International Journal of Educational Technology Research (IJETR)
Vol.3, No.3 September, 2025: 560-575

The Influence of Principal's Digital Leadership, Teacher Competence, and Availability of Facilities nd Infrastructure on the Quality of Public Senior High School Education in Pelalawan Regency

Kasmadi[1*], Nurtanio Agus Purwanto[2]
Universitas Negeri Yogyakarta
Corresponding Author: Kasmadi: kasmadi.2024@student.uny.ac.id

A R T I C L E I N F O
Keywords: Digital Leadership, Teacher Competence, Facilities And Infrastructure, Education Quality, Senior High School

Received : 12, July
Revised : 25, August
Accepted: 20, September

A B S T R A C T
This study analyzes the effects of digital leadership by school principals, teacher competence, and the availability of facilities and infrastructure on the educational quality of state senior high schools in Pelalawan Regency. A quantitative ex post facto design was employed, with a population of 214 teachers and a sample of 138 selected via proportional random sampling. Data were collected using questionnaires validated for content and reliability (Cronbach's α = 0.961–0.983) and analyzed through multiple linear regression. Descriptive results revealed mean scores of 24.62 (38.49 %) for educational quality, 24.63 (38.50 %) for digital leadership, 22.48 (35.14 %) for teacher competence, and 26.29 (41.09 %) for facilities and infrastructure. Partial tests indicated significant effects of digital leadership (β = 0.150; t = 2.373; p = 0.019), teacher competence (β = 0.294; t = 4.097; p < 0.001), and facilities and infrastructure (β = 0.520; t = 9.162; p < 0.001) on educational quality. The simultaneous test yielded F = 160.838 (p < 0.001) and R^2 = 0.783, indicating that these three variables collectively explain 78.3 % of the variance in educational quality. Further research should explore external factors such as student characteristics and parental support to enhance the predictive model and broaden the generalizability of these results across diverse educational contexts.

DOI : https://doi.org/10.59890/ijetr.v3i3.127
ISSN-E: 3025-7131
https://ntlmultitechpublisher.my.id/index.php/ijetr

INTRODUCTION

Digital transformation in education is recognized as a complex phenomenon requiring not only visionary leadership but also highly competent teachers and the provision of adequate infrastructure. In the context of Pelalawan Regency, persistent challenges in improving the quality of public senior high schools are reflected in uneven school accreditation and the struggle to attain international standards (Hamzah et al., 2021). As highlighted by Zhu et al. (2024), these disparities necessitate comprehensive strategies that bridge managerial, pedagogical, and infrastructural gaps to elevate educational performance. Particularly, the digital leadership of school principals has become a pivotal factor as schools strive to systematically integrate technology into both management and classroom practices, serving as the axis for broader educational change (Hidayat et al., 2024). Pribadi et al. (2024) further emphasize that effective digital leadership shapes organizational culture and learning environments, fostering readiness for digital adaptation. Therefore, understanding how principal's digital leadership, teacher competence, and infrastructure collectively influence school quality is critical for addressing educational challenges in Pelalawan Regency. Synthesizing these perspectives, it is evident that a multi-dimensional approach is essential to promote a holistic and sustainable improvement in the quality of public senior high school education.

The pursuit of improved educational quality in Pelalawan Regency is intrinsically linked to the digital leadership competencies demonstrated by school principals (Saeed & Kang, 2024). As Pribadi et al. (2024) have observed, principals who effectively model digital leadership foster environments that encourage the adoption and integration of digital technologies across all aspects of school operations. This includes not only the implementation of digital communication platforms but also the facilitation of ongoing professional development for teachers, both of which are essential for maintaining institutional adaptability (Hidayat et al., 2024). Alam et al. (2023) highlight that digital leadership also involves building collaborative cultures, which enable teachers and staff to jointly solve problems and innovate in pedagogical practice. Principals with robust digital leadership abilities inspire teachers and students alike to embrace digital innovations, serving as catalysts for school-wide transformation (Affan, 2024). Hu (2023) demonstrates that such leadership contributes significantly to school climate and educational quality, especially when embedded in strategic management. In summary, strong digital leadership among principals is not just a management imperative but a key determinant of how effectively educational innovations are adopted, ultimately influencing overall school quality within Pelalawan Regency.

Equally vital within this equation is the dimension of teacher competence, particularly with regard to digital literacy and instructional innovation (Sunu, 2022). Alam et al. (2023) underscore that the digital capabilities of teachers directly determine their effectiveness in the classroom, shaping both instructional strategies and the quality of student learning outcomes. Numerous studies, such as those by B et al. (2023), emphasize that increasing teacher digital literacy enables more effective integration of technology into the curriculum, thereby

supporting transformative learning models suited for today's dynamic educational landscape. Hu (2023) further highlights that well-prepared and digitally competent teachers are better able to adapt their teaching approaches to diverse student needs, fostering greater engagement and learning achievement. Moreover, Nurshinta et al. (2024) note that the combination of strong teacher competence and digital leadership from school principals triggers systematic and sustainable improvements within the school ecosystem. Ultimately, a coordinated effort to enhance teacher digital competence not only elevates instructional quality but also mitigates the negative impacts of accreditation disparities and resource gaps, creating a foundation for more equitable and effective education in Pelalawan Regency.

Furthermore, the presence and quality of physical resources within schools—such as laboratories, information and communication technology (ICT) facilities, and libraries—are indispensable in constructing a supportive learning environment (Dwiyono et al., 2024). The availability and accessibility of such infrastructure are key indicators of a school's commitment to educational excellence, serving not only the academic but also the developmental needs of students. Pandey et al. (2023) argue that resource disparities among schools, especially in technology and facility allocation, amplify existing inequalities and undermine efforts to meet both national and international educational standards. Zhang et al. (2023) support this view by demonstrating how equitable access to educational technology contributes to a fairer distribution of learning opportunities and helps close achievement gaps linked to socioeconomic backgrounds. In Pelalawan Regency, such resource imbalances remain a pressing concern and directly influence the capacity of schools to deliver high-quality, technology-enabled education. Collectively, the literature indicates that comprehensive improvement in facilities and infrastructure is not simply a logistical necessity but a fundamental pillar for achieving sustained educational progress and equitable outcomes for all students.

In analyzing the interconnectedness of principal's digital leadership, teacher competence, and facility availability in Pelalawan Regency, it becomes apparent that these elements exert both independent and synergistic effects on educational quality (Torlak & Kuzey, 2019). Empirical studies, such as those by Xie & Wang (2023), reveal that collaborative leadership models—where teachers are actively engaged in school decision-making—significantly enhance job satisfaction and overall instructional effectiveness. Ming & Mansor (2024) also highlight that empowering teachers through participative leadership strengthens their commitment and facilitates innovation within the classroom. Howard & Dhillon (2021) add that when strong digital leadership is combined with highly competent staff and robust resources, the adoption of educational technology becomes more seamless, directly benefitting student engagement and achievement. Hidayat et al. (2024) further note that this interplay is especially crucial in regions facing uneven distribution of resources, such as Pelalawan Regency, where collaborative approaches can bridge gaps between policy and practice. Thus, the effective integration and interaction of these factors constitute

the backbone of educational improvement strategies in digital transformation contexts, underscoring the need for holistic analysis and targeted interventions.

The convergent findings from the existing literature on digital leadership, teacher competence, and educational infrastructure affirm their central roles in driving the quality of public senior high school education in Pelalawan Regency (Zhu et al., 2024). As noted by Asirit (2023), fostering an environment where digital leadership is prioritized enables principals and educators to respond proactively to the demands of the digital era, while simultaneously supporting teachers in their professional development. Wahyudi (2019) underscores the importance of aligning school management strategies with the broader goals of digital transformation to ensure that technology is leveraged effectively to enhance institutional performance. Muspawi (2020) further points out that high-quality educational outcomes are achieved when strong leadership, competent teaching, and adequate facilities are present and harmoniously integrated within the school system. Pramono & Rahman (2024) emphasize the need for context-sensitive approaches that consider regional challenges, resource disparities, and local policy priorities. Altogether, these studies suggest that addressing the intertwined factors of leadership, competence, and infrastructure will not only improve current educational standards but also create a resilient and adaptive system that can support continuous innovation and improvement in Pelalawan's public high schools.

This study is therefore designed to systematically examine the effects of principals' digital leadership, teacher competence, and the availability of facilities and infrastructure, both individually and in combination, on the quality of education in public senior high schools in Pelalawan Regency (Muspawi, 2020; Wiguna, 2023; Umar et al., 2024). By employing a multiple regression approach, this research aims to provide a holistic perspective on how these critical variables interact to shape educational quality, particularly amid the ongoing digital transformation. Pramono & Rahman (2024) highlight the importance of developing adaptive and evidence-based educational policies that address regional disparities in resources and human capital. Ramidi & Hikmah (2024) further suggest that research findings in this area can serve as strategic references for local stakeholders—such as policymakers, school leaders, and teachers—in designing and implementing effective quality improvement programs. Ultimately, the integration of digital leadership, teacher competence, and educational infrastructure is expected to serve as a catalyst for continuous quality enhancement in Pelalawan's public high schools, offering pathways to more equitable and future-ready education for all students in the region.

METODE

Research Design

This study employed a quantitative approach with an ex post facto design, since all data analyzed had already occurred at the time of sampling. The relationships among three independent variables—school principals' digital leadership (X_1), teacher competence (X_2), and the availability of facilities and infrastructure (X_3)—and educational quality (Y) were tested through multiple

linear regression, as recommended by Sugiyono for multi-predictor analysis on a single criterion variable.

Research Location and Period

The study was conducted at nine public senior high schools (SMA Negeri) scattered across Pelalawan Regency, Riau Province. The selection of locations considered diversity in leadership, teacher competence, and facility conditions. Data collection took place from February to June 2025, covering the stages of coordination, instrument trials, questionnaire distribution, document verification, and data analysis.

Population and Sampling Technique

The population comprised 214 permanent teachers (both civil servants and PPPK) in all public senior high schools in Pelalawan Regency. The sample size was determined to be 138 teachers using the Isaac & Michael formula at a 5% significance level, then selected through proportional random sampling to represent the teacher distribution at each school.

Variables and Operational Definitions

Educational Quality (Y)

The result of teacher assessments regarding the design, process, evaluation, and learning outcomes of students.

School Principals' Digital Leadership (X_1)

The ability to integrate ICT in management, supervision, and instructional innovation.

Teacher Competence (X_2)

Pedagogical, professional, social, and personal skills in accordance with national educator standards.

Availability of Facilities and Infrastructure (X_3)

The completeness and quality of classrooms, laboratories, libraries, and learning media. All operational definitions and indicators were adapted into a four-level Likert questionnaire.

Instruments and Data Collection

Primary data were obtained using closed questionnaires developed based on the indicators for each variable. Secondary data regarding school facilities were collected through documentation and verified by field observations.

Instrument Validity and Reliability Tests

Construct validity was verified by two education experts; item validity was tested using the Product-Moment correlation with N = 30 pilot teachers, with an r table cut-off of 0.361 at $\alpha = 0.05$. Reliability was measured using Cronbach's Alpha, yielding coefficients of 0.961 (X_1), 0.983 (X_2), 0.976 (X_3), and 0.979 (Y), all greater than 0.600, thus declared reliable.

Data Analysis Techniques

Prior to regression analysis, the data were tested for normality (Kolmogorov–Smirnov), multicollinearity (VIF & Tolerance), and heteroscedasticity (Glejser) to ensure fulfillment of classical assumptions. The multiple regression model was formulated as $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$, with t-tests (partial) and F-tests (simultaneous) at $\alpha = 0.05$, as well as the coefficient of determination (R^2) to measure the explanatory power of the independent variables.

RESULT

Descriptive Statistics of Research Variables

The summary of descriptive statistics reveals the distribution of scores for four variables among 138 teacher respondents. The Principal's Digital Leadership (X1) recorded a minimum score of 16, a maximum of 64, a mean of 24.63, and a standard deviation of 8.89. This average only reaches 38.5% of the theoretical maximum score, placing the digital leadership category in the low range. Teacher Competence (X2) shows a mean of 22.48 and a standard deviation of 7.74; the percentage of 35.14% confirms that competence remains at a low level. The Availability of Facilities and Infrastructure (X3) has a mean of 26.29 and a standard deviation of 8.71; a percentage of 41.09% places it in the medium category. The Quality of Education (Y) obtains a mean of 24.62 and a standard deviation of 8.36, with a percentage of 38.49% confirming that the overall quality remains low. The relatively high standard deviation in all variables indicates heterogeneity of teachers' perceptions and highlights the need for differential interventions at each educational unit.

Partial Influence Analysis (t-Test)

The coefficients of multiple linear regression confirm the positive effect of each predictor on the quality of education. X1 contributes 0.150 with a t-value of 2.373 ($p = 0.019$); although its effect is the smallest, digital leadership remains significant, indicating that enhancing the school principal's digital vision has a direct impact on learning services. X2 provides a coefficient of 0.294 with a t-value of 4.097 ($p < 0.001$), almost double the strength of X1, confirming the importance of professional training and technological literacy for teachers. X3 demonstrates the largest coefficient, 0.520 with a t-value of 9.162 ($p < 0.001$). This interpretation means every unit increase in the completeness of facilities raises quality by nearly half a point, reflecting the dependence of learning quality on an adequate physical and digital environment. Overall, the t-test proves that all three variables play a significant role, but the magnitude of their effects varies and suggests a priority order for intervention.

Simultaneous Influence Analysis (F-Test and R^2)

The ANOVA test produces an F-value of 160.838, which far exceeds the F-table value of 2.67 with a significance of 0.000. This result confirms that the combination of X1, X2, and X3 simultaneously has a real impact on the quality of education. The R value of 0.885 and R Square of 0.783 show that 78.3% of the variance in educational quality can be explained by the model; the remaining 21.7% originates from external factors such as regional policy or student characteristics. The standard error of the estimate is 3.94, indicating sufficient prediction accuracy. Statistically, this model is feasible as a basis for policy formulation because it meets strong criteria for significance and goodness of fit. The category of each variable at the item level is consistent—the majority of X1 and X2 items are low and a mix of medium-low for X3 and Y—so the inferential pattern is reflected across all sample schools.

DISCUSSION

The quality of education in Pelalawan Regency remains critically low, as reflected in persistently below-standard school performance scores, highlighting a combination of systemic issues including insufficient digital innovation, underdeveloped teacher competence, and inadequate educational facilities (Gupta et al., 2022; Yangambi, 2023; Wahyudi, 2019). These interrelated factors are exacerbated by disparities in resource allocation, which create significant inconsistencies among schools within the region (Muspawi, 2020). Furthermore, limitations in digital infrastructure hinder the integration of technology in classrooms, ultimately restricting the advancement of pedagogical practices and student learning outcomes (Pramono & Rahman, 2024). Notably, the high variability in educational quality underscores the need for systemic intervention and equitable support to bridge these gaps (Tolulu et al., 2023). The findings strongly indicate that unless there is a collaborative effort focusing on improving digital leadership, teacher competence, and the availability of educational resources, disparities will persist, undermining educational equity across the regency. Therefore, comprehensive strategies must prioritize both targeted infrastructure development and professional capacity building to drive sustainable improvements in education quality in Pelalawan Regency, ensuring all schools can meet national and international benchmarks.

A pivotal determinant shaping educational quality in Pelalawan Regency is the digital leadership demonstrated by school principals, which, according to multiple studies, remains inadequately developed (Sutrisno et al., 2023; Muspawi, 2020; Wahyudi, 2019). Despite the crucial role of principals in integrating technology within school administration and instructional processes, evidence shows that their digital leadership capacity often falls short, limiting the effectiveness of technology adoption in schools (Pramono & Rahman, 2024). Targeted professional development and leadership training are thus identified as urgent needs, as such initiatives can significantly enhance principals' competencies in digital management (Yap et al., 2022). It has been demonstrated that when school leaders are equipped with robust digital skills, they can foster a culture of innovation and adaptability, which cascades throughout the school community (Triyunita et al., 2025). However, the low mean scores in principal digital leadership further emphasize the necessity for systematic interventions that address both skill gaps and the institutional support structures needed for effective implementation. Therefore, the elevation of digital leadership must be prioritized as a foundational step toward enabling broader educational transformation and maximizing the impact of technology-driven initiatives in public senior high schools throughout Pelalawan Regency.

Teacher competence emerges as a central factor in determining the overall quality of education, with substantial evidence indicating that many teachers in Pelalawan Regency continue to struggle with both digital literacy and innovative instructional strategies (Gupta et al., 2022; Chen et al., 2024; Wiguna, 2023). The regression analysis highlights the strong influence of teacher competence on education quality, with a coefficient of 0.294 and a significant t-value, underscoring the critical need for enhanced professional development (Ramidi

& Hikmah, 2024). Notably, teachers who possess advanced digital skills and are adept at creating engaging, student-centered learning environments contribute significantly to improved learning outcomes (Tendo-Bugondo et al., 2023). Conversely, the current low average competence score, alongside wide disparities among teachers, signals persistent gaps in adaptation to technological change and modern pedagogical demands (Pirera et al., 2024). These findings validate the urgent necessity for comprehensive training programs, regular mentoring, and continuous capacity-building initiatives specifically designed to elevate teacher proficiency in both conventional and digital domains. Strengthening teacher competence, particularly through technology-integrated pedagogies, thus stands as a decisive element for transforming the educational landscape and boosting school performance in Pelalawan Regency.

The availability and quality of educational facilities and infrastructure stand out as the most dominant factors influencing education quality in Pelalawan Regency, as evidenced by the highest regression coefficient among all variables studied (Yangambi, 2023; Tolulu et al., 2023; Pirera et al., 2024). Many schools still lack fundamental physical and digital resources such as laboratories, ICT devices, and representative classrooms, directly constraining both teaching effectiveness and student engagement (Umar et al., 2024). Disparities in infrastructure distribution perpetuate inequities in educational experiences, particularly between well-resourced and under-resourced schools, which ultimately manifests in uneven student achievement and motivation (Werang et al., 2024). The empirical data highlight that schools with more comprehensive facilities consistently record higher academic performance and improved learning environments (Huang et al., 2023). These observations collectively underscore the urgent need for a policy focus on equitable infrastructure development and resource allocation to address persistent gaps and promote educational parity. Thus, prioritizing the sustainable and balanced provision of educational facilities is indispensable for supporting systemic improvements and advancing the quality of public senior high school education across the regency.

Simultaneous analysis through regression and F-test confirms that the collective influence of principal digital leadership, teacher competence, and the availability of facilities and infrastructure accounts for the majority of variations in educational quality, with an R Square value reaching 0.783 (Wahyudi, 2019; Muspawi, 2020; Pramono & Rahman, 2024). This high explanatory power signifies that targeted improvements in any of these core areas can yield significant enhancements in school performance if managed synergistically (Nduta et al., 2024). However, the data also reveal substantial variation in school readiness and adaptability, suggesting that one-size-fits-all interventions may not be effective across all contexts (Le et al., 2021). Differentiated strategies that consider each school's unique needs, strengths, and resource gaps are thus essential for maximizing the impact of policy and programmatic initiatives (Widodo et al., 2024). By fostering integrated and context-sensitive interventions, stakeholders can optimize the contributions of leadership, teacher quality, and infrastructure to advance equitable education outcomes. Therefore, comprehensive reform efforts must emphasize both the synergy and specificity

of these variables to ensure sustained improvement in the quality of public senior high school education in Pelalawan Regency.

The prioritization of infrastructure development and the equitable distribution of educational resources emerges as a foundational strategy, forming the basis for subsequent efforts to enhance teacher competence and strengthen principals' digital leadership (Hasan & Hosen, 2022; Villegas-Ch et al., 2020; Istakri et al., 2024). Empirical findings highlight that investments in educational facilities yield immediate improvements in learning environments, thus providing a platform upon which further capacity-building initiatives can be effectively implemented (Bentri & Hidayati, 2023). When infrastructure development is synchronized with targeted teacher training and leadership support, the resulting synergy can significantly accelerate progress toward higher educational standards (Astuti et al., 2021). Policymakers are thus encouraged to design comprehensive action plans that allocate resources proportionally across these interdependent domains, ensuring no single aspect is overlooked in the drive for quality improvement (Rawung et al., 2023). This integrative approach not only addresses performance disparities among schools but also paves the way for a more robust, adaptive, and inclusive education system that benefits all students in Pelalawan Regency. In conclusion, a staged yet interconnected reform strategy is essential for the realization of sustainable educational advancement in the region.

A consolidated strategy addressing all three critical factors—digital leadership, teacher competence, and facility adequacy—is essential for fostering a fair and high-quality educational environment across Pelalawan Regency (Jin-lian & Ma, 2022; Tallo et al., 2024; Fraile et al., 2018). The research findings indicate that improvements in just one area are unlikely to produce sustained or widespread advancements unless they are complemented by parallel efforts in the other domains (ElSayary, 2023). For example, the introduction of advanced technology in schools is most effective when principals possess strong digital leadership and teachers are adept in both digital literacy and innovative pedagogical methods (Yopi, 2024). Conversely, even the most competent educators and visionary leaders will face limitations if physical infrastructure and learning resources remain suboptimal (Norhagen et al., 2024). Such interconnectedness necessitates a holistic approach, integrating facility upgrades with professional development and leadership training to bridge existing gaps and enhance learning outcomes (Astuti & Setiawan, 2023). Ultimately, only through a comprehensive and simultaneous improvement of these components can the region expect to realize meaningful and equitable progress in educational quality.

The present study reveals that digital leadership among principals exerts a significant, though relatively moderate, impact on educational quality, as reflected by a regression coefficient of 0.150 and a t-value of 2.373 ($p = 0.019$) (Muspawi, 2020; Wahyudi, 2019; Triyunita et al., 2025). Principals capable of leveraging digital tools in management, supervision, and communication foster a more innovative and responsive learning environment (Pramono & Rahman, 2024). The adaptation of information technology—such as Learning Management

Systems and digital administration—streamlines school operations, encourages data-driven decision-making, and enables flexible instructional delivery (Sutrisno et al., 2023). However, the overall digital leadership score remains low, with an average of only 24.63 or 38.5% of the maximum, emphasizing a critical need for targeted leadership development and institutional support (Yap et al., 2022). These findings affirm that strengthening the digital leadership capacity of principals should be prioritized as an essential precondition for responsive and adaptive education management. By focusing on digital leadership, schools can be better positioned to navigate global and technological changes, ultimately driving sustained improvements in educational quality across the region.

Teacher competence remains a decisive determinant of educational quality, exhibiting the strongest influence among the variables studied, as indicated by a regression coefficient of 0.294 and a highly significant t-value ($p < 0.001$) (Wiguna, 2023; Ramidi & Hikmah, 2024; Triyunita et al., 2025). Despite its pivotal role, the mean competence score among teachers stands at only 22.48 or 35.14% of the maximum, highlighting substantial gaps in pedagogical, professional, social, and personal domains (Pirera et al., 2024). Teachers who are digitally literate and capable of developing interactive learning media are instrumental in elevating student engagement and achievement, whereas those reliant on conventional methods often lag behind (Tendo-Bugondo et al., 2023). The marked variation in teacher competence, as shown by high standard deviation values, underscores the necessity for continuous and differentiated professional development, mentorship, and technology-based training initiatives (Sumarni et al., 2023). Thus, bridging these competency gaps is fundamental for optimizing teaching effectiveness and preparing students for the evolving demands of 21st-century education. In summary, comprehensive capacity building and support for teachers are vital to achieving systemic and sustainable educational quality improvement in Pelalawan Regency.

The role of adequate facilities and infrastructure is unequivocally confirmed as the most dominant factor affecting education quality in Pelalawan Regency, as revealed by a regression coefficient of 0.520 and a t-value of 9.162 ($p < 0.001$) (Tolulu et al., 2023; Pirera et al., 2024; Umar et al., 2024). With an average score of just 26.29 or 41.09% of the maximum, most schools still face considerable shortages in essential physical and digital infrastructure, which hampers effective teaching, student engagement, and overall learning outcomes (Yangambi, 2023). Facilities such as laboratories, up-to-date ICT devices, libraries, and conducive classrooms play a crucial role in supporting modern pedagogical approaches and fostering innovation (Werang et al., 2024). Schools equipped with such resources consistently deliver better learning experiences, stimulate student motivation, and enable the adoption of diverse instructional models (Huang et al., 2023). In contrast, disparities in resource availability perpetuate educational inequality across the regency. Therefore, a strategic commitment to the sustainable development and equitable distribution of facilities and infrastructure is a necessary precondition for achieving high and consistent educational quality in all public senior high schools in Pelalawan Regency.

From a statistical modeling perspective, the determination coefficient (R Square) of 0.783 illustrates that 78.3% of the variation in education quality is collectively explained by principal digital leadership, teacher competence, and the availability of facilities and infrastructure (Wahyudi, 2019; Muspawi, 2020; Pramono & Rahman, 2024). The remaining 21.7% is attributable to other factors, such as local policy support, community involvement, or student backgrounds, which, while not directly analyzed in this study, should not be underestimated in future research and interventions (Nduta et al., 2024). The F-test value of 160.838 ($p = 0.000$) strongly reinforces the critical contribution of the three main variables in determining the quality of education, suggesting that policy and strategic interventions in these areas will deliver measurable improvements (Le et al., 2021). Practical implications highlight the importance of simultaneous and integrated management of leadership, teacher development, and infrastructure investment to maximize their synergistic effect (Widodo et al., 2024). Therefore, for quality improvement programs to succeed, it is essential that all stakeholders foster intersectoral collaboration and tailor interventions to local needs, ensuring that improvements are not only widespread but also sustainable in the context of Pelalawan Regency.

In summary, this study's findings make a substantive contribution to evidence-based educational policy in Pelalawan Regency, clearly demonstrating that the integrated advancement of facilities and infrastructure, teacher competence, and principals' digital leadership is key to systemic quality improvement (Wiguna, 2023; Ramidi & Hikmah, 2024; Triyunita et al., 2025). The strength of the regression model—with an R Square of 0.783—emphasizes that nearly 80% of quality improvement can be attributed to coordinated efforts in these three domains, supported by robust empirical data from the field (Tolulu et al., 2023). To maximize impact, local education authorities must align intervention strategies with school-specific needs, regularly monitor and evaluate progress, and facilitate collaborative engagement across all levels of the education system (Pirera et al., 2024). Ensuring that infrastructure upgrades, teacher professional development, and leadership training are addressed in tandem will allow for the closing of persistent gaps and the realization of a globally competitive education standard (Astuti & Setiawan, 2023). Thus, synergy between physical infrastructure, human resource capacity, and innovative leadership constitutes the foundation for achieving sustained excellence and equity in public senior high school education throughout Pelalawan Regency.

CONCLUSION

This study empirically demonstrates that the quality of public senior high school education in Pelalawan Regency remains relatively low, as reflected in the average education quality score of 24.62, or only 38.49% of the maximum score. Multiple linear regression analysis shows that the principal's digital leadership, teacher competence, and the availability of educational infrastructure have a significant influence—both partially and simultaneously—on education quality. The principal's digital leadership has a regression coefficient of 0.150 and a t-value of 2.373 ($p = 0.019$), indicating that integrating

technology into school management can significantly drive quality improvement. Teacher competence shows an even stronger effect, with a coefficient of 0.294 and a t-value of 4.097 ($p < 0.001$), underscoring the importance of ongoing professional development and teachers' digital literacy to support innovative learning processes. The availability of infrastructure emerges as the most dominant factor, with a coefficient of 0.520 and a t-value of 9.162 ($p < 0.001$), highlighting that the completeness of both physical and digital infrastructure is the main foundation for creating a conducive learning environment.

The simultaneous test produced an F-value of 160.838 ($p = 0.000$) and an R Square value of 0.783, meaning that 78.3% of the variation in education quality is explained by these three variables, while the remaining 21.7% is influenced by external factors. The order of influence shows that educational infrastructure serves as the primary foundation, teacher competence acts as an accelerator, and digital leadership serves as the main driver of school transformation. These findings affirm that strategies to improve education quality must be implemented in an integrated and continuous manner, emphasizing the synergy between facility development, teacher professionalism, and the strengthening of principals' digital leadership capacity. This integrative model can boost education quality by nearly 80% and may serve as a reference for policymakers in designing adaptive, contextual, and needs-oriented interventions for schools.

REFERENCE

Affan, M. (2024). Requirements for digital leadership implementation in indonesian. Journal of Educational and Human Sciences, 33. https://doi.org/10.33193/jeahs.33.2024.464

Alam, S., Badeni, B., Kristiawan, M., & Yanti, F. (2023). Implementation of transformational leadership on the performance of paud teachers in the digital era. Jurnal Obsesi Jurnal Pendidikan Anak Usia Dini, 7(6), 6654-6665. https://doi.org/10.31004/obsesi.v7i6.5417

Asirit, L. (2023). Investigating the interplay of raat leadership qualities in shaping school leadership competence in the bani landscape. International Journal of Educational Management and Development Studies, 4(4), 186-215. https://doi.org/10.53378/353031

Astuti, K. and Setiawan, A. (2023). Fostering teacher's digital competencies and innovative work behavior in facing merdeka belajar policy: digital informal learning as a mediator. International Journal of Educational Research & Social Sciences, 4(2), 288-295. https://doi.org/10.51601/ijersc.v4i2.619

Astuti, M., Arifin, Z., Mutohhari, F., & Nurtanto, M. (2021). Competency of digital technology: the maturity levels of teachers and students in vocational education in indonesia. Journal of Education Technology, 5(2). https://doi.org/10.23887/jet.v5i3.35108

B, A., Bachtiar, A., Guntoro, G., Riyantie, M., & Ridwan, N. (2023). The role of leadership in digital transformation management in organisations. Jurnal Minfo Polgan, 12(1), 1306-1314. https://doi.org/10.33395/jmp.v12i1.12731

Bentri, A. and Hidayati, A. (2023). Improving digital pedagogy competence through in- service training for elementary school teacher. Journal of Physics Conference Series, 2582(1), 012064. https://doi.org/10.1088/1742-6596/2582/1/012064

Chen, A., Li, W., & Fu, W. (2024). Unleashing digital superheroes: unravelling the empathy factor in digital competence and online teacher autonomy support. British Journal of Educational Technology, 55(4), 1790-1810. https://doi.org/10.1111/bjet.13433

Chen, B., Zhang, H., Wong, C., Chen, X., Li, F., Wei, X., … & Shen, J. (2024). Research on the spatial distribution characteristics and influencing factors of educational facilities based on poi data: a case study of the guangdong–hong kong–macao greater bay area. Isprs International Journal of Geo-Information, 13(7), 225. https://doi.org/10.3390/ijgi13070225

Dwiyono, G., Purnomo, P., Sutadji, E., & Devi, M. (2024). The investigation of the influence of leadership, work environment, and motivation on teacher performance on the quality of vocational school education. Evolutionary Studies in Imaginative Culture, 1459-1477. https://doi.org/10.70082/esiculture.vi.1543

ElSayary, A. (2023). The impact of a professional upskilling training programme on developing teachers' digital competence. Journal of Computer Assisted Learning, 39(4), 1154-1166. https://doi.org/10.1111/jcal.12788

Hasan, M. and Hosen, Z. (2022). Influence of university service quality on student satisfaction and loyalty in bangladesh. The Journal of Quality in Education, 12(19), 169-181. https://doi.org/10.37870/joqie.v12i19.319

Hidayat, R., Patras, Y., & Mulyawati, Y. (2024). Digital leadership and professional commitment to enhance teacher innovativeness as a priority strategy. International Journal of Learning Teaching and Educational Research, 23(10), 252-271. https://doi.org/10.26803/ijlter.23.10.12

Howard, C. and Dhillon, J. (2021). Outstanding primary leadership in times of turbulence. Education Sciences, 11(11), 714. https://doi.org/10.3390/educsci11110714

Hu, J. (2023). Principals digital leadership: connotation structure, development status, and improvement path. Lecture Notes in Education Psychology and Public Media, 12(1), 16-23. https://doi.org/10.54254/2753-7048/12/20230769

Huang, Q., Cui, X., & Ma, L. (2023). The equity of basic educational facilities from the perspective of space. Sustainability, 15(15), 12031. https://doi.org/10.3390/su151512031

Istakri, D., Sofyan, H., & Ismail, I. (2024). Infrastructure management for improved learning outcomes: insights from junior high schools in southwest aceh, indonesia. J. Educ. Manag. Learn., 2(1), 20-27. https://doi.org/10.60084/jeml.v2i1.169

Jin-lian, H. and Ma, H. (2022). Spatial heterogeneity of public service facilities in the living circle and its influence on housing prices: a case study of central urban dalian, china. Land, 11(7), 1095. https://doi.org/10.3390/land11071095

Le, T., Nguyen, V., Nguyen, T., Le, T., & Duong, T. (2021). Assessment of students' satisfaction of facility service quality in private universities. Universal Journal of Educational Research, 9(5), 974-983. https://doi.org/10.13189/ujer.2021.090510

Ming, G. and Mansor, M. (2024). Unveiling digital leadership: exploring models and theories. South Asian Journal of Social Sciences and Humanities, 5(4), 1-17. https://doi.org/10.48165/sajssh.2024.5401

Muspawi, M. (2020). Strategi Menjadi Kepala Sekolah Profesional. Jurnal Ilmiah Universitas Batanghari Jambi, 20(2), 402. https://doi.org/10.33087/jiubj.v20i2.938

Nduta, B., Itegi, F., & Muchanje, P. (2024). Influence of management of physical facilities on quality of education in selected private universities in kenya. Journal of Education and Practice, 8(3), 26-35. https://doi.org/10.47941/jep.1919

Norhagen, S., Krumsvik, R., & Røkenes, F. (2024). Developing professional digital competence in norwegian teacher education: a scoping review. Frontiers in Education, 9. https://doi.org/10.3389/feduc.2024.1363529

Pandey, J., Majumdarr, S., Hassan, Y., & Benuyenah, V. (2023). Role of digital leadership capability in shaping it innovation. Journal of Global Information Management, 31(8), 1-20. https://doi.org/10.4018/jgim.333168

Pirera, C., Xanderina, M., Patimah, Y., & Parhusip, J. (2024). Analisis Penggunaan Teknologi Informasi Sebagai Sumber Belajar. informatech, 1(2), 225-232. https://doi.org/10.69533/nnkz3218

Pramono, D. and Rahman, G. (2024). Manajemen Pembelajaran untuk Meningkatkan Mutu Pendidikan di SMA Negeri Bandarkedungmulyo Jombang. Mozaic Islam Nusantara, 10(2), 129-142. https://doi.org/10.47776/mozaic.v10i2.1391

Pribadi, L., Nurdin, D., & Edy, S. (2024). Digital leadership in improving teacher performance during the covid-19 pandemic. International Journal of Humanities Education and Social Sciences (Ijhess), 3(4). https://doi.org/10.55227/ijhess.v3i4.783

Ramidi, T. and Hikmah, L. (2024). Pengembangan Literasi Digital di Pembelajaran PAI oleh Guru Profesional: Studi di SMA Al-Muslim.

Tadzkirah Jurnal Pendidikan Dasar, 8(1), 41-49. https://doi.org/10.55510/tadzkirah.v8i1.278

Rawung, R., Lumapow, H., Palilingan, V., & Lengkong, J. (2023). Interactional model of digital managerial competence of kindergarten teachers in north sulawesi. IJITE, 2(2), 1-18. https://doi.org/10.62711/ijite.v2i2.105

Saeed, S. and Kang, M. (2024). The impact of digital leadership on the performance of secondary teachers. Academy of Education and Social Sciences Review, 4(1), 12-20. https://doi.org/10.48112/aessr.v4i1.696

Sugiyono. (2019). Metode Penelitian Kuantitatif Kualitatif dan R&D (Sutopo (ed.); 1st ed.). ALFABETA.

Sumarni, S., Iskandar, I., & Santosa, I. (2023). Assessing digital competence among pre-service english language teachers: strengths and weakenesses. Journal of English Education and Teaching, 7(3), 613-631. https://doi.org/10.33369/jeet.7.3.613-631

Sunu, I. (2022). The impact of digital leadership on teachers' acceptance and use of digital technologies. Mimbar Ilmu, 27(2), 311-320. https://doi.org/10.23887/mi.v27i2.52832

Sutrisno, S., Hayati, H., Saputra, N., Arifin, S., & Kartiko, A. (2023). The influence of the head of madrasah and infrastructure facilities on the quality of education through teacher competence. Tafkir Interdisciplinary Journal of Islamic Education, 4(2), 274-288. https://doi.org/10.31538/tijie.v4i2.423

Tallo, A., Alraouf, A., & Wibowo, C. (2024). Multi-scenario location-allocation in decision-making for improving educational facility services in kupang city. Arteks Jurnal Teknik Arsitektur, 9(1), 121-128. https://doi.org/10.30822/arteks.v9i1.3264

Tendo-Bugondo, C., Lieke, O., Kasongo, P., Diur, B., Canagasabey, D., Thior, I., … & Kiluba, J. (2023). Facilitating person-centred care: integrating an electronic client feedback tool into continuous quality improvement processes to deliver client-responsive hiv services in the democratic republic of congo. Journal of the International Aids Society, 26(S1). https://doi.org/10.1002/jia2.26112

Tolulu, P., Panigoro, M., Payu, B., Hafid, R., & Sudirman, S. (2023). Pengaruh Sarana dan Prasarana terhadap Mutu Pendidikan di Sekolah SMA Negeri 2 Tilamuta Kabupaten Boalemo. JIIP - Jurnal Ilmiah Ilmu Pendidikan, 6(12), 9669-9672. https://doi.org/10.54371/jiip.v6i12.2279

Torlak, N. and Kuzey, C. (2019). Leadership, job satisfaction and performance links in private education institutes of pakistan. International Journal of Productivity and Performance Management, 68(2), 276-295. https://doi.org/10.1108/ijppm-05-2018-0182

Triyunita, H., Yana, N., Bachtiar, M., & Abdurrahmansyah, A. (2025). Transformasi Digital terhadap Kompetensi Guru dalam Pendidikan. JIIP -

Jurnal Ilmiah Ilmu Pendidikan, 8(4), 4364-4368. https://doi.org/10.54371/jiip.v8i4.7715

Umar, S., Senang, S., & Sunardi, S. (2024). Peningkatan Mutu Pembelajaran Melalui Pengembangan Sarana dan Prasarana. Irsyaduna Jurnal Studi Kemahasiswaan, 4(1), 16-28. https://doi.org/10.54437/irsyaduna.v4i1.1552

Villegas-Ch, W., Cañizares, M., Jaramillo-Alcázar, Á., & Palacios-Pacheco, X. (2020). Data analysis as a tool for the application of adaptive learning in a university environment. Applied Sciences, 10(20), 7016. https://doi.org/10.3390/app10207016

Wahyudi, Y. (2019). Peran Kepala Sekolah dalam Meningkatkan Kompetensi Pedagogik Guru di SMA Negeri 6 Samarinda. Tarbiyah Wa Ta Lim Jurnal Penelitian Pendidikan Dan Pembelajaran, 6(1), 74-86. https://doi.org/10.21093/twt.v6i2.2046

Wang, X., Zhao, J., Lu, Y., & Li, X. (2024). Spatial pattern, quality evaluation, and implications of preschool education facilities in new urban areas using multi-source data: a case study from lingui new district in west china. Buildings, 14(6), 1718. https://doi.org/10.3390/buildings14061718

Wiguna, K. (2023). Analisis Kompetensi Literasi Digital pada Guru Sekolah Menengah Atas. Jurnal Riset Manajemen Komunikasi, 3(1), 21-32. https://doi.org/10.29313/jrmk.v3i1.2316

Xie, Y. and Wang, N. (2023). The connotation evolution and enhancement strategies of digital leadership in china's universities in the context of digital transformation. Advances in Education Humanities and Social Science Research, 8(1), 221. https://doi.org/10.56028/aehssr.8.1.221.2023

Yangambi, M. (2023). Impact of school infrastructures on students learning and performance: case of three public schools in a developing country. Creative Education, 14(04), 788-809. https://doi.org/10.4236/ce.2023.144052

Yap, J., Hew, Q., & Skitmore, M. (2022). Student learning experiences in higher education: investigating a quantity surveying programme in malaysia. Construction Economics and Building, 22(1). https://doi.org/10.5130/ajceb.v22i1.7835

Yopi, F. (2024). Tpack and teachers' digital competence in the era of industry 4.0. IJMI, 1(1), 16-23. https://doi.org/10.61796/ijmi.v1i1.32

Zhang, Y., Lee, K., & Shaharom, M. (2023). Enhancing self-leadership in online fitness education and training: exploring strategies and addressing challenges among social media influencers in henan province, china. Sage Open, 13(4). https://doi.org/10.1177/21582440231219325

Zhu, R., Alias, B., Hamzah, M., & Hamid, M. (2024). A threefold examination of university digital leadership, teacher digital competency, and teacher technology behavior for digital transformation of education. International Journal of Learning Teaching and Educational Research, 23(10), 272-289. https://doi.org/10.26803/ijlter.23.10.13