers' professional competence (Xu et al., 2025).

Three gaps remain. First, few studies integrate both digital leadership and ICT resource management with the dual outcomes of teacher professionalism and student digital literacy in a single model; most examine isolated paths (Thannimalai & Raman, 2018; Xu et al., 2025). Second, most of this evidence comes from mainstream public or private settings in Western or generalized Asian contexts (AlAjmi, 2022; Schmitz et al., 2023). Islamic schools, which work at the intersection of Islamic values and digital pedagogy, remain underexamined, and it cannot be assumed that findings from general education apply without modification (Huda et al., 2021). Third, the position of teacher professionalism as a mediator between leadership or resources and student digital literacy, although implied in some studies (Xu et al., 2025), has not been tested empirically within the Islamic school context.

This study addressed these gaps by developing and testing an integrative model in Islamic schools. The aim was not to replicate earlier findings but to examine how digital leadership and ICT resource management work together in this specific setting to shape teacher professionalism and, through it, student digital literacy. Four hypotheses were tested: (1) a principal's digital leadership has a direct positive effect on teacher professionalism and on student digital

literacy; (2) ICT resource management has a direct positive effect on teacher professionalism and on student digital literacy; (3) teacher professionalism mediates the effects of digital leadership and ICT resource management on student digital literacy; and (4) the Islamic school context shapes these relationships.

The contribution of this study is twofold. Theoretically, it offers a Value-Integrated Digital Leadership (VIDL) framework for faith-based education by showing that the effectiveness of digital leadership in Islamic schools is not values-neutral. Practically, it identifies teacher professionalism rather than the mere availability of ICT resources as the stronger lever for student digital literacy, which has direct implications for how Islamic schools allocate investment between infrastructure and teacher development. The study is limited by its cross-sectional single-country design and by its reliance on teacher self-report, and these limitations are discussed at the end of the paper.

The remainder of the article is organized as follows. The next section describes the research design, participants, instrument, and data analysis procedure. The results section presents the measurement and structural model findings. The discussion interprets the findings against the existing literature and develops the VIDL framework. The conclusion summarizes the contribution, acknowledges limitations, and suggests directions for future research.

2. Method

2.1 Research Design

This study used a quantitative, non-experimental cross-sectional survey design to test a hypothesized structural model. The model examined the direct and indirect effects of a principal's technology-driven leadership and the school's ICT resource management on teacher professionalism and, through it, on student digital literacy. The design sits within a positivist paradigm oriented to causal-predictive inference from empirical data. Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3 was chosen as the main analytical technique because it is well suited to exploratory theory development, does not require multivariate normality, and handles complex models with multiple latent variables and mediation paths in a single estimation (Hair et al., 2019, 2021).

2.2 Participant and Sampling

The target population consisted of full-time teachers in private Islamic secondary schools (*Madrasah Aliyah*, Islamic senior high schools) in Indonesia. A full-time teacher was defined as a teacher who held a permanent contract at a single madrasah, taught at least 24 teaching hours per week in line with Ministry

of Religious Affairs Regulation No. 2 of 2012, and had at least one academic year of service at the sampled school. Principals were not surveyed as respondents to avoid common-source bias on the key exogenous variable (leadership); they were involved only at the institutional consent stage, in which the principals of all 25 sampled schools ($N = 25$) signed the school participation agreement. Teachers served as the appropriate unit of analysis because they are the direct recipients of leadership and resource management and the primary facilitators of student digital literacy. Students were not surveyed directly; student digital literacy was assessed through teachers' perceptions of class-level behaviours, consistent with prior PLS-SEM studies on teacher-rated student outcomes (Xu et al., 2025).

A multistage sampling technique was employed. First, six provinces were selected purposively to reflect socioeconomic diversity using the Regional Development Index (Indeks Pembangunan Manusia, IPM) published by Statistics Indonesia (BPS): DKI Jakarta and East Java (high IPM), West Java and Central Java (medium-high IPM), and Jambi and South Sulawesi (medium IPM). These six provinces were selected to capture variation in infrastructure, teacher supply, and household income, three factors that prior studies have linked to ICT access and teacher professional development uptake (Ruiz & Muñoz, 2024). Socioeconomic diversity was relevant for the study because it is plausibly correlated with the independent variable (ICT resource management, through school budget and family contribution) and with the dependent variable (student digital literacy, through out-of-school access to devices and the internet), and its inclusion reduced the risk of confounding. Second, within these provinces, 25 private madrasah aliyah were selected on two criteria: accreditation of at least B (Good), and documented ICT infrastructure investment in the last five years. The minimum accreditation of B was set because B-accredited schools meet at least 71% of the National Education Standards, which ensures baseline pedagogical and managerial conditions for a meaningful test of the ICT resource management construct; including schools with C accreditation would have introduced cases in which basic governance, not leadership style, was the limiting factor. Third, 15 to 20 teachers were selected from each school through simple random sampling from the teacher roster, yielding a final sample of 377 complete responses, which exceeds the "10-times rule" minimum of 40 for PLS-SEM given that the largest construct has four predictors.

2.3 Data Instruments

All constructs were measured with reflective indicators on a five-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree. The scale was presented in both Bahasa Indonesia and English to

accommodate bilingual respondents. The complete instrument contained 18 items distributed across four constructs:

(a) Principal's Technology-Driven Leadership (4 items, DL1–DL4), adapted from Anderson & Dexter (2005) Technology Leadership scale and the Principal Technology Leadership Assessment (PTLA), with indicators covering visionary support, intellectual stimulation, individualized consideration, and digital ethics modelling. (b) ICT Resource Management (4 items, ICT1–ICT4), adapted from the UNESCO ICT Competency Framework for Teachers and Thannimalai and Raman (2018), with indicators on infrastructure adequacy, technical support, pedagogical support, and systematic planning. (c) Teacher Professionalism (5 items, TP1–TP5), adapted from the Teacher Professional Standards of the Indonesian Ministry of Education and Culture and Hair et al. (2019)'s operationalization of professional competence, with indicators on pedagogical ICT competence, engagement in digital professional learning communities, reflective practice, digital ethics integration, and continuous professional development. (d) Student Digital Literacy (5 items, SDL1–SDL5), adapted from the European DigComp 2.2 framework, measured through teacher perception, with indicators on information and data literacy, communication and collaboration, digital content creation, safety, and problem solving.

All items were adapted, not directly adopted, because wording was modified for the Islamic school context (for example, by adding references to *akhlāq* and digital *adab* in the teacher professionalism and digital literacy dimensions). The adaptation procedure followed three stages. First, a panel of three experts reviewed the item pool for content validity: an Islamic education leadership scholar, an educational technology researcher, and a psychometrician. The content validity index (CVI) was 0.93 at the item level and 0.96 at the scale level, which exceeds the 0.80 threshold recommended by Polit & Beck (2006). Second, a pilot test was conducted with 30 teachers from three *madrasah aliyah* that were not included in the main sample; pilot data showed Cronbach's α between 0.81 and 0.90 across the four constructs and no ambiguous items. Third, the final instrument was administered in the main study.

2.4 Data Collection and Ethical Procedures

Data were collected between March and May 2025 through an online, self-administered questionnaire deployed on Google Forms. The link was distributed through two official channels: the school principal's WhatsApp group of teachers, and the school's official email to the teacher coordinator, who then forwarded the link to eligible full-time teachers. The survey opened with a detailed information sheet and a consent form. The information sheet explained the research purpose, the voluntary nature of participation, the estimated

completion time (approximately 15 minutes), the right to withdraw at any time without penalty, the anonymity of responses, and the intended use of the data for academic publication only. The consent form required an active tick before respondents could access the items; responses without consent were excluded at the entry point. To reduce common-method bias, procedural remedies were applied, including the psychological separation of scale items across sections, the inclusion of three reverse-coded items, and an explicit statement that there were no right or wrong answers. Ethical clearance was obtained from the Research Ethics Committee of Universitas Islam Mamba'ul Ulum.

3. Findings

3.1 Respondent profile

Of the 410 teachers invited to participate, 392 opened the survey and 377 completed it in full and met the inclusion criteria, giving a response rate of 92.0%. Fifteen cases were removed during data screening because of straight-lining, missing attention-check items, or completion time below the 20th percentile, following Hair et al. (2019) guidance on response quality. In addition to the 377 teachers, 25 school principals signed the institutional consent at the school level, although they were not respondents. No students were surveyed directly; students were represented indirectly through teachers' perception of class-level digital literacy, with teachers reporting on their class cohorts averaging 28 to 32 students per class. Respondent characteristics are summarized in Table 1.

Table 1. Respondent profile (N = 377 teachers)

Profile	Classification	Count	%
Teaching experience	Less than 5 years	94	25.0
	5–10 years	113	30.0
	11–15 years	75	20.0
	More than 15 years	95	25.0
Sex	Female	221	58.6
	Male	156	41.4
Highest qualification	Bachelor (S1)	298	79.1
	Master (S2)	73	19.4
	Doctoral (S3)	6	1.5
Region (province)	DKI Jakarta	62	16.4
	West Java	68	18.0
	Central Java	63	16.7
	East Java	71	18.8
	Jambi	58	15.4
	South Sulawesi	55	14.6
Total		377	100.0

The sample was balanced across teaching experience, with the 5–10 year group the largest (30.0%) and the under-5 and over-15 year groups equally represented at 25.0% each. This distribution covers early-career, mid-career, and highly experienced teachers, which strengthens the representativeness of the data for perceptions of digital leadership, ICT resource management, teacher professionalism, and student digital literacy. The regional distribution across six provinces confirms that the multistage sampling procedure produced a cross-provincial dataset rather than a dataset concentrated in a single region.

3.2 Internal Consistency Reliability

Table 2. Internal consistency reliability

Variable	Cronbach's α	Status
Digital leadership	0.8669	Very good
ICT resource management	0.8764	Very good
Teacher professionalism	0.9213	Very good
Student digital literacy	0.9166	Very good

Cronbach's α for all four variables was between 0.87 and 0.92, above the 0.70 threshold and within the 0.80–0.95 range considered ideal in social science research (Trizano-Hermosilla & Alvarado, 2016). None of the values exceeded 0.95, which rules out the redundancy concern raised by Diamantopoulos et al., (2012). The items within each scale are therefore sufficiently intercorrelated to measure a common construct, and the instrument can be considered reliable for the subsequent PLS-SEM analysis.

3.3 Convergent Validity

Table 3. Convergent validity results

Variable	Indicator	Loading	CR	AVE
Digital leadership	DL1 / DL2 / DL3 / DL4	0.86 / 0.88 / 0.79 / 0.86	0.9095	0.7156
ICT resource management	ICT1 / ICT2 / ICT3 / ICT4	0.90 / 0.75 / 0.90 / 0.86	0.9160	0.7326
Teacher professionalism	TP1-TP5	0.95 / 0.89 / 0.80 / 0.84 / 0.89	0.9413	0.7629
Student digital literacy	SDL1-SDL5	0.90 / 0.77 / 0.84 / 0.92 / 0.90	0.9380	0.7523

All indicator outer loadings exceeded 0.70, all composite reliability (CR) values exceeded 0.90, and all AVE values exceeded 0.50 (Hair et al., 2019). These values indicate that the indicators consistently measure their respective constructs and that each construct explains more than half of the variance in its indicators. No indicator needed to be dropped because none fell in the 0.40–0.70 range where removal may improve composite reliability (Hair et al., 2019).

3.4 Discriminant Validity (Fornell–Larcker Criterion)

Table 4. Fornell–Larcker discriminant validity

Variable	1	2	3	4
1. Digital leadership	0.8459			
2. ICT resource management	0.9885	0.8559		
3. Teacher professionalism	0.9877	0.9913	0.8734	
4. Student digital literacy	0.9739	0.9912	0.9918	0.8673

The diagonal values (square roots of AVE) are greater than the off-diagonal inter-construct correlations on some paths but very close to them on others. This is a known limitation of the Fornell–Larcker criterion in models with highly correlated constructs (Henseler et al., 2015; Radomir & Moisescu, 2019). For that reason, discriminant validity was also assessed using the Heterotrait-Monotrait ratio (HTMT), which is considered more sensitive in such cases.

3.5 Discriminant Validity (HTMT Ratio)

Table 5. HTMT Discriminant Validity

Variable	1	2	3
1. Digital leadership	—		
2. ICT resource management	1.1342	—	
3. Teacher professionalism	1.1056	1.1033	—
4. Student digital literacy	1.0935	1.1056	1.0797

Some HTMT values exceeded the 0.90 threshold recommended by Henseler et al., (2015). This pattern suggests that the four constructs, although conceptually distinct, are empirically very close in the data. This is plausible because, in a faith-based institutional setting with strong top-down alignment, a principal's digital leadership, the school's ICT resource management, teacher professionalism, and student digital literacy tend to move together. The high HTMT values are therefore reported transparently and interpreted as a boundary condition of the study rather than as a fatal validity issue (Voorhees et al., 2016). Hypotheses were still tested, but with this caution in mind when interpreting effect sizes.

3.6 R-squared

Table 6. R-squared results

Dependent variable	R ²	Adjusted R ²	Status
ICT resource management	0.9770	0.9770	Substantial
Teacher professionalism	0.9755	0.9755	Substantial
Student digital literacy	0.9874	0.9873	Substantial

The R² values for ICT resource management (0.977), teacher professionalism (0.976), and student digital literacy (0.987) fall in the substantial category under Chin's (2010) classification. Adjusted R² values are

nearly identical to R^2 , which indicates that the model is not overfitted despite the number of predictors (Hair et al., 2017). Nearly 98.7% of the variance in student digital literacy is accounted for by the predictors in the model.

3.7 Hypothesis Testing

This study used SEMinR to test the structural model. A bootstrapping procedure with 1,000 iterations was used to test the influence of constructs. The following are the results of the PLS-SEM analysis:

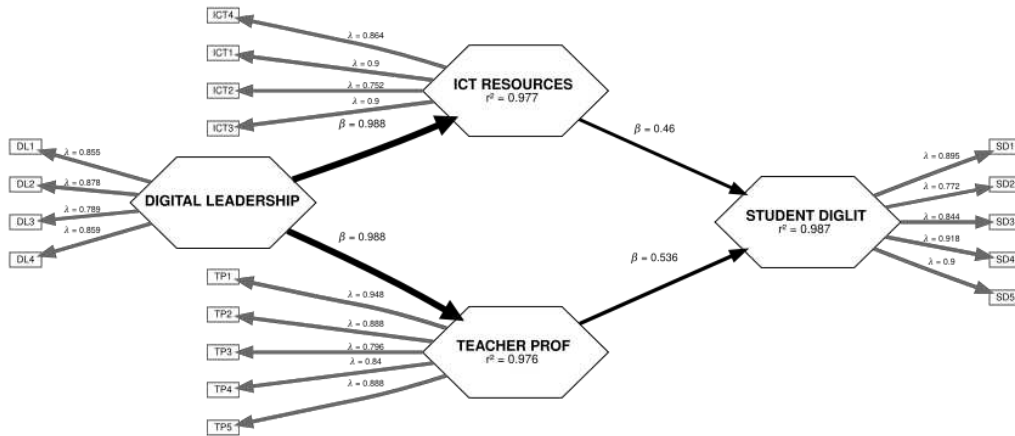


Figure 1. Hypothesis Testing

The next step is to test the strength of the established relationship. This testing is conducted by examining the t-test statistic or p-value from the hypothesis test results. The complete results of the hypothesis testing can be seen in the following table:

Table 7. Hypothesis Testing Results

Hipotesis	Original Sample	Standard Deviation	T-Test	Status
Digital Leadership → Ict Resources	0.9885	0.0012	836.7183	Sign.
Digital Leadership → Teacher Prof	0.9877	0.0008	1230.4571	Sign.
Ict Resources → Student Diglit	0.4601	0.0358	12.8494	Sign.
Teacher Prof → Student Diglit	0.5357	0.0360	14.8866	Sign.

4. Discussion

The four hypotheses were supported. Digital leadership had a direct effect of $\beta = 0.99$ on both ICT resource management and teacher professionalism, and teacher professionalism was a stronger predictor of student digital literacy ($\beta = 0.54$) than ICT resource management ($\beta = 0.46$). Three interpretive points

follow, organized around the nexus between leadership and outcomes, the weight of teacher professionalism relative to resource availability, and the theoretical framework that best accounts for these patterns.

4.1 Digital leadership, ICT management, and educational outcomes

The finding that digital leadership is strongly associated with ICT management and teacher professionalism is consistent with contemporary literature on digital leadership as a driver of technological transformation through strategic vision and a culture of innovation (Akhmad, 2025; Ayasrah et al., 2025; Baldera et al., 2025). The magnitude of the coefficient observed here ($\beta \approx 0.99$) is larger than the effects reported in secular or general educational settings, which points to a context-specific amplification in Islamic schools. A plausible reading is that, in value-centric institutions, the principal's leadership acts not only as an administrative function but as a unifying moral voice that aligns teachers and resources around a shared purpose (Huda et al., 2021; Supriyanto et al., 2020; Yuting et al., 2022).

The observation that digital leadership is associated with teacher professionalism challenges a view of professional development as a discrete training input separate from daily leadership (Asante & Novak, 2024). In the present data, principals' digital leadership appears to act as a continuous motivational and modelling force for teachers' ICT pedagogical practice (Liao & Ismail, 2025; Xu et al., 2025), which is consistent with prior findings that leadership has a meaningful impact on teacher learning and self-efficacy (Thoonen et al., 2019). In the Islamic school context, this influence has a specific character: principals support teachers as they reconcile digital pedagogies with traditional Islamic methods, a task that requires institutional backing as well as personal commitment (Çetinkaya & Sürücü, 2025).

The relationship is not without friction. Infrastructural limitations, resistance to change, the cost of continuous professional development, and the digital divide are recurrent challenges in the literature (Akhmad, 2025; Danganan & Gamboa, 2025; Okunlola & Naicker, 2025; Ruiz & Muñoz, 2024). These conditions bound the generalizability of the present findings, particularly to less resourced schools. The finding that digital leadership is necessary but not sufficient on its own, and that it must be coupled with investment in infrastructure and equitable access, is consistent with this broader literature.

4.2. Teacher Professionalism as the Stronger Lever

Teacher professionalism was a stronger direct predictor of student digital literacy than ICT resource management. This finding requires a shift away from a purely resource-centric interpretation of technology integration in schools. It is consistent with Sailin & Mahmor (2018) argument that the quality of integration matters more than the mere presence of tools. Resources set the floor;

professional teachers set the ceiling. Professionalism here is not a single trait but a composite construct built through continuous professional development, reflective practice, pedagogical autonomy, and programmes such as Teacher Professional Education (PPG), which Indonesian studies have identified as central to teacher ICT competence (Karaiskos et al., 2024; Loeneto et al., 2022; Purwantiningsih & Suharso, 2019).

4.3 Towards a Value-Integrated Digital Leadership (VIDL) framework

Established frameworks such as the Technology Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK) provide a useful vocabulary for technology integration but operate largely as values-neutral models (Sposato, 2024). The present findings point to a limitation of that neutrality in faith-based contexts and motivate a Value-Integrated Digital Leadership (VIDL) framework. Under VIDL, the effectiveness of digital leadership in value-centric institutions depends on the conscious integration of the institution's core religious and ethical commitments. This integration amplifies the impact of leadership on the orchestration of resources and on teachers' professional identity, which in turn enables teachers to translate the vision into pedagogy that cultivates value-aware digital literacy in students.

The VIDL framework is consistent with work on spiritual leadership in organizational management (Fry & Nisiewicz, 2013) and with digital leadership research that foregrounds ethics, value-based vision, and stakeholder legitimacy in public and educational settings (Branderhorst & Ruijter, 2025; Suresh Babu et al., 2025). It also aligns with Kollenschner et al. (2018) integration of micro, meso, and macro perspectives of value-creating leadership. Dynamic Capabilities Theory and the Resource-Based View explain how leadership loosens innovation constraints (Li et al., 2023); Resource Orchestration Theory explains how leadership builds resilience (Yang et al., 2025); Upper Echelon Theory explains how managerial cognition shapes the translation of digital investment into value (Aldhi et al., 2025). Under VIDL, a specific value system acts as the cognitive anchor that ties these processes together.

The framework is offered here as a theoretical proposal grounded in the present data, not as a fully validated model. Longitudinal studies across value-based contexts, including other religious schools, moral education programmes in secular schools, and mission-driven nonprofits, are needed to test its boundary conditions (Sposato, 2024). Mixed-methods research that pairs structural modelling with case analysis could further examine how different value systems navigate dilemmas such as data privacy and algorithmic bias in schools (Branderhorst & Ruijter, 2025; Niu et al., 2022).

5. Conclusion

This study tested an integrative model of digital leadership, ICT resource management, teacher professionalism, and student digital literacy in 25 private Islamic senior high schools across six Indonesian provinces (N = 377 teachers). Digital leadership had a strong direct effect on ICT resource management ($\beta = 0.99$) and teacher professionalism ($\beta = 0.99$), and teacher professionalism ($\beta = 0.54$) was a stronger direct predictor of student digital literacy than ICT resource management ($\beta = 0.46$). Teacher professionalism significantly mediated the effect of digital leadership on student digital literacy.

The study has two main limitations. First, it is cross-sectional and cannot establish causal direction; the unusually high path coefficients and HTMT values also suggest that the four constructs are empirically closer in this context than they are conceptually, which may reflect strong institutional alignment in Islamic schools but should be tested in other samples. Second, student digital literacy was measured through teacher report rather than student self-report or performance assessment, which introduces potential shared-source bias on the teacher professionalism–student digital literacy path.

The contribution of the study is a Value-Integrated Digital Leadership (VIDL) framework for faith-based education, in which the effectiveness of digital leadership is conditioned on the explicit integration of religious and ethical values. Practically, the findings suggest that Islamic schools should strengthen principals' digital leadership capacity as a combination of technical skill and values-based vision, sustain investment in teacher professional development in areas that combine ICT with Islamic pedagogy and digital ethics, and frame school policies so that the digital culture they promote is consistent with Islamic identity while also supporting equitable access and adequate technical support. Future research should test the VIDL framework longitudinally, include student-level measures of digital literacy, and extend the model to other faith-based and mission-driven educational settings.

References

- Akhmad, A. (2025). Digital leadership practices in educational management: A narrative literature review on trends and challenges. *International Journal of Learning, Teaching and Educational Research*, 24(1), 1–20. <https://doi.org/10.26803/ijlter.24.1.1>
- AlAjmi, M. K. (2022). The impact of digital leadership on teachers' technology integration during the COVID-19 pandemic in Kuwait. *International Journal of Educational Research*, 115, 102045. <https://doi.org/10.1016/j.ijer.2022.102045>
- Aldhi, I. F., Suhariadi, F., Rahmawati, E., & Abbas, A. (2025). Bridging digital gaps in smart city governance: The mediating role of managerial digital readiness and the moderating role of digital leadership. *Smart Cities*, 8(1), 100–115. <https://doi.org/10.3390/smartcities8010007>
- Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly*, 41(1), 49–82. <https://doi.org/10.1177/0013161X04269517>
- Asante, K., & Novak, P. (2024). When the push and pull factors in digital educational resources backfire: The role of digital leader in digital educational resources usage. *Education and Information Technologies*, 29(6), 6553–6578. <https://doi.org/10.1007/s10639-023-12095-8>

- Ayasrah, F. T., Alsoub, M. K. K., Al-Ababneh, H. A., & Wuan Jing, K. (2025). Educational performance and the role of e-learning, digital leadership, and digital innovation: A study of high schools in Jordan in the context of 5G. *Data and Metadata*, 4, 100. <https://doi.org/10.56294/dm2025100>
- Baldera, P. R., Saunil, C. C., Patiam, A. M. C., & Valenzuela, R. M. (2025). Digital leadership pioneers: Navigating outstanding school principals' successes in the evolving educational landscape. *International Journal of Learning, Teaching and Educational Research*, 24(2), 210–230. <https://doi.org/10.26803/ijlter.24.2.12>
- Branderhorst, E. M., & Ruijter, E. (2025). Digital leadership in local government: An empirical study of Dutch city managers. *Local Government Studies*, 51(1), 1–22. <https://doi.org/10.1080/03003930.2024.2312054>
- Çetinkaya, B., & Sürücü, L. (2025). The influence of digital culture and digital leadership on innovative work behavior. *Studies in Media and Communication*, 13(1), 1–15. <https://doi.org/10.11114/smc.v13i1.6987>
- Chin, W. W. (2010). How to write up and report PLS analyses. In V. Esposito Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of partial least squares: Concepts, methods and applications* (pp. 655–690). Springer. https://doi.org/10.1007/978-3-540-32827-8_29
- Danganan, C. G., & Gamboa, A. G. (2025). Unveiling the dynamic landscape: Exploring practices, challenges, and resilience strategies of digital leaders in secondary education. *Journal of Cultural Analysis and Social Change*, 10(1), 1–18. <https://doi.org/10.20897/jcasc/15467>
- Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for choosing between multi-item and single-item scales for construct measurement: A predictive validity perspective. *Journal of the Academy of Marketing Science*, 40(3), 434–449. <https://doi.org/10.1007/s11747-011-0300-3>
- Fry, L. W., & Nisiewicz, M. S. (2013). *Maximizing the triple bottom line through spiritual leadership*. Stanford University Press.
- Ghavifekr, S., & Wong, S. Y. (2022). Technology leadership in Malaysian schools: The way forward to education 4.0 – ICT utilization and digital transformation. *International Journal of Asian Business and Information Management*, 13(1), 1–20. <https://doi.org/10.4018/IJABIM.20220701.oa3>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). Sage.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*. Springer. <https://doi.org/10.1007/978-3-030-80519-7>
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- 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>
- Huda, M., Yusuf, J. B., Jasmi, K. A., & Zakaria, G. N. (2021). The prophetic leadership in technology integration for Islamic education. *International Journal of Ethics and Systems*, 37(2), 200–215. <https://doi.org/10.1108/IJOES-09-2020-0146>
- Kollenscher, E., Popper, M., & Ronen, B. (2018). Value-creating organizational leadership. *Journal of Management and Organization*, 24(2), 174–193. <https://doi.org/10.1017/jmo.2016.33>
- Kurniasih, D. D., Zh, M. H. R., Ayunisa, D. A., Maryono, Mustofa, K., & Siswanto. (2025). Analysis of awareness and confidence in learning outcomes with students' academic motivation: SEM approach. In *Jurnal Inovasi Teknologi Pendidikan* (Vol. 12, Issue 1, pp. 58–67). Program Pascasarjana Universitas Negeri Yogyakarta.
- Kuswandi, D., Fadhli, M., Zh, M. H. R., Haditia, M., Sinaga, M. N. A., Thaariq, Z. Z. A., & Ardiansyah, A. (2025). *Implementation of personalized approach in video editing learning to improve digital competency of 21st century learners*.
- Li, Y., Cai, Y., & Tang, R. (2023). Linking instructional leadership and school support to teacher expertise: The mediating effect of teachers' professional development agency. *Sustainability*, 15(9), 7586. <https://doi.org/10.3390/su15097586>
- Liao, S., & Ismail, A. B. (2025). The impact of digital leadership on the ICT competence of Chinese university teachers: Organizational commitment as a mediating variable. *International Research Journal of Multidisciplinary Scope*, 6(1), 1–15. <https://doi.org/10.47857/irjms.2025.v06i01.01>

- Niu, S., Park, B. I., & Jung, J. S. (2022). The effects of digital leadership and ESG management on organizational innovation and sustainability. *Sustainability*, 14(23), 15639. <https://doi.org/10.3390/su142315639>
- Okunlola, J. O., & Naicker, S. R. (2025). Principals' digital leadership competencies in the fourth industrial revolution: Teachers' perspectives. *Education Sciences*, 15(1), 1–18. <https://doi.org/10.3390/educsci15010054>
- Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing & Health*, 29(5), 489–497. <https://doi.org/10.1002/nur.20147>
- Radomir, L., & Moisesescu, O. I. (2019). Discriminant validity of the customer-based corporate reputation scale: Some causes for concern. *Journal of Product & Brand Management*, 29(4), 457–469. <https://doi.org/10.1108/JPBM-11-2018-2115>
- Rasdiana, Nurhadi, T., Akbar, B. M. I., & Habibah, L. B. (2024). The effect of digital leadership in nurturing teachers' innovation skills for sustainable technology integration mediated by professional learning communities. *Journal of Infrastructure, Policy and Development*, 8(10), 8480. <https://doi.org/10.24294/jipd.v8i10.8480>
- Ruiz, S. V. C., & Muñoz, S. D. P. (2024). *Challenges and opportunities for digital leadership in the transformation of educational organisations: Developing digital, soft, intercultural, and inclusive skills*. Springer. <https://doi.org/10.1007/978-3-031-54230-9>
- Schmitz, M.-L., Antonietti, C., Consoli, T., & Petko, D. (2023). Transformational leadership for technology integration in schools: Empowering teachers to use technology in a more demanding way. *Computers & Education*, 197, 104–120. <https://doi.org/10.1016/j.compedu.2023.104750>
- Sinaga, M. N. A., Fadhli, M., Al Fawaz, A. A., & Aulia, F. (2026). Digital Library-Based LMS with TRINGO Strategy: Cross-Tradition Approach for Technological Content Knowledge Development. *Educational Technology in Developing Countries*, 1(1), 43–62.
- Sposato, M. (2024). *Digital leadership in organizations for digital transformation*. Elsevier. <https://doi.org/10.1016/C2023-0-00184-9>
- Supriyanto, A., Wiyono, B. B., & Burhanuddin, B. (2020). Principal's digital leadership and its impact on teacher's ICT integration in learning. *International Journal of Instruction*, 13(4), 83–100. <https://doi.org/10.29333/iji.2020.1346a>
- Suresh Babu, C. V., William, M. P., & Rohith, M. (2025). Innovative pedagogy in the digital era: Empowering learning through digital leadership and technology integration. In M. S. Khan (Ed.), *Digital leadership for sustainable higher education* (pp. 89–110). Elsevier. <https://doi.org/10.1016/B978-0-443-21900-0.00006-3>
- Thannimalai, R., & Raman, A. (2018). The influence of principals' technology leadership and professional development on teachers' technology integration in secondary schools. *Malaysian Journal of Learning and Instruction*, 15(2), 241–264. <https://doi.org/10.32890/mjli2018.15.2.9>
- Thoonen, E. E. J., Slegers, P. J. C., Peetsma, T. T. D., & Oort, F. J. (2019). How to improve teaching practices: The role of teacher motivation, organizational factors, and leadership practices. *Educational Administration Quarterly*, 55(1), 133–168. <https://doi.org/10.1177/0013161X11400185>
- Trizano-Hermosilla, I., & Alvarado, J. M. (2016). Best alternatives to Cronbach's alpha reliability in realistic conditions: Congeneric and asymmetrical measurements. *Frontiers in Psychology*, 7, 769. <https://doi.org/10.3389/fpsyg.2016.00769>
- Voorhees, C. M., Brady, M. K., Calantone, R., & Ramirez, E. (2016). Discriminant validity testing in marketing: An analysis, causes for concern, and proposed remedies. *Journal of the Academy of Marketing Science*, 44(1), 119–134. <https://doi.org/10.1007/s11747-015-0455-4>
- Xu, C., Hania, A., & Waqas, M. (2025). Guiding the digital generation: Role of principals' leadership, ICT competence, and teacher professional competence in fostering digital citizenship among university students. *Education and Information Technologies*, 30, 1–22. <https://doi.org/10.1007/s10639-024-13088-x>
- Yang, Q., Alias, B. S., & Nor, M. Y. M. (2025). Principals' technology leadership and teachers' ICT integration: A systematic review on capacity building for quality improvement and sustainable education. *International Journal of Learning, Teaching and Educational Research*, 24(3), 300–320. <https://doi.org/10.26803/ijlter.24.3.16>
- Yuting, Z., Adams, D., & Lee, K. C. S. (2022). The relationship between technology leadership and teacher ICT competency in higher education. *Education and Information Technologies*, 27,

7895-7912. <https://doi.org/10.1007/s10639-022-10941-9>

Zh, M. H. R., Sari, C. M., Thaariq, Z. Z. A., Sumalee, I., & Kamilah, A. N. (2026). Enhancing conceptual understanding in Islamic education through a hypercontent digital flipbook in blended learning: Evidence from Indonesian madrasah. *Educational Technology in Developing Countries*, 1(1), 1-22.