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Article

Mediation of digital literacy in investigating the effect of school culture on teacher performance: Implication for educational policy

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Abstract: The digital era has transformed education, making digital literacy essential for teachers to integrate technology and enhance student outcomes effectively. This study aims to examine how school culture influences teachers' performance through their digital literacy, focusing on junior high school teachers in Malang City, East Java, Indonesia. Employing a quantitative approach, data were collected from 214 teachers out of a 457 population using questionnaires. The analysis was conducted through AMOS for Confirmatory Factor Analysis (CFA), SPSS for descriptive statistics, and PLS-SEM for hypothesis testing. The findings reveal that school culture significantly affects teachers' digital literacy (Ho1) and teacher performance (Ho2) with supportive and innovative environments, while rigid cultures limit creativity. Furthermore, digital literacy was found to enhance teachers' performance (Ho3) and mediate the impact of school culture on teachers' performance (Ho4), enhancing teachers' effectiveness in planning, implementing, and evaluating instruction. This study highlights the critical role of school culture in shaping digital literacy and offers new insights for improving teacher practices in diverse educational settings. Moreover, the role of education policies in fostering a collaborative school culture that enhances teachers' digital literacy and performance, leading to improved educational outcomes, plays a crucial implication.

Keywords: school culture; teachers' digital literacy; digital innovation; collaborative culture; and teachers' performance

1. Introduction

The digital era of the 21st century has revolutionized how we live, work, and learn, integrating technology deeply into educational settings. In this context, teachers play a vital role in shaping educational outcomes and preparing students for the digital age. Teachers' roles change with societal shifts, new educational approaches, and technological advancements (Karakose et al., 2023). Digital literacy is increasingly recognized as a crucial competency for teachers in the modern educational landscape (Ibda et al., 2023; Zhang, 2023). As technology continues to evolve, teachers' abilities, including pedagogical integration (Gruszczynska et al., 2013; Krumsvik, 2008), digital safety and competence (Hadi Mousavi, 2020;

Rahmawati et al., 2024; Tomczyk, 2020) are essential for enhancing educational outcomes and preparing students for the digital age. A recent study by Deschênes (2024) identifies three dimensions of digital literacy: technical, cognitive, and socioemotional. However, several challenges still hinder the effective implementation and development of these competencies, including inadequate internet access, insufficient professional development, and lack of institutional support (Purmayanti, 2022; Soekamto et al., 2022; Soepriyanti et al., 2022). Likewise, many teachers struggle with accessing digital literacy training and resources, necessitating more proactive efforts from educators and educational authorities to promote and facilitate this education, including in Indonesia (Hendrarso and Habib, 2022). Inadequate digital literacy competence can severely impair teachers' ability to manage learning environments, deliver effective online instruction, and perform their duties efficiently, ultimately affecting their overall job performance. Similarly, low teacher performance is also attributed to a lack of teaching qualifications, irrelevant backgrounds, limited access to knowledge enrichment, insufficient support from colleagues and supervisors, and inadequate facilities and infrastructure (Rindra Risdiantoro, 2021). Hence, it is supported by several studies that prove that teachers' digital literacy is increasingly recognized as a crucial skill, impacting their ability to manage learning processes effectively and enhance student engagement (Ibda et al., 2023; Korkmaz and Akçay, 2024; Marnita et al., 2023).

Furthermore, to keep pace with these changes, schools must cultivate a positive culture that promotes collaboration, innovation, and well-being, ensuring that students, teachers, and administrators can thrive in this evolving environment. Hence, the culture of a school plays a crucial role in shaping the educational environment, directly influencing outcomes for students, administrators, specifically teachers (Družinec, 2019; Marković et al., 2023). As schools navigate the complexities of modern education, fostering a positive and cohesive culture becomes essential for enhancing teacher performance, supporting teacher well-being, and preventing organizational conflicts arising from differing perceptions of leadership (Barker et al., 2023; Brady and Wilson, 2021; Jukić, 2022). With its vast archipelago of over 17,000 islands, Indonesia offers a rich cultural diversity that significantly influences school culture (Indonesia Development Forum, 2018). Poorly managed school culture in Indonesia's culturally diverse schools can result in misunderstandings, conflicts, and a weakened sense of community, ultimately harming collaboration and academic performance. In this context, a supportive school culture can help resolve these cultural differences by promoting inclusivity, open communication, and mutual respect, leading to a more harmonious and collaborative learning environment. A positive organizational culture emphasizes family values like harmony, openness, friendship, cooperation, and trust, creating a friendly work environment where colleagues assist each other (Kast and Rosenzweig, 1979). This will enhance teacher performance by fostering a sense of value, collaboration, and motivation, leading to higher engagement, reduced stress, and improved teaching quality.

According to Bandura (1999), positive school culture, as an environmental influence, improves teachers' self-efficacy, increasing their confidence and

motivation to adopt new skills such as digital literacy. Supported by Davis (1985) indicates that in a positive school culture, teachers are more inclined to perceive digital tools positively and incorporate them into their teaching, thanks to the encouragement and resources provided. Previous studies have also explored how a positive school culture affects teachers' digital literacy. A survey by Sogalrey et al. (2022) found that school culture significantly influences digital teacher literacy services, with a combined impact of 41.59%. Similarly, a literature study by Spiteri and Chang Rundgren (2020) found that primary teachers' use of digital technology is influenced by their knowledge, attitudes, and skills, including school culture. Furthermore, other studies have also emphasized that school culture influences teacher performance e.g., Muhsin et al. (2020) found that school culture can boost teachers' four fundamental competencies: pedagogical, social, and professional skills. This is aligned with other studies that found similar findings regarding how this school culture enhances teachers' overall performance (Kanya et al., 2021; Suwarto and Subyantoro, 2018). These studies indicate the pivotal role of school culture in elevating teachers' digital literacy and, ultimately, job performance. However, limited existing studies are exploring the mediating role of teachers' digital literacy in predicting the influence of school culture on teacher performance, precisely in the Indonesian context. Consequently, this study aims to examine the influence of school culture on teacher performance mediated by teachers' digital literacy in Junior High school teachers in Malang City, East Java, Indonesia. Malang City was chosen due to its diverse educational challenges and opportunities, where improving teacher performance at public junior high schools is crucial for enhancing educational competitiveness and adapting to the evolving dynamics of modern education and technology. This study's significance deepens our understanding of how a positive school culture can boost teacher performance by fostering digital literacy as a mediation, especially in the Indonesian context. It offers practical guidance for educational leaders on nurturing digital skills and improving teaching practices. More importantly, it highlights the need for future research to explore the lasting impact of school culture and digital literacy and specific ways to help teachers develop these skills in different school environments.

2. Literature review

In this exploratory review, we gathered literature from multiple academic databases, including Google Scholar, Web of Science (WoS), and Scopus, using keywords related to teacher performance, school culture, and teachers' digital literacy. We first examine the importance of teacher performance in student achievement, considering how it is influenced and measured. Next, we explore how school culture shapes the teaching and learning environment, particularly in relation to teachers' digital literacy and performance. Lastly, we discuss how teachers' digital skills act as a link between school culture and their. This review provides a solid foundation for understanding how these elements interact and why they matter for improving education.

2.1. Teacher performance

Teacher performance is a critical factor in the educational process, influencing the quality of education and student outcomes (Monier Llovio et al., 2023; Nochefranca, 2022). Performance is a manifestation of the behavior produced by an individual in carrying out their authority and responsibilities. Teacher performance can be observed when the teacher engages in activities related to their core duties and functions, which are assigned to them based on their skills, experience, and dedication (Moghtader and Aziz, 2019). Likewise, several studies indicate that teacher performance is influenced by competence and professionalism (Alimmudin, 2022; Baety, 2021), work discipline and motivation (Esterlina and Hariani, 2021), skill development (Anggraeni, 2021), including supportive work environment provided by the principal as a leader (Anita et al., 2022; Rizkie, 2022). Given the importance of competence and school culture for a supportive work environment, teachers must work together to improve their digital skills in today's tech-driven era (Rasdiana et al., 2024). These studies indicate that in the digital era, fostering a supportive school culture that promotes digital literacy among teachers and integrates these skills into the instructional process is crucial for teacher success and achieving educational goals. However, teachers encounter challenges with digital literacy and school culture, such as low digital competence (Garzón-Artacho et al., 2021; Sánchez-Cruzado et al., 2021), a generational gap in technology use (Yefanov et al., 2020), and insufficient training programs (Martín-Párraga et al., 2023). Additionally, the type of school and its culture significantly influence these competencies (Garzón-Artacho et al., 2021; Rasdiana et al., 2024; Trujillo-Torres et al., 2020).

According to Law Number 14 of 2005 concerning teachers and lecturers, teachers have three primary duties: planning, implementing, and assessing learning (Law Number 14 of 2005 on Teachers and Lecturers, 2005). Effective lesson planning is essential for successful teaching. For instance, a study on teacher performance revealed that teachers who carefully plan their lessons and materials generally achieve better outcomes in the classroom (Wahyu et al., 2021). Similarly, the Performance Assessment for California Teachers (PACT) highlights planning as a key predictor of future teaching effectiveness (Darling-Hammond et al., 2013). In the context of the Merdeka Curriculum, lesson planning is assessed based on the completeness of teaching modules, including general information and core components (Kasman and Lubis, 2022). Furthermore, effective lesson implementation is crucial for teacher performance, including engaging content, creating a conducive learning environment, and participating in professional development. Research by Yansyah (2022) emphasizes that successful performance management involves following planned activities and ongoing professional growth. The Australian Teaching Performance Assessment (TPA) also mandates that teachers show their capability to implement lessons effectively, which has been proven to improve professional readiness (Buchanan et al., 2020). Finally, teachers need to interpret assessment data skillfully and give constructive feedback. The PACT study found that these assessment skills are vital predictors of teaching effectiveness (Darling-Hammond et al., 2013). Moreover, a systematic review found

that implementing Assessment for Learning (AFL) effectively depends on teachers offering meaningful, constructive feedback and promoting a collaborative school culture (Heitink et al., 2016). Therefore, these three primary duties are key to effectively measuring teacher performance and examining the impact of school culture and teachers' digital literacy in our study.

2.2. The necessity of school culture

Organizational culture arises from various administrative factors and is defined as a system composed of four elements: values, assumptions, beliefs, and norms (Burhanuddin et al., 2019; McKee et al., 2013). These elements are adopted by individuals within the organization, uniting them, and are manifested on four levels: artefacts, perspectives, values, and assumptions (McKee et al., 2013). Likewise, Sergiovanni (1991) stated that a school, as an organization, possesses distinct cultural dimensions, including artefacts, perspectives, values, and assumptions. Meanwhile, Burhanuddin (2019) states that a university as an organization can be characterized by specific cultural attributes such as bureaucracy, clan dynamics, market orientation, adhocracy, innovation, and support. However, applying these cultural attributes has not been extensively examined within the school context, highlighting a limitation in the research. The school as an organization has a culture encompassing shared beliefs, practices, and norms, which not only impacts day-to-day operations but also helps define the school's identity, values, and reputation (Jukić, 2022).

Different conceptions of school culture can help understand the diverse ways students, teachers, and administrators make sense of their everyday encounters in schools (Erickson, 1987). Several studies proved that school organizational culture directly and significantly influences teacher performance, suggesting that a strong culture can enhance teaching outcomes (Kanya et al., 2021; Öztürk et al., 2021; Spiteri and Chang Rundgren, 2020; Syukron et al., 2020), particularly in teachers' performance to plan, implement, and evaluate instructional process (Chennatuserry et al., 2022; Prihatini et al., 2021; Rachman et al., 2023; Tabak and Şahin, 2020). Besides, a supportive school culture can promote digital literacy and strengthen teachers' overall digital competencies (Litina and Rubene, 2024; Sogalrey et al., 2022; Spiteri and Chang Rundgren, 2020). A bibliometric study by Karakose et al. (2022) confirmed that education computing, which fosters teachers' digital literacy is closely connected to themes like education reform, organizational factors, interactive learning, learning communities, teaching, and social and economic effects—all of which are essential components of school culture.

Furthermore, school culture plays a crucial role in shaping how educators perceive and embrace technology, fostering shared values that support successful technology integration in learning (Rasdiana et al., 2024; Timotheou et al., 2023). It is also emphasized that school leaders who foster a supportive school culture can enhance teacher capability in the digital transformation at schools, including their digital literation (Navaridas-Nalda et al., 2020; Yondler and Blau, 2023). This association suggests that a positive school culture plays a crucial role in supporting and enhancing teachers' digital literacy, as these interconnected factors create an

environment that fosters technological integration and educational development. Therefore, in this context, applying and investigating cultural attributes like bureaucracy, clan dynamics, market orientation, adhocracy, innovation, and support for teacher digital literacy and performance significantly contributes to educational practice and future research. This is consistent with previous studies (Chennatuserry et al., 2022; Fuad et al., 2022; Irawati et al., 2023).

2.3. Mediating role of teachers' digital literacy

The necessity of teacher digital literacy has become more evident in the rapid advancement of digital technologies, especially in the post-COVID-19 pandemic. These underscored the critical need for teachers to have strong digital literacy skills to teach online and adopt innovative educational models effectively (Sánchez-Cruzado et al., 2021). Walton (2016) defines digital literacy as finding, evaluating, using, sharing, and creating content using information technology and the internet. However, existing frameworks and models often emphasize only technical and information skills, falling short of the comprehensive digital competence needed in modern classrooms (Falloon, 2020). Therefore, a recent study from Deschênes (2024) emphasizes that digital literacy dimensions are divided into three parts: (1) technical digital literacy, (2) cognitive digital literacy, and (3) socio-emotional digital literacy. Furthermore, several studies show that while many teachers have basic digital literacy, ongoing professional development is needed as most remain intermediate (Rahmawati et al., 2024). Similarly, teachers are expected to master digital skills, culture, ethics, and safety to meet 21st-century learning demands (Isrokatun et al., 2022). Several strategies to enhance teacher digital literacy include training programs focused on digital teaching materials and integrating digital literacy into the curriculum through ICT learning and media literacy approaches, which have proven effective in some institutions (Suwarto et al., 2022). Moreover, teachers with solid digital literacy provide better online learning experiences (Afriliandhi et al., 2022; Sappaile et al., 2023).

Teachers' digital literacy has been proven to enhance their performance by enabling access to teaching models, media, and innovative content creation (Aravantinos et al., 2024; Park and Yoon, 2023). Despite its importance, digital literacy faces challenges like limited technology access, inadequate training, and insufficient support from educational authorities (Hendrarso and Habib, 2022), as well as intrinsic factors, such as teachers' attitudes towards technology and their knowledge of digital tools, which also significantly impact the successful adoption of digital literacy practices (Karakose et al., 2023; Papadakis et al., 2024; Pratolo and Solikhati, 2020). School culture is crucial for enhancing teacher digital literacy, as a supportive environment that promotes continuous learning and collaboration can significantly boost digital competencies. For instance, private schools in Yogyakarta have effectively implemented digital literacy programs by using local resources and fostering a collaborative culture (Suwarto et al., 2022).

Meanwhile, studies collectively indicate that digital competence, i.e., digital literacy, is a crucial factor in enhancing teacher performance, such as better professional engagement (Reisoğlu, 2022), improved teaching practices, and higher

student motivation and performance (Montilla et al., 2023). These studies highlight the vital role of a supportive school culture in boosting teacher performance through digital literacy in the digital era, emphasizing its complex parts, including (1) technical digital literacy, (2) cognitive digital literacy, and (3) socio-emotional digital literacy. Therefore, we aim to explore the mediating effect of teachers' digital literacy of school culture on teacher performance.

2.4. What is the importance of educational policy for school culture, teachers' digital literacy, and performance?

Fullan (2015) accentuates that educational policy helps create a school culture where teamwork and shared values thrive, making schools more positive for teachers and students. It also supports teachers in building their digital skills by providing training and access to technology. By setting clear expectations and offering support, policies help teachers perform at their best, leading to better outcomes for everyone. Recent works of literature amplified their findings regarding the importance of educational policies in school settings, e.g., for collaborative and inclusive school culture (Lakkala et al., 2021; Tabak and Şahin, 2020), leadership and professional development (King, 2022), social and emotional support (Opdenakker, 2021), and organizational culture perception in general (Huang and Teo, 2020). This literature emphasizes that educational policy is crucial for shaping school culture, enhancing teachers' digital literacy, and improving performance by guiding the planning, delivery, and evaluation of instructional processes and ensuring a supportive environment that promotes collaboration, technological advancement, and effective teaching practices. Therefore, it is important to mention the educational policy implications when talking about school culture, teachers' competence in terms of digital literacy, and their overall performance.

3. Method

In this section, we outline the methods we used to explore how school culture influences teachers' performance through their digital literacy. We will break down each part of our approach, including how we designed the study, selected participants, and created our measurement tools. We will also cover how we gathered the data and the techniques used to analyze it. Each step was carefully planned to ensure we got precise and reliable results.

3.1. Study design

This study utilized a quantitative approach with a regression design, incorporating Structural Equation Modeling to assess direct and indirect effects (Cresswell and Clark, 2014; Hair et al., 2021). The main goal was to explore the impact of school culture on teachers' performance, focusing on the mediating role of teachers' digital literacy in Junior High Schools in Malang City (See **Figure 1**).

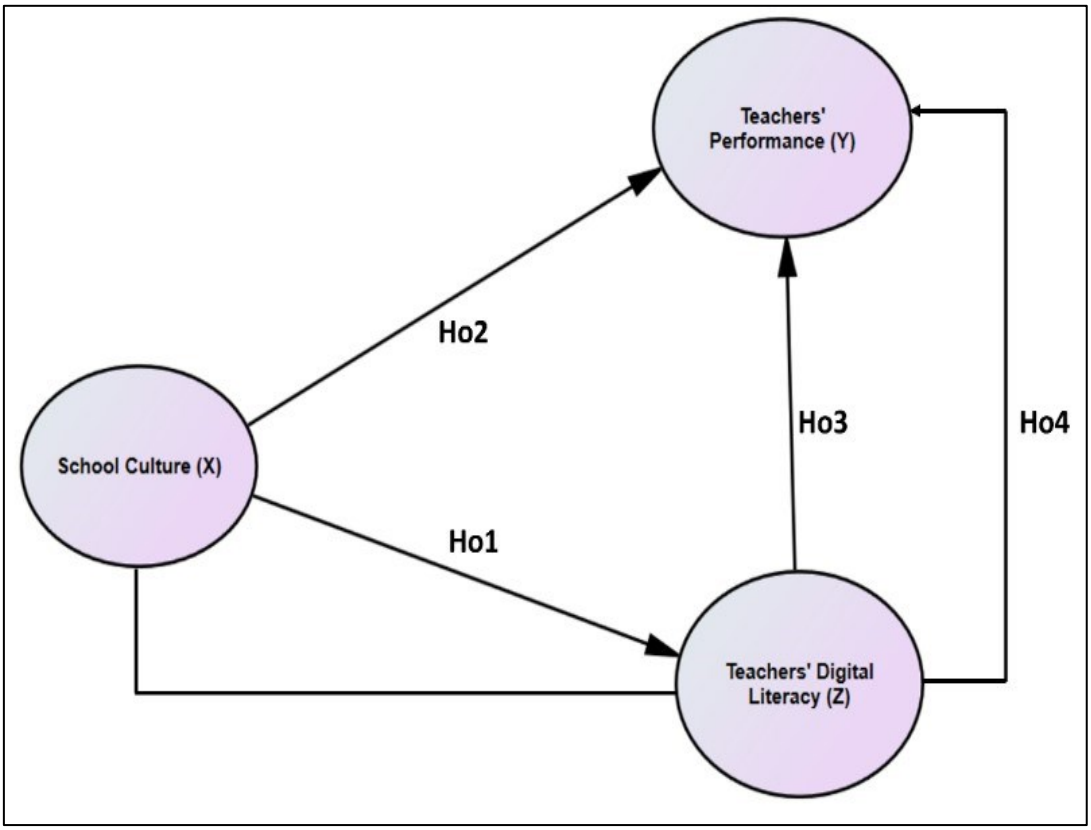

Figure 1. Study design and hypotheses development.
Sources: author's conceptual model.

Figure 1 illustrates a conceptual model examining the relationships among School Culture (X), Teachers' Performance (Y), and Teachers' Digital Literacy (Z). The model proposes four hypotheses: (1) Ho1 suggests that School Culture directly influences Teachers' Digital Literacy; (2) Ho2 indicates a direct relationship between School Culture and Teachers' Performance; (3) Ho3 posits that Teachers' Digital Literacy directly impacts Teachers' Performance; and (4) Ho4 suggests an indirect effect of School Culture on Teachers' Performance mediating by Teachers' Digital Literacy.

3.2. AMOS to run CFA (confirmatory factor analysis)

We used AMOS for our factor analysis because it comprehensively examines relationships between variables through Structural Equation Modeling (SEM). Arbuckle (2009) noted that AMOS software can perform Structural Equation Modeling (SEM) using various estimation methods, such as maximum likelihood and Bayesian estimation. This approach benefits our study, as it helps ensure a more robust understanding of the relationships between school culture, digital literacy, and teacher performance. Moreover, AMOS provides flexibility in factor loading thresholds, where values as low as 0.5 are still considered acceptable, ensuring our analysis remains valid even with moderate loadings (Hair et al., 2010). The threshold of factor loading should be 0.70, but 0.5 is still acceptable.

3.3. Participant

This study involved 457 public junior high school teachers in Malang City, East Java, Indonesia as a population. It involved ten schools across five subdistricts, with two schools from each representing the public school population (See **Table 1** and **Figure 2**).

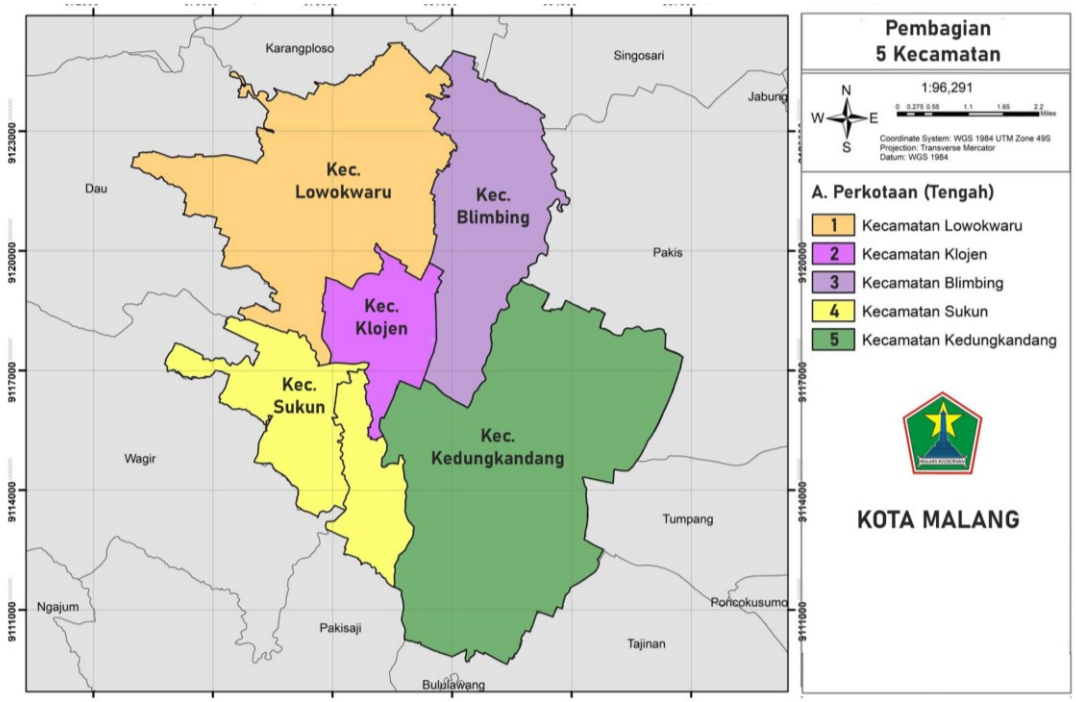

Figure 2. Map of 5 subdistricts in Malang for research population and respondents.
Source: internet.

Table 1. Study participants.

No.	Schools Name	Sub-districts area	Population	Sample
1	SMP Negeri 11 Malang	Lowokwaru	45	21
2	SMP Negeri 4 Malang	Lowokwaru	47	22
3	SMP Negeri 1 Malang	Klojen	43	20
4	SMP Negeri 5 Malang	Klojen	45	21
5	SMP Negeri 10 Malang	Kedungkandang	47	22
6	SMP Negeri 7 Malang	Kedungkandang	45	21
7	SMP Negeri 15 Malang	Sukun	50	23
8	SMP Negeri 17 Malang	Sukun	46	22
9	SMP Negeri 20 Malang	Blimbing	47	22
10	SMP Negeri 24 Malang	Blimbing	42	20
Total			457	214

$$n = \frac{N}{1 + Ne^2} = \frac{457}{1 + 457 \times 0.05^2}$$

$$n = \frac{457}{1 + 1.142} = \frac{457}{2.142}$$

$$n = 214$$

From this group, a sample of 214 was chosen through a simple random sampling method based on a sample size of Slovin formulation and a significance of 5 percent margin sampling error (Cresswell and Clark, 2014; Fowler, 2009). We chose Slovin's formulation because it is ideal for ensuring that the sample size is representative of the larger population while keeping sampling error within acceptable limits. This method also simplifies the random sampling process, making it practical and reliable for our study.

3.4. The measures

We created a questionnaire with 40 questions to understand teachers' views on their school's culture. These questions were divided into six areas: bureaucratic (9 questions), supportive (7 questions), market (5 questions), clan (8 questions), adhocracy (5 questions), and innovative (6 questions). The design of these questions was inspired by Burhanuddin et al. (2019; 2019). To assess teachers' digital literacy, we used 22 questions covering technical skills (10 questions), cognitive skills (6 questions), and socio-emotional skills (6 questions), based on Deschênes (2024). Teacher performance was evaluated with 30 questions focusing on three key areas: planning (8 questions), lesson implementation (10 questions), and evaluating learning (12 questions). These questions were developed according to the primary duties of teachers (Law Number 14 of 2005 on Teachers and Lecturers, 2005). Respondents answered these questions using a Likert scale with five options: 5 for "very true," 4 for "somewhat true," 3 for "occasionally true," 2 for "seldom true," and 1 for "not true." They selected the statements that best matched their experiences with school culture, digital literacy, and their performance as teachers.

Before distributing the questionnaire (items of measured latent variables), we conducted a pilot test with schools similar to our study sample and analyzed the data using IBM SPSS. To ensure consistent measurement of the construct, an item must be considered valid if its significance level is below 0.05, and for reliability, Cronbach's alpha coefficient must exceed 0.7. Our pilot testing resulted in two items in the school culture variable and four in teachers' digital literacy being found invalid, as their significance exceeded the 0.5 threshold. In contrast, all items for teachers' performance were valid. Moreover, reliability tests showed strong results: teachers' digital literacy (0.962), school culture (0.954), and teachers' performance (0.983) all exceeded the required 0.7, confirming that the instruments are reliable for further research.

3.5. Data collection

We collected data by administering questionnaires on teachers' performance, digital literacy, and school culture. After getting permission from the local and provincial authorities, we visited schools to distribute these questionnaires to teachers. We focused on teachers from public junior high schools in Malang City, East Java, Indonesia. The research took place from February to April 2024. Once the teachers completed the questionnaires, we analyzed the data to test our hypotheses and meet the study's goals.

3.6. Measurement procedure and data analysis

Before applying Structural Equation Modeling (SEM), we grouped items under each construct based on previous research. School culture was divided into six dimensions (bureaucratic, supportive, market, clan, adhocracy, and innovative), while teachers' digital literacy was categorized into technical, cognitive, and socio-emotional aspects. Teacher performance was measured by planning, implementing, and evaluating instruction. Afterward, we used Confirmatory Factor Analysis (CFA) with AMOS software to validate the scale's constructs, following Arbuckle's (2009) method aimed to check if the data supported the hypothesized structure of the model. The CFA assessed whether the observed variables for school culture (SC), teachers' digital literacy (DL), and teacher performance (TP) matched their respective factors in the model. After conducting CFA, we again filtered the factor loading through PLS-SEM and excluded the items that did not support the threshold.

Figure 3 illustrates that this step effectively assigns each construct to its corresponding indicators. Ovals or circles represent constructs, while observed variables are shown as rectangles. The arrows from the circles to the rectangles indicate the relationships between the factors and the items. Several items were excluded because they did not meet the threshold. Besides, we found that our data was not normally distributed.

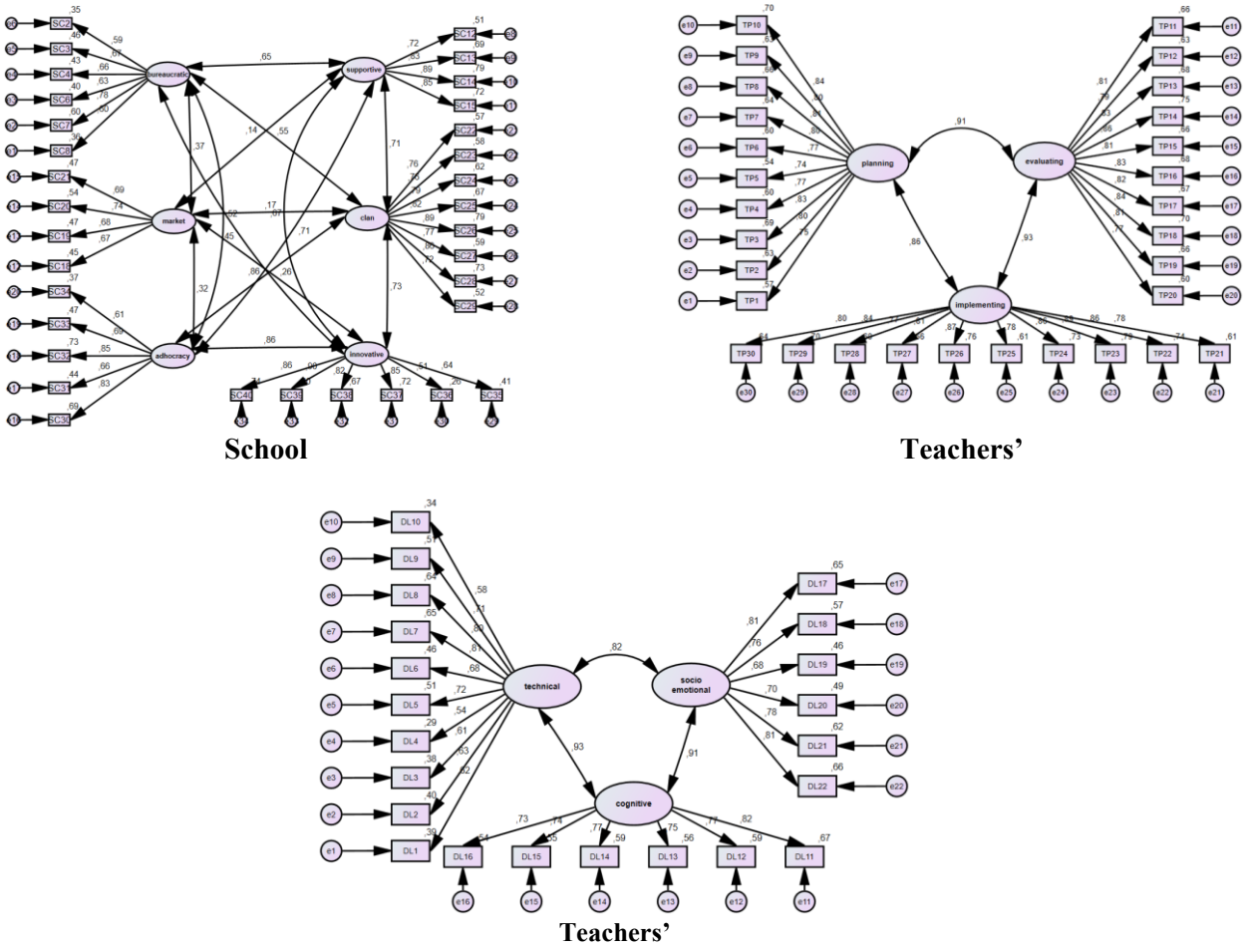

Figure 3. CFA of school culture (SC), teachers' digital literacy (DL), and performance (TP).

Furthermore, we used cross-sectional Structural Equation Modeling (SEM) with the Partial Least Squares Structural Equation Modeling (PLS-SEM) method to assess the model in our study because our data is non-parametric and does not follow a normal distribution. PLS-SEM is well-suited for handling such data, making it an appropriate choice for our analysis. PLS-SEM involves two fundamental models: the measurement model, which evaluates metrics like Average Variance Extracted (AVE), discriminant validity, Variance Inflation Factor (VIF), and composite reliability (CR), and the structural model. AVE should exceed 0.5, and CR should be above 0.7 for a good fit (Hair et al., 2021; Henseler et al., 2015). Discriminant validity is tested using the Heteroit-Monotrait Ratio (HTMT) and Fornell and Larcker Criterion, ensuring the square root of AVE is higher than correlations with other constructs (Fornell and Larcker, 1981). Moreover, we developed two models: one that examines the direct effect of school culture on teachers; performance and another that adds a partial mediation through teachers' digital literacy. Additionally, we assessed the indirect effect of school culture on performance via digital literacy. Structural model evaluation included metrics like R^2, chi-square results, Q^2, and SRMR, followed by bootstrapping to test the significance of direct, indirect, and overall effects. The analysis utilized *t*-statistics and *P* values to determine significance, with regression coefficients calculated from the original sample (Hair et al., 2021; Henseler et al., 2015).

4. Results

This result section presents our three main objectives: (1) to explore how school culture, teachers' digital literacy, and performance are being implemented; (2) to investigate the direct impact of school culture on teachers' digital literacy and performance; and (3) to examine how school culture indirectly influences teacher performance through the role of digital literacy as a mediator.

4.1. Descriptive statistics

Table 2 offers a snapshot of how School Culture, Teachers' Digital Literacy, and Teachers' Performance are implemented in schools, supported by critical statistics. School Culture has an average score of 62.28, with most schools scoring around the middle, but there is some variation in how strong the culture is, as indicated by the standard deviation of 7.085. Teachers' Digital Literacy stands out with a high average score of 131.03, showing that most teachers are pretty tech-savvy, though there are differences in proficiency across the group. Teachers' Performance averages 129.21, with scores varying more, as indicated by a slight skew towards lower performance. Overall, the data shows that while teachers generally perform well and are digitally literate, school culture varies more widely across different schools.

Table 2 shows that the skewness and excess kurtosis values for the three EC indicators are near zero, ranging from −0.578 to −0.317 and −0.256 to 0.194, respectively. Each indicator exhibits a nearly normal distribution (Kock, 2016). The normality of the indicators also ensures that any potential biases due to extreme values are minimized, allowing for a more accurate estimation of the relationships

between digital leadership, teacher innovation skills, and the mediating effect of PLCs. Therefore, this analysis supports the robustness of the findings and the validity of the conclusions drawn from the research model.

Table 2. Descriptive statistic of latent variables.

Latent variables		School culture	Teacher's digital literacy	Teachers' performance
N	Valid missing	214 0	214 0	214 0
Mean		62.28	131.03	129.21
Std. error of mean		0.484	0.867	0.850
Median		61.00	128.50	124.00
Mode		60	124	120
Std. deviation		7.085	12.683	12.434
Skewness		0.182	0.154	0.531
Std. error of skewness		0.166	0.166	0.166
Kurtosis		−0.779	−0.515	−1.031
Std. error of kurtosis		0.331	0.331	0.331
Minimum		48	98	101
Maximum		75	155	150

Furthermore, the data in **Table 2** also shows slight deviations from a normal distribution. School Culture and Teachers' Digital Literacy have skewness values close to zero, indicating minimal asymmetry, while Teachers' Performance shows a moderate positive skew. However, all three variables exhibit negative kurtosis, meaning their distributions are somewhat flatter than a normal curve. Overall, the data is not perfectly normally distributed. Therefore, non-parametric tests with PLS-SEM will be more effective for testing hypotheses. Non-parametric tests are better at handling data that is not perfectly normal, which helps ensure more accurate and reliable results.

4.2. Structural equation modeling

4.2.1. Evaluation of validity, reliability, and collinearity

Table 3, depicted below, summarizes the reliability and validity analysis for Teacher Performance (TP), Digital Literacy (DL), and School Culture (SC). Most factor loadings are above 0.7, indicating strong item representation. However, loadings as low as 0.5 are still acceptable. The CR values are high (TP: 0.938, DL: 0.957, SC: 0.976), and AVE values meet or exceed 0.5, confirming reliability and validity. VIF values are within acceptable limits, indicating no major multicollinearity issues. Despite some lower loadings, the constructs are still reliable and valid, supported by strong CR and AVE values.

Table 3. Evaluation of validity and reliability.

Construct	Item code	β	C. R	AVE	VIF	Reliability decision	Validity decision	Collinearity decision
TP	TP1	0.704	0.938	0.699	2.352	Yes	Yes	Yes
	TP10	0.831			2.533			Yes
	TP11	0.801			2.698			Yes
	TP12	0.773			2.286			Yes
	TP13	0.800			2.108			Yes
	TP14	0.832			2.306			Yes
	TP15	0.825			1.649			Yes
	TP16	0.823			2.172			Yes
	TP17	0.803			2.542			Yes
	TP18	0.827			2.697			Yes
	TP19	0.813			2.280			Yes
	TP2	0.747			2.050			Yes
	TP20	0.770			1.707			Yes
	TP21	0.771			3.254			Yes
	TP22	0.829			2.870			Yes
	TP23	0.860			2.333			Yes
	TP24	0.819			3.464			Yes
	TP25	0.752			4.079			Yes
	TP26	0.836			3.441			Yes
	TP27	0.791			1.931			Yes
	TP28	0.753			2.992			Yes
	TP29	0.827			3.229			Yes
	TP3	0.781			3.842			Yes
	TP30	0.802			4.376			Yes
	TP4	0.740			5.121			Yes
	TP5	0.716			3.331			Yes
	TP6	0.766			4.969			Yes
	TP7	0.756			3.197			Yes
	TP8	0.780			2.045			Yes
	TP9	0.791			3.681			Yes
DL	DL12	0.774	0.957	0.529	2.083	Yes	Yes	Yes
	DL13	0.739			4.055			Yes
	DL14	0.742			2.465			Yes
	DL15	0.733			1.982			Yes
	DL18	0.723			2.222			Yes
	DL19	0.689			1.900			Yes
	DL2	0.546			4.424			Yes
	DL20	0.680			3.674			Yes
	DL21	0.790			5.582			Yes
	DL22	0.804			2.052			Yes
	DL3	0.596			3.845			Yes

Table 3. (*Continued*).

Construct	Item code	β	C. R	AVE	VIF	Reliability decision	Validity decision	Collinearity decision
DL	DL12	0.774	0.957	0.529	2.083	Yes	Yes	Yes
	DL4	0.565			1.671			Yes
	DL6	0.659			2.223			Yes
	DL7	0.794			3.508			Yes
	DL8	0.766			3.903			Yes
SC	SC12	0.585	0.544	0.976	4.046	Yes	Yes	Yes
	SC13	0.733			4.498			Yes
	SC14	0.733			4.184			Yes
	SC15	0.719			5.602			Yes
	SC17	0.645			4.187			Yes
	SC22	0.686			4.544			Yes
	SC23	0.725			3.786			Yes
	SC24	0.706			4.790			Yes
	SC25	0.721			4.113			Yes
	SC26	0.782			4.646			Yes
	SC27	0.684			5.569			Yes
	SC28	0.784			3.173			Yes
	SC29	0.737			5.984			Yes
	SC3	0.516			6.111			Yes
	SC30	0.777			4.475			Yes
	SC31	0.619			4.091			Yes
	SC32	0.809			6.118			Yes
	SC33	0.661			4.850			Yes
	SC34	0.616			3.964			Yes
	SC35	0.621			5.446			Yes
	SC36	0.504			5.590			Yes
	SC37	0.787			4.036			Yes
	SC38	0.761			4.676			Yes
	SC39	0.770			3.135			Yes
	SC4	0.514			3.169			Yes
	SC40	0.726			3.888			Yes
	SC6	0.517			3.927			Yes
	SC7	0.537			4.154			Yes

Table 3 illustrates that the outer loading values for each item fulfill the criteria by exceeding 0.7 for items within the DL, PLCs, and TIS variables. Furthermore, the average variance extracted (AVE) value surpasses 0.5, consistent with the specified standard. Similarly, the composite reliability (CR) registers a value greater than 0.7. Consequently, this study's convergent validity and composite reliability evaluations are considered satisfactory.

4.2.2. Discriminant validity

We used the Fornell-Larcker Criterion and the HTMT ratio to assess discriminant validity. The FornellLarcker method (depicted in **Table 4**) confirms that each construct's square root of Average Variance Extracted (AVE) is higher than its correlations with other constructs, indicating distinctiveness. For example, Digital Literacy (DL) has a square root AVE of 0.711, higher than its correlation with Teacher Performance (TP) at 0.657. Similarly, School Culture (SC) and TP also meet this criterion. Additionally, the HTMT ratio (depicted in **Table 5**) shows that correlations between constructs are below 0.85 threshold, indicating that DL, SC, and TP are distinct and not overly correlated. Together, these results confirm the constructs' uniqueness and the validity of our analysis.

Table 4. Evaluation of fornell-larcker criterion.

	DL	SC	TP
DL	0.711		
SC	0.400	0.684	
TP	0.657	0.597	0.791

Table 5. Evaluation of Heteroit-Monotrait ratio (HTMT).

	DL	SC	TP
DL			
SC	0.388		
TP	0.664	0.600	

4.2.3. Fitness of model

This evaluation is performed to analyze the coefficient of determination values for chi-square, *R* Square (R^2), SRMR, and d_ULS, as well as D_G and NFI (Henseler and Sarstedt, 2013).

Table 6. Goodness of fit model evaluation.

	Saturated model	Estimated model	Consideration
SRMR	0.081	<0.10	Good fit
d_ULS	17.609	>0.05	Good fit
d_G	8.307	>0.06	Good fit
Chi-Square	7.220	<3.00	Marginal fit
NFI	0.584	>0.80	Marginal fit

Table 6 indicates that the model generally fits well with the data. The SRMR (0.081), d_ULS (17.609), and d_G (8.307) values all indicate a good fit. However, the Chi-Square (7.220) and NFI (0.584) suggest a marginal fit. Despite these minor issues, the model is suitable for further bootstrapping analysis to confidently explore variable influences, though some areas could be improved.

4.3. Significance testing of hypotheses.

Table 7. Path evaluation of hypotheses.

Path	Total direct effect	Total indirect effect	*t*-value	*p*-value	Bias	Confident interval bias corrected		Significance decision
						5.0%	95.0%	
Digital literacy → teachers' performance	0.498		10.367	0.000	0.000	0.395	0.584	Yes
School culture → digital literacy	0.410		6.782	0.000	0.011	0.290	0.521	Yes
School culture → teachers' performance	0.605		10.582	0.000	0.008	0.500	0.706	Yes
School culture → digital literacy → teachers' performance		0.204	5.753	0.000	0.005	0.130	0.261	Yes

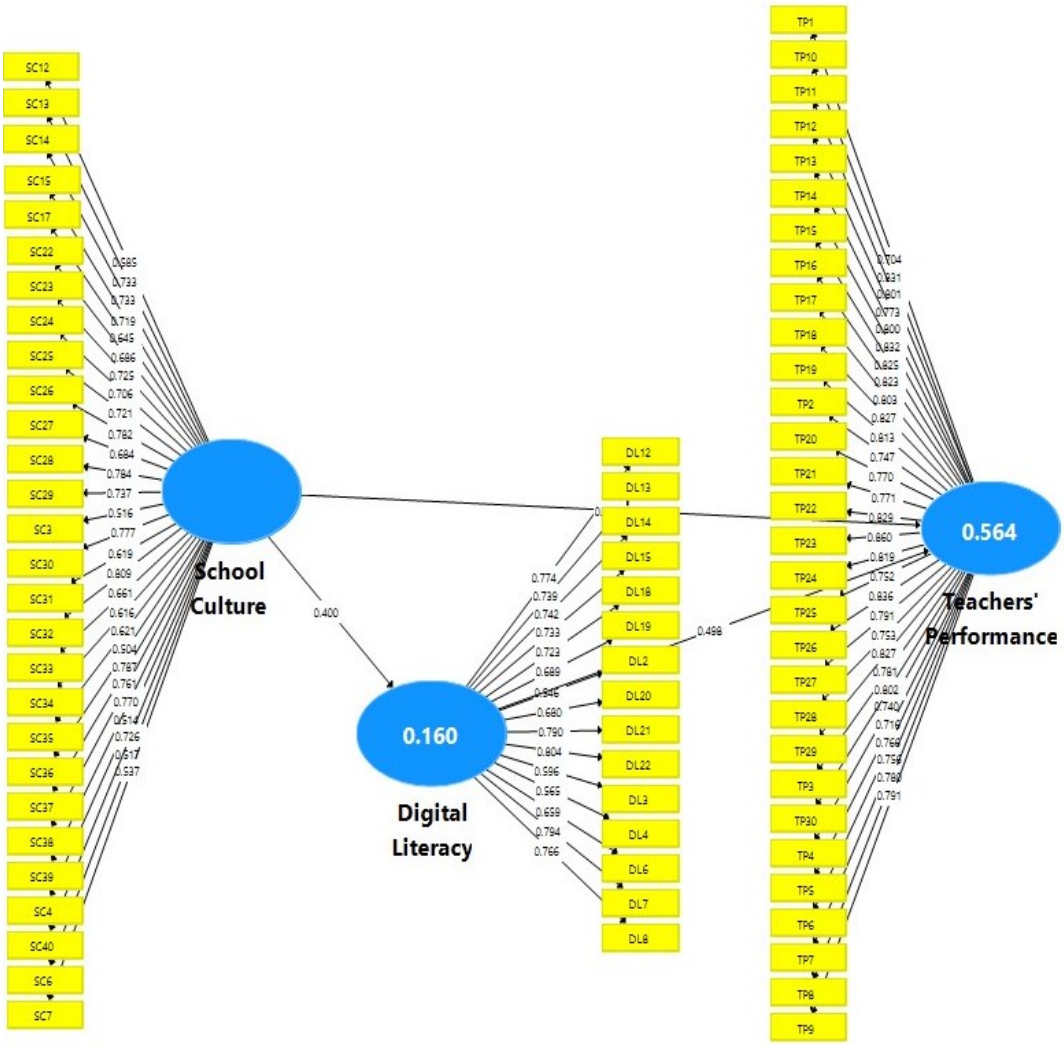

Figure 4. Analysis of PLS-SEM model.

Note: (*P* value < 0.05, two-tailed test).

Table 7 and **Figure 4** show that our result analysis supports the proposed

hypotheses, confirming the relationships outlined in the theoretical model. First, Ho1 is validated, as School Culture significantly influences Teachers' Digital Literacy (path coefficient = 0.410, *t*-value = 6.782, *p*-value = 0.000). Ho2 is also supported, showing a significant direct impact of School Culture on Teachers' Performance (path coefficient = 0.605, *t*-value = 10.582, *p*-value = 0.000). Ho3 is confirmed, with Teachers' Digital Literacy having a significant direct effect on Teachers' Performance (path coefficient = 0.498, *t*-value = 10.367, *p*-value = 0.000). Lastly, Ho4 is supported by the significant indirect effect of School Culture on Teachers' Performance, mediated by Teachers' Digital Literacy (indirect effect = 0.204, *t*-value = 5.753, *p*-value = 0.000). All relationships are statistically significant, as the confidence intervals and bias corrections indicate. This confirms that the model effectively explains the dynamics between School Culture, Teachers' Digital Literacy, and Teachers' Performance.

Table 8. R square determination coefficient.

	R square	R square adjusted	Interpretation
TP	0.160	0.156	<0.75 strong
DL	0.564	0.560	<0.75 strong

Table 8 highlights the strength of the relationships between the variables. For Teacher Performance (TP), the predictors explain about 15.6% of the variance, which indicates a moderate influence. In contrast, Digital Literacy (DL) is more strongly impacted, with 56% of its variance explained by the predictors, showing a solid influence. These findings suggest that while the factors moderately affect Teacher Performance, they have a much stronger impact on Digital Literacy. Further details on these results will be explored in the following sections.

5. Discussion

5.1. Hypotheses discussion

Our first finding showed that school culture can predict teachers' digital literacy (Ho1). School culture shapes how teachers develop digital literacy by influencing their technical, cognitive, and socio-emotional skills. Therefore, these school culture factors initiated by Burhanuddin (2019a; 2019b) can be implemented in the school context. Followingly, Erickson (1987) and McKee et al. (2013) state that the different understandings of school culture can provide valuable insights into how teachers develop perspectives, values, and assumptions, specifically their digital literacy in this context, and how they and leaders navigate and interpret their daily experiences in educational settings. Previous studies consistently support this finding and demonstrate school culture's critical role in shaping teachers' digital literacy across technical, cognitive, and socio-emotional dimensions. According to Litina and Rubene (2024) and Sogalrey et al. (2022), schools emphasizing innovation, providing technological resources, and offering continuous training significantly boost teachers' technical digital literacy. This allows teachers to become proficient in using digital tools, navigating educational software, and integrating technology into

their teaching practices. Regarding cognitive digital literacy, Spiteri and Rundgren's (2020) research asserted that a school culture fostering critical thinking, problem-solving, and collaboration enhances teachers' ability to effectively evaluate, organize, and apply digital information. In schools where intellectual openness, reflection, and professional development are prioritized, teachers are more likely to engage deeply with digital content, making informed pedagogical decisions on integrating technology into their instructional strategies. Confirmed from recent studies that the role of school culture in developing teachers' socio-emotional digital literacy (Karakose et al., 2022; Navaridas-Nalda et al., 2020; Rasdiana et al., 2024; Sogalrey et al., 2022; Timotheou et al., 2023). In schools emphasizing emotional intelligence, respect, and social responsibility, teachers are better prepared to navigate the ethical challenges of digital interactions. A supportive school environment encourages teachers to manage digital communication with care, fostering positive and responsible digital behavior for themselves and their students. Such cultures help teachers build the emotional and social skills to create inclusive and empathetic digital learning spaces.

The second hypothesis (Ho2) result analysis shows that school culture can predict teachers' performance (Ho1). This is indicating school culture influences how teachers work, affecting their planning, instruction, and evaluation. This finding is aligned with previous studies emphasizing its positive impact on teacher performance (Prihatini et al., 2021; Rachman et al., 2023). In more structured, rule-focused environments like bureaucratic and market-oriented cultures, teachers often create detailed lesson plans and focus on measurable outcomes but may feel constrained in their creativity. Previous research found that emphasizing organization, consistency, and adherence to established procedures in a bureaucratic culture helps create a stable learning environment where expectations are clear for teachers and students (Öztürk et al., 2021). On the other hand, in supportive and clan cultures, where relationships and collaboration are key, teachers tend to work together, personalize their teaching, and focus on student growth, making their instruction more adaptable to individual needs. Previous studies found that schools with a supportive, achievement-focused, and task-oriented culture are more effective in fostering professional learning communities that enhance school performance (Tabak and Şahin, 2020). Similarly, clan culture, which emphasizes a family-like environment, has significantly enhanced teacher leadership and overall school performance (Chennatuserry et al., 2022). In innovative and adhocracy cultures, teachers are encouraged to experiment, integrate new technologies, and take creative risks, resulting in dynamic and engaging classrooms. This is also consistent with previous studies (Fuad et al., 2022; Irawati et al., 2023). However, as mentioned, it can be emphasized that a bureaucratic structure can hinder opportunities for creativity and flexibility, preventing teachers from using more innovative digital tools or building deeper socio-emotional connections with students. Although technical digital literacy may develop in such environments, the broader cognitive and socio-emotional aspects—like critical thinking, adaptability, and relationship-building—can be overlooked, diminishing the effectiveness of technology integration and teacher's overall performance.

Furthermore, the third hypothesis (Ho3) result analysis found that teachers'

digital literacy influences teachers' performance. Teachers skilled with technology can craft engaging and interactive lessons that capture students' interest and make learning more exciting. Teachers' digital literacy plays a crucial role in shaping their effectiveness in planning, implementing, and evaluating instruction, mainly through three key areas: technical, cognitive, and socio-emotional digital literacy. Teachers with solid technical digital skills can dive into various online resources and digital tools, allowing them to create engaging lesson plans that connect with students' diverse learning styles. As highlighted by Park and Yoon (2023), digitally savvy teachers can enrich their lessons with captivating content, making learning more interactive and enjoyable for their students. Furthermore, Aravantinos et al. (2024) emphasize that teachers with strong digital literacy can access innovative teaching models and media, enhancing their ability to craft lessons that inform and inspire students. Cognitive digital literacy shines through during instruction as teachers apply critical thinking to integrate technology in ways that encourage student participation and responsiveness. This validates research by Afriliandhi et al. (2022) and Sappaile et al. (2023) shows that teachers who use digital tools can adapt their lessons on the fly, creating a lively classroom environment that meets students' changing needs. Meanwhile, socio-emotional digital literacy allows teachers to build genuine connections with their students, fostering a warm and supportive atmosphere where learners feel appreciated and motivated. This aspect is emphasized in studies by Chennatuserry et al. (2022) and Prihatini et al. (2021), which highlights how important these emotional skills are for cultivating positive digital learning spaces that lead to better student outcomes. Together, these three dimensions of digital literacy enable teachers to craft lessons that resonate with their students, ultimately leading to greater engagement and improved learning results, as shown in the research by Montilla et al. (2023). In essence, when teachers embrace digital literacy, they enhance their teaching practices and create richer, more fulfilling educational experiences for their students.

Lastly, our analysis shows that teachers' digital literacy is a significant mediator of school culture in influencing teachers' performance (Ho4). This indicates that a positive school culture fosters an environment where collaboration, support, and innovation thrive, empowering teachers to enhance their digital skills and effectively integrate technology into their teaching practices. This supportive atmosphere encourages educators to share best practices, engage in professional development, and adopt new digital tools to elevate their instructional methods. For instance, Yogyakarta's private schools have successfully implemented digital literacy initiatives by leveraging local resources and fostering a collaborative culture (Suwarto et al., 2022). This aligns with findings from Reisoğlu (2022), which highlights how a strong school culture significantly enhances professional engagement, leading to more effective teaching practices and improved student motivation and achievement (Montilla et al., 2023).

In schools with a robust culture of collaboration, teachers are more likely to engage in open dialogue about their experiences and challenges with digital tools. This exchange of ideas can lead to collective problem-solving and the development of innovative teaching strategies. This is consistent with research showing that a strong school culture encourages teachers to pursue training and development

opportunities, enhancing their technical digital literacy. For instance, Chennatuserry et al. (2022) emphasize that when teachers are supported by their peers and administration, they are more willing to experiment with various digital resources, leading to improved engagement in their lessons. Additionally, cognitive digital literacy—the ability to critically assess and utilize digital resources—also benefits from a positive school culture that promotes inquiry and continuous learning. In such environments, teachers are encouraged to reflect on their practices and adapt their lessons based on student feedback, which aligns with findings from Prihatini et al. (2021) regarding the impact of reflective practices on educational outcomes. Furthermore, socio-emotional digital literacy, which involves effectively communicating and building relationships with students through digital platforms, is enhanced by a school culture prioritizes emotional well-being and community building. Confirmed by previous studies have shown that teachers who feel valued and supported are better equipped to create warm and inclusive digital learning environments, as suggested by the work of Afriliandhi et al. (2022) and Sappaile et al. (2023). When teachers are emotionally engaged in their work, they are more likely to provide meaningful feedback and support, contributing to a positive classroom atmosphere that enhances student learning.

5.2. Correlation of findings to educational policies

The study underscores the urgency of improving digital literacy among teachers, as current levels are insufficient to enhance the teaching-learning process fully. This gap highlights the need for comprehensive training programs integrating technology with educational strategies and methodologies that drive a paradigm shift. In line with this, the education policies proposed by Fullan (2015) strongly align with our study's hypotheses. Fullan emphasizes that educational policies are vital in cultivating a school culture that promotes teamwork, shared values, and teacher development. This supports Hypothesis 1 (Ho1), which asserts that school culture predicts teachers' digital literacy, with policies fostering collaboration and growth being essential for teachers to build digital skills effectively. Fullan's emphasis on clear expectations and support aligns with Hypothesis 2 (Ho2), suggesting that a positive school culture improves teacher performance by prioritizing collaboration and technological advancement.

Regarding Hypothesis 3 (Ho3), which posits that teachers' digital literacy directly influences their performance, Fullan's perspective further supports the idea that policies encouraging digital skill development are essential for enhancing teaching practices. Literature by Lakkala et al. (2021) and Tabak and Şahin (2020) reinforces this by highlighting how collaborative policies enhance teacher development through Professional Learning Communities (PLCs). Finally, Hypothesis 4 (Ho4) demonstrates that effective policies are necessary to ensure that school culture, alongside teachers' digital literacy, mediates their ability to adapt and perform in various educational contexts, creating richer and more engaging learning experiences. These statements altogether indicate that providing clear guidelines, resources, opportunities for training, and educational policies enables schools to develop a culture where digital literacy is not just an individual endeavor but a

shared goal. This promotes a supportive network where teachers can navigate the complexities of digital tools together, fostering an atmosphere of innovation and continuous improvement.

6. Conclusion

The study confirms that all of our four hypotheses are supported, revealing how pivotal school culture and digital literacy are in shaping teacher performance. We found that a supportive, achievement-oriented, and task-focused school culture significantly boosts teachers' digital literacy ($p < 0.01$). In these nurturing environments, teachers gain valuable skills and resources, enhancing their ability to use technology creatively and effectively. In contrast, more rigid, bureaucratic settings may improve technical skills but can stifle creativity and limit deeper student connections. Additionally, school culture profoundly influences teacher performance ($p < 0.01$), affecting how teachers plan lessons, deliver instruction, and evaluate their students. Supportive and collaborative cultures foster personalized teaching, while innovative environments encourage experimentation and dynamic lesson creation. Teachers' digital literacy further enhances their performance ($p < 0.01$), helping them create engaging lessons, manage their workload efficiently, and adapt their teaching to student needs. Importantly, digital literacy mediates the link between school culture and teacher performance ($p < 0.01$), underscoring its crucial role in aligning teaching practices with cultural values and ultimately improving teaching effectiveness and student outcomes. Overall, this study uniquely highlights the mediating role of teachers' digital literacy in linking school culture to teacher performance. Our findings show that a supportive school culture enhances teachers' technical, cognitive, and socio-emotional digital skills, enabling them to integrate technology more effectively into their teaching and improve student outcomes. However, in bureaucratic environments, the focus on structure may hinder creativity and deeper socio-emotional connections with students.

Implication for theory and practitioner

This study sheds light on the vital role of integrating digital literacy into our understanding of school culture. It shows how different aspects of school culture—whether supportive, bureaucratic, or innovative—shape and enhance teachers' digital literacy and performance. This new perspective adds depth to existing theories, emphasizing that school culture does not just influence but actively boosts digital literacy, which is essential for meeting today's educational challenges. This shift in understanding calls for updating our school culture models to include digital literacy, ensuring they reflect and support modern educational needs.

The findings also highlight the need for school leaders and policymakers to cultivate a positive and forward-thinking school culture to boost teachers' digital literacy. Creating an environment that fosters collaboration, creativity, and technological experimentation is crucial. Professional development should go beyond technical training, addressing digital literacy's cognitive and emotional aspects. Investing in these supportive frameworks can enhance teacher performance and, in turn, enrich student engagement and learning experiences. Developing

targeted interventions to improve digital literacy in various school settings will also be necessary. This approach will help tailor programs to diverse educational environments and make them more effective in enhancing teaching and learning.

7. Limitation

There are a few limitations to keep in mind with this study. First, while Partial Least Squares Structural Equation Modeling (PLS-SEM) is excellent for exploring complex relationships and predicting outcomes, it might not capture every detail of how school culture impacts teachers' digital literacy and performance. The model's assumptions and the risk of overfitting could affect the results' reliability. Additionally, the study's small sample size and focus on a specific region in Indonesia mean the findings might not apply to other areas or educational contexts. This narrow focus could limit how broadly we can generalize the results. Furthermore, the bureaucratic culture is a critical aspect that needs to be addressed broadly regarding what aspects can be useful, as it hinders creativity and deeper socio-emotional connections. To get a fuller picture, future research should involve more extensive, more diverse samples and consider different methods to explore these relationships more comprehensively.

8. Implication for future work

Based on our findings, several implications for future research emerge. Firstly, there is a need to delve deeper into the nuanced dynamics of digital leadership and its impact on teacher innovation for sustainable technology integration, considering contextual factors and cultural variations. Comparative studies across diverse educational contexts could provide valuable insights into the generalizability of findings and inform culturally responsive leadership practices. Additionally, longitudinal studies tracking the long-term effects of leadership interventions and PLC initiatives on teacher innovation skills for sustainable technology integration could offer a more comprehensive understanding of causal relationships over time.

Furthermore, intervention studies evaluating the effectiveness of specific leadership strategies or PLC interventions in promoting teacher innovation skills are warranted. By implementing controlled interventions and rigorously assessing their impact, researchers can provide evidence-based recommendations for educational leaders seeking to enhance technology integration in schools. Mixed-methods approaches combining quantitative analyses with qualitative methods also offer a more comprehensive understanding of the mechanisms underlying the relationship between leadership, collaboration, and innovation in educational settings. By addressing these research gaps, scholars can advance our understanding of the complex interplay between leadership, collaboration, and innovation in technology integration, ultimately contributing to developing effective strategies for enhancing sustainable teaching and learning outcomes in schools.

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