



Influence of principals' role, teachers' ICT skills, and infrastructure management on quality of education

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ABSTRACT

This study was motivated by the fact that the quality of education in public vocational high schools (SMK) in Blora Regency remains suboptimal. Several factors influence the quality of education, including the role of school principals, teachers' information and communication technology (ICT) competence, and the management of facilities and infrastructure. The objective of this research was to analyze the influence of these three variables, both individually and in combination, on the quality of education. A quantitative ex post facto design was employed. The population consisted of 383 teachers from public vocational schools in Blora, with 196 teachers selected using a proportional random sampling method. Data were collected through a Likert-scale questionnaire and analyzed using simple and multiple linear regression with SPSS 29. The findings revealed that school leadership, teachers' ICT competence, and facilities management have a positive and significant effect on education quality, both individually and collectively. These results indicate that while the three variables are important, education quality is also shaped by other external factors. In conclusion, improving the quality of education in Blora's vocational schools requires strengthening school leadership, enhancing teachers' digital literacy, optimizing facilities management, and fostering broader collaboration with stakeholders.

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ABSTRAK

Penelitian ini dilatarbelakangi oleh mutu pendidikan SMK Negeri di Kabupaten Blora yang masih belum optimal. Faktor yang memengaruhi mutu pendidikan antara lain peran kepala sekolah, kemampuan teknologi informasi dan komunikasi (TIK) guru, serta manajemen sarana prasarana. Tujuan penelitian ini adalah menganalisis pengaruh ketiga variabel tersebut baik secara parsial maupun simultan terhadap mutu pendidikan. Penelitian menggunakan pendekatan kuantitatif jenis ex post facto. Populasi penelitian adalah seluruh guru SMK Negeri di Kabupaten Blora sebanyak 383 orang, dengan sampel 196 guru dipilih secara proportional random sampling. Data dikumpulkan menggunakan angket skala Likert, kemudian dianalisis dengan regresi linier sederhana dan berganda menggunakan SPSS 29. Hasil penelitian menunjukkan bahwa kepemimpinan kepala sekolah, kompetensi TIK guru, serta manajemen sarana prasarana berpengaruh positif dan signifikan terhadap mutu pendidikan, baik secara parsial maupun simultan. Temuan ini mengindikasikan bahwa meskipun peran ketiga variabel penting, mutu pendidikan juga dipengaruhi faktor lain di luar model penelitian. Kesimpulannya, peningkatan mutu pendidikan SMK Negeri di Kabupaten Blora dapat dilakukan melalui penguatan kepemimpinan kepala sekolah, peningkatan literasi digital guru, pengelolaan sarana prasarana yang lebih optimal, serta dukungan dari berbagai pemangku kepentingan.

Kata Kunci: kemampuan tik guru; kepala sekolah; mutu pendidikan; sarana prasarana

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INTRODUCTION

Education is a strategic foundation for nation-building because it plays a vital role in enhancing individual knowledge and skills and serves as a form of human capital investment that can foster global competitiveness (Arifin, 2023). In the context of the globalization era and the industrial revolution 4.0, demands for quality education are increasingly high and cannot be ignored (Fitriyanti & Sirozi, 2024). Efforts to improve the quality of education do not focus solely on the curriculum and the learning process. However, they are also influenced by supporting factors such as the principal's leadership, teacher competence in using information and communication technology (ICT), and optimal management of educational facilities and infrastructure (Azizah & Subiyantoro, 2023).

In particular, Vocational High Schools (SMKs) play a strategic role in producing high-quality human resources ready to enter the world of work (Ridwan, 2021). Based on *Undang-Undang Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional*, vocational schools are designed to produce graduates who are productive, creative, and innovative, and who possess competencies aligned with the needs of the industrial world and the world of work. However, the reality on the ground shows that the quality of education at state vocational high schools in Blera Regency remains a serious challenge. This is reflected in the decline in education report card scores for several key indicators, such as graduate absorption and graduate competency, despite an increase in the graduate income indicator in Jamaluddin's 2024 research (accessible at: <https://repository.unhas.ac.id/id/eprint/37554/>).

Various previous studies have identified factors that influence educational quality. The principal acts as an innovator and motivator for the entire academic community at the school (Permatasari et al., 2023). The principal's leadership has a strategic role in creating a conducive, character-based, and competitive learning environment (Dimara et al., 2025). A visionary principal can motivate teachers and educational staff to work professionally, thereby improving the quality of education (Hatimah et al., 2025). Despite this, variations in principal leadership styles persist, which affect the quality of learning in schools. Second, in terms of technological competence, teachers' ability to utilize ICT is a key requirement in the digital era. Teachers no longer act solely as conveyors of information but also as facilitators of technology-based learning. However, some teachers still do not optimally utilize ICT in planning, implementing, and evaluating learning, which impacts the quality of student learning outcomes (Miftah, 2022).

Third, the management of facilities and infrastructure is also a crucial factor. The availability of good facilities does not automatically guarantee improved quality if not accompanied by proper management (Widat & Diana, 2025). Inadequate management often creates obstacles, such as irregular use of facilities, poor maintenance, or facilities that are not aligned with learning needs. Furthermore, educational facilities and infrastructure must be properly managed to create a conducive learning environment, which will ultimately contribute to improving the overall quality of education (Ismaya et al., 2024).

Most previous research has focused only partially on the role of the principal and has been conducted primarily at the high school level. Therefore, this study presents scientific novelty by comprehensively and simultaneously examining three main variables: principal

leadership, teacher ICT competency, and infrastructure management in the context of vocational education. Furthermore, this research focuses specifically on state vocational high schools (SMK), which have distinct characteristics and challenges compared to other levels of education.

Based on the phenomenon in Blora Regency, where Vocational High Schools (SMKs) play a crucial role in preparing graduates ready to work, the quality of education must excel not only in academic aspects but also in vocational skills. However, the facts on the ground indicate that there are still challenges related to principal leadership, teacher ICT skills, and suboptimal infrastructure management. This condition has the potential to negatively affect the quality of education in State Vocational High Schools in Blora Regency. Thus, the problem formulation in this study is: "How do principal leadership, teacher ICT competency, and infrastructure management influence the quality of education in State Vocational High Schools in Blora Regency?"

Based on the identified problem formulation, the purpose of this study is to analyze the influence of principal leadership, teacher ICT competency, and infrastructure management on the quality of education at State Vocational High Schools in Blora Regency. The results of this study are expected to provide theoretical and practical contributions to improving the quality of education, particularly at State Vocational High Schools in Blora Regency, and to serve as a reference for the development of more effective and sustainable education policies.

LITERATURE REVIEW

Quality of Education

Educational quality results from planned, effective, and efficient educational delivery. Quality is understood as the ability of an educational system to manage various input factors, such as curriculum, teaching staff, infrastructure, and students, to produce optimal output (Fachrudin, 2021; Muttaqin et al., 2023). Quality achievement is not only reflected in academic results but also in non-academic achievements, such as sports, arts, and skills, as well as in intangible aspects such as discipline, school culture, and a conducive learning atmosphere (Mualip & Saputra, 2024). From a management perspective, the quality of education reflects the institution's ability to utilize educational resources effectively to meet the needs of society and the world of work (Umam, 2020; Zahroh, 2018). In addition, quality is seen as the degree of excellence in school management that produces graduates with academic and extracurricular excellence in accordance with established standards (Arifin, 2018; Mahani, 2023). Thus, the quality of education can be understood as an integration of the quality of the learning process, school management, and the achievement of student learning outcomes, reflected in their competencies and attitudes (Kartika & Arifudin, 2020).

In general, educational quality can be measured through input, process, output, and outcome indicators. Input includes teacher readiness, infrastructure, and student readiness. Process indicators emphasize interactive and innovative learning, including the use of information technology (Dinayanti et al., 2024). Meanwhile, according to Muharam in his book entitled "*Tata Kelola Mutu Sekolah: Membangun fondasi melalui faktor-faktor pendukung*" output refers to academic achievement and skills, while outcome relates to the success of graduates

in continuing their education, entering the workforce, or contributing to society. School governance factors, principal leadership, and community involvement also contribute to strengthening educational quality, so that educational quality can be seen as the result of the integration of all aspects of education delivery.

The Role of the Principal

The role of the principal is a determining factor in the success or failure of educational implementation because effective leadership directly impacts the quality of learning, teacher performance, and the overall school climate (Hidayat, 2023). From the perspective of National Education, there are seven main roles of the principal: educator, manager, administrator, supervisor, leader, innovator, and motivator (Ilham, 2021; Mukaddamah, 2023). Each role has a complementary function in realizing educational goals, both from a managerial and pedagogical perspective. Of these seven roles, the two most influential for educational quality are the principal's roles as leader and educator. As a leader, the principal is tasked with motivating, directing, and providing an example for teachers and other educational staff in achieving school goals. Meanwhile, as an educator, the principal ensures that the learning process follows sound pedagogical principles and fosters a positive learning culture (Simatupang et al., 2023). These two roles serve as the primary foundation for building superior educational quality. However, a principal's success is not determined solely by these two roles; it also requires support from other roles, such as manager, administrator, supervisor, innovator, and motivator, all of which complement each other (Alhabsyi et al., 2022). By carrying out these roles in an integrated manner, the principal can create an effective education system, a conducive learning environment, and improve the quality of graduates in accordance with the demands of the times.

Information and Communication Technology (ICT) Skills

Minister of National Education Regulation Number 16 of 2007 concerning Academic Qualification Standards and Teacher Competencies stipulates four main competencies that teachers must master: pedagogical, professional, social, and personality competencies. Pedagogical competencies emphasize that teachers must be able to utilize information and communication technology (ICT) to support the learning process (see: <https://peraturan.bpk.go.id/Details/216104/permendikbud-no-16-tahun-2007>). This shows that mastery of ICT is not just an additional skill, but an integral part of a teacher's professional competence.

Several experts have also emphasized the importance of technological mastery. Teachers are required to continually improve their knowledge and skills in mastering technological devices, including computers and other learning media, that are relevant to students' needs (Nurdin, 2019). In addition, ICT is understood as an umbrella concept that encompasses various technical devices for processing, manipulating, and conveying information, where technology is not limited to hardware but also serves as a strategic means to support the effectiveness of teaching and learning activities (Kusnadi, 2024).

The use of ICT in learning has a direct impact on the quality of education in schools. Technology integration enables the teaching and learning process to be more interactive and relevant to current developments, and it supports the strengthening of 21st-century competencies. Teachers who master ICT skills can facilitate students' access to a wider range of learning resources, foster creativity, and improve the overall quality of learning (Azizah & Subiyantoro, 2023; Subadre et al., 2023). Thus, mastery of ICT by teachers is not only a regulatory obligation, but also a real strategy in improving the quality of education.

Infrastructure Management

The government and society have made various efforts to achieve national education goals, including improving the quality of educational facilities and infrastructure. Increasing the number, type, and quality of educational facilities and infrastructure must be supported by adequate management services. In this regard, the management of educational facilities and infrastructure is a crucial aspect in improving the quality of education (Suranto et al., 2022). Effective management, including planning, procurement, and maintenance of facilities and infrastructure, significantly contributes to achieving educational goals (Azzahra, 2024).

Educational resources are anything used directly in the learning process. These resources serve as the primary aids that support teachers and students in achieving educational goals. Examples include desks, chairs, whiteboards, textbooks, computers, LCD projectors, and laboratories used for teaching and learning. With adequate resources, learning activities can be more effective, interactive, and engaging (Malau et al., 2022). Conversely, educational infrastructure is a basic facility that is not directly used in learning activities, but its existence is crucial as a support. Infrastructure serves as the foundation that enables educational activities to run smoothly. Examples of infrastructure include school buildings, classrooms, libraries, sports fields, internet networks, roads to schools, and electricity and air conditioning. Without good infrastructure, the learning process will be hampered even if complete facilities are available (Azzahra, 2024). Thus, facilities and infrastructure are two complementary components. Facilities provide direct support to the learning process, while infrastructure provides the basic support for optimal implementation.

Facilities and infrastructure management is a series of management activities carried out by schools to support all activities, both learning and non-learning, ensuring they run smoothly. This management includes a process that is planned and deliberately carried out continuously to ensure that facilities and infrastructure are always ready for use. These efforts aim to create an effective and efficient learning process that supports the achievement of educational goals (Maizah et al., 2024).

METHODS

This study used a quantitative, ex post facto design. The study was conducted from May to June 2025 at all state vocational schools (SMK) in Blora Regency. The study population included all 383 state vocational school teachers in Blora Regency. The study sample consisted of 196 respondents, determined using proportional random sampling. The sample size was determined using the Slovin formula:

$$n = \frac{N}{1 + N(e)^2} = \frac{383}{1 + 383(0,05)^2} = 195,6577 = 196$$

This technique was chosen due to the large and heterogeneous population. The research instrument was a questionnaire with a Likert scale. This instrument underwent validity and reliability testing to ensure the quality of the data collected. Data were collected through an online questionnaire sent to all state vocational schools in Blora Regency.

Data analysis was conducted through several interrelated stages. The initial stage was data processing from the questionnaire, followed by validity and reliability tests, and descriptive analysis to describe the data in general. Next, prerequisite analysis tests were conducted, as outlined by Basuki in his 2015 book "Regression Analysis with SPSS," including tests for normality, linearity, multicollinearity, and heteroscedasticity. Hypothesis testing was then performed using simple regression and multiple regression analyses using SPSS version 29 for Windows. Simple regression analysis was used to examine the effect of one independent variable, while multiple regression analysis was used because more than one independent variable was tested simultaneously on the dependent variable.

RESULTS AND DISCUSSION

The variables analyzed in this study include educational quality, the principal's role, teachers' information and communication technology skills, and infrastructure management. Each test is presented in the following tables.

Table 1. Descriptive Statistics of Research Variables

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
Peran Kepala Sekolah	196	96	161	255	215,48	20,105
Kemampuan Teknologi Informasi dan Komunikasi Guru	196	46	112	158	135,27	8,681
Manajemen Sarana dan Prasarana	196	47	98	145	125,11	11,120
Mutu Pendidikan	196	67	108	175	147,25	15,381
Valid N (listwise)	196					

Source: Research 2025

Table 1 explains the results of descriptive statistical analysis of four research variables with a total of 196 respondents. The Principal's Role variable has a value range of 96, with a minimum score of 161 and a maximum of 255, and a mean (M) = 215.48 and a standard deviation (SD) = 20.11. The Teacher's Information and Communication Technology Ability variable has a value range of 46, with a minimum score of 112 and a maximum of 158, a mean (M) = 135.27, and a standard deviation (SD) = 8.68. The Facilities and Infrastructure Management variable has a value range of 47, with a minimum score of 98 and a maximum

of 145, a mean (M) = 125.11, and a standard deviation (SD) = 11.12. The Education Quality variable has a value range of 67, with a minimum score of 108 and a maximum of 175, a mean (M) of 147.25, and a standard deviation (SD) of 15.38. All variables have valid data from 196 respondents. Before conducting the analysis, there are prerequisite tests that must be completed:

Test Results

Table 2 shows the results of the normality test in this study.

Table 2. Results of the Kolmogorov-Smirnov Normality Test for the Education Quality Variable (Y)

One-Sample Kolmogorov-Smirnov Test

		MUTU PENDIDIKAN		
N				196
<i>Normal Parameters a.b</i>	Mean			147,25
	Std. Deviation			15,381
	Absolute			,055
	Positive			,036
	Negative			-,055
<i>Test Statistic</i>				,055
<i>Asymp. Sig. (2-tailed)^c</i>				,200 ^d
<i>Monte Carlo Sig. (2-tailed)^d</i>				,162
	99% Confidence Interval	Lower Bound		,152
		Upper Bound		,171

Source: Research 2025

Table 3 shows the results of the linearity test of educational quality on the role of the principal.

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Anova Table

			Sum of Squares	df	Mean Square	F	Sig.
MUTU PENDIDIKAN*	<i>Between Groups</i>	<i>(Combined)</i>	17113,148	65	263,279	1,179	,213
		<i>Linearity</i>	4327,231	1	4327,231	19,385	<,001
PERAN KEPALA SEKOLAH *		<i>Deviation from Linearity</i>	12785,918	64	199,780	,895	,686
	<i>Within Groups</i>		29019,602	130	223,228		
	<i>Total</i>		46132,750	195			

Source: Research 2025

Multicollinearity Test

The results of the multicollinearity test in this study can be seen in **Table 4** below.

Table 4. Multicollinearity Test Results

Coefficients^a

Model	Collinearity Statistics	
	Tolerance	VIF
1 (Constant)		
PERAN KEPALA SEKOLAH	,430	2,325
KEMAMPUAN TEKNOLOGI INFORMASI DAN KOMUNIKASI GURU	,703	1,423
MANAJEMEN SARANA DAN PRASARANA	,366	2,730

Source: Research 2025

Next, **Table 5** shows the results of the heteroscedasticity test.

Table 5. Heteroscedasticity Test Results

Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1 (Constant)	6,822	9,541		,715	,475
PERAN KEPALA SEKOLAH	-,103	,044	-,252	2,312	,022
KEMAMPUAN TEKNOLOGI INFORMASI DAN KOMUNIKASI GURU	,071	,080	,075	,877	,382
MANAJEMEN SARANA DAN PRASARANA	,136	,086	,185	1,570	,118

Source: Research 2025

The results of the descriptive statistical analysis presented in **Table 2**, **Table 3**, **Table 4**, and **Table 5** indicate that the research data meet the assumptions required for regression analysis. Based on Table 1, the results of the Kolmogorov-Smirnov normality test for the education quality variable (Y) show a significance value of 0.200 ($p > 0.05$). This indicates that the data is normally distributed, so that the normality assumption is met. Furthermore, Table 2 presents the results of the linearity test between the education quality variable (Y) and the role of the principal (X_1), which produces a significance value of 0.213 in the Deviation from Linearity row ($p > 0.05$), which means the relationship between the two variables is linear. In Table 3, the results of the multicollinearity test show a Tolerance value > 0.10 and a Variance Inflation Factor (VIF) < 10 for all variables, namely the role of the principal (Tolerance = 0.430; VIF = 2.325), teachers' ICT skills (Tolerance = 0.703; VIF = 1.423), and infrastructure management (Tolerance = 0.366; VIF = 2.730). Thus, there is no multicollinearity problem in the regression model. Finally, Table 4 shows the results of the heteroscedasticity test obtained from a significance value (Sig.) greater than 0.05 for all independent variables, except for the role of the principal, which has a Sig. value of 0.022.

However, the relatively small coefficient value indicates that the symptoms of heteroscedasticity are not significant, and the model can still be used for regression analysis. Based on the prerequisite test results, the research data met statistical assumptions because they were normally distributed, homogeneous, linear, free from multicollinearity, and free from heteroscedasticity. Furthermore, the regression analysis is shown in **Table 6** below.

Table 6. Results of Simple Regression Analysis of X1 and Y

<i>Coefficients^a</i>					
Model	<i>Unstandardized B</i>	<i>Coefficients Std. Error</i>	<i>Standardized Coefficients Beta</i>	t	Sig.
1 (Constant)	93,088	10,728		8,677	<,001
PERAN KEPALA SEKOLAH	,213	,050	,294	4,288	<,001

Source: Research 2025

Based on the results of the simple regression analysis in **Table 6**, the Principal's Role variable (X_1) has a positive and significant effect on the quality of education (Y) with a regression coefficient value of 0.213 and a significance value <0.001 . The resulting regression equation is $Y = 93.088 + 0.213X_1$, which means that every one-unit increase in the principal's role will increase the quality of education by 0.213 units. The standardized beta coefficient is 0.294 with a calculated t value of 4.288 ($p < 0.001$), indicating the contribution of the principal's role to the quality of education is 8.2%.

Table 7. Results of Simple Regression Analysis of X2 and Y

<i>Coefficients^a</i>					
Model	<i>Unstandardized B</i>	<i>Coefficients Std. Error</i>	<i>Standardized Coefficients Beta</i>	t	Sig.
1 (Constant)	103,987	16,087		6,464	<,001
KEMAMPUAN TEKNOLOGI INFORMASI DAN KOMUNIKASI GURU	,119	,119	,154	2,174	,031

Source: Research 2025

Furthermore, **Table 7** shows the results of a simple regression analysis between Teachers' Information and Communication Technology Skills (X_2) and the quality of education (Y). The regression coefficient value of 0.119 with a significance of 0.031 ($p < 0.05$) indicates that teachers' ICT skills have a positive effect on the quality of education. The regression equation obtained is $Y = 103.987 + 0.119X_2$, with a beta value of 0.154 and a calculated t value of 2.174. This indicates a contribution of 1.9%, which is relatively small but significant.

Table 8. Results of Simple Regression Analysis of X₃ and Y

Coefficients^a

Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1 (Constant)	104,513	11,515		9,077	<,001
MANAJEMEN SARANA DAN PRASARANA	,275	,092	,210	2,997	,003

Source: Research 2025

The results in **Table 8** show the influence of Facilities and Infrastructure Management (X₃) on the quality of education (Y) with a regression coefficient value of 0.275 and a significance of 0.003 (p < 0.05). The regression equation formed is $Y = 104.513 + 0.275X_3$, with a beta value of 0.210 and a t-value of 2.997. The contribution of this variable's influence on the quality of education is 3.9%.

Table 9. Results of Multiple Regression Analysis

Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1 (Constant)	87,583	16,267		5,384	<,001
MANAJEMEN SARANA DAN PRASARANA	-,065	,147	-,050	-,444	,658
PERAN KEPALA SEKOLAN	,225	,076	,311	2,974	,003
MANAJEMEN SARANA DAN PRASARANA	,082	,137	,049	,596	,552

Source: Research 2025

Simultaneously, the results of the multiple regression analysis presented in **Table 9** show that the three independent variables, namely the role of the principal (X₁), teachers' ICT skills (X₂), and infrastructure management (X₃), have a joint influence on the quality of education (Y). The regression equation obtained is $Y = 87.583 - 0.065X_1 + 0.225X_2 + 0.082X_3$, with a contribution of 8.9%. Of the three variables, the role of the principal has the most dominant influence ($\beta = 0.311$; p = 0.003), while infrastructure management has an insignificant influence (p = 0.552). Thus, it can be concluded that the role of the principal, teachers' ICT skills, and infrastructure management have a positive influence on the quality

of education, although the contribution of these three variables simultaneously is still relatively small. This shows that other factors outside the research variables also influence the quality of education, so a strategy is needed to strengthen these three variables to improve the quality of education at SMK Blora Regency.

Discussion

Based on the research results, the role of the principal, teachers' ICT skills, and facility and infrastructure management have a significant influence on the quality of education at State Vocational High Schools in Blora Regency, although the contribution of each variable is relatively small. This finding confirms the view that educational quality is a product of the integration of school leadership, educator competence, and facility management, which aligns with the concept of quality as the integration of input, process, and output (Fachrudin, 2021; Kartika & Arifudin, 2020; Muttaqin et al., 2023).

Analysis of the Influence of Variable X1 (Role of the Principal) on Variable Y (Quality of Education)

The results of the regression analysis show that the role of the principal has a positive and significant effect on the quality of education, with the equation $Y = 93.088 + 0.213X_1$, $p = 0.001$, and $R^2 = 0.082$. This 8.2% contribution illustrates that the principal makes a significant contribution but is not the sole determinant of school quality. The prominent dimensions are administrator, climate creator, and educator, indicating that a strong administrative role must be combined with the ability to create a conducive school climate and pedagogical functions to impact the quality of learning. This finding is consistent with the framework of the principal's role, which includes the functions of educator and leader as a foundation for improving quality (Ilham, 2021; Mukaddamah, 2023; Simatupang et al., 2023).

Theoretically, principal leadership influences quality through two main mechanisms: resource management and the creation of a professional climate. Good management facilitates the distribution of resources, teacher assignments, and instructional supervision, while the creation of a climate influences teacher motivation and collaborative practices. (Hidayat, 2023; Umam, 2020). Previous research strengthens this by showing that visionary and effective principals are able to improve teacher performance and the academic climate, which impacts quality (Permatasari et al., 2023; Rahmani et al., 2025; Setiawati, 2023).

However, the relatively low R^2 value warrants a critical reading. The low quantitative contribution may be due to external factors not included in the model, such as student motivation, parental involvement, and regional education policies that influence learning outcomes (Mualip & Saputra, 2024; Umam, 2020). The practical implication is that the enhanced role of the principal needs to be enriched with supportive policies (e.g., transformational leadership training, strengthening instructional supervision, and collaboration with stakeholders) so that its effect on quality is greater (Alhabsyi et al., 2022; Hatimah et al., 2025).

Analysis of the Influence of Variable X2 (Teachers' Information and Communication Technology Skills) on Variable Y (Quality of Education)

The analysis shows that teachers' ICT skills have a significant but small contribution with $R^2 = 0.019$. The dominant dimensions are internet access skills, followed by mastery of basic hardware and software, and ICT integration into learning. This finding aligns with the regulation requiring ICT competency for teachers as part of the pedagogical competency of the Minister of National Education Regulation No. 16 of 2007, and also aligns with studies showing that the use of ICT increases learning effectiveness when integrated meaningfully (Azizah & Subiyantoro, 2023; Rusi et al., 2022).

The explanation for the relatively small contribution of ICT can be seen from three aspects. First, the availability of infrastructure and unequal internet access limit the implementation of effective ICT practices (Dinayanti et al., 2024; Maizah et al., 2024). Second, differences in digital literacy levels among teachers and the lack of ongoing training hinder meaningful ICT integration in learning planning, implementation, and evaluation. (Nurdin, 2019; Miftah, 2022). Third, without managerial support and enabling infrastructure (e.g., well-maintained equipment, dedicated budgets, and time for development), ICT capabilities have only a limited impact on learning outcomes (Kusnadi, 2024; Subadre et al., 2023).

In terms of implications, strengthening teachers' digital literacy through relevant training programs, providing access to reliable infrastructure, and integrating ICT into lesson plans and evaluations will enhance ICT's contribution to educational quality. Because ICT serves as a multiplier for the effectiveness of modern learning methods, targeted investments in teacher capacity and infrastructure can magnify their impact (Azizah & Subiyantoro, 2023).

Analysis of the Influence of Variable X3 (Management of Facilities and Infrastructure) on Variable Y (Quality of Education)

Management of facilities and infrastructure significantly influences educational quality with $R^2 = 0.039$. The dominance of the inventory dimension indicates that good asset administration is a prerequisite for optimal facility utilization. This finding aligns with the idea that facilities are direct aids to the learning process, while infrastructure serves as the foundation; both must be managed comprehensively, from planning and procurement to maintenance, to impact quality (Azzahra, 2024; Malau et al., 2022; Suranto et al., 2022).

The small, though significant, contribution of infrastructure management can be explained by the fact that the availability of facilities alone does not automatically improve learning outcomes without appropriate pedagogical use. Previous studies have shown that without appropriate utilization and ongoing supervision, facilities tend to become underutilized or damaged due to weak management. (Ismaya et al., 2024; Widat & Diana, 2025). Therefore, practical recommendations include the implementation of an information-based inventory system, routine allocation of maintenance budgets, and training for administrative staff and teachers on the use of facilities according to curriculum needs. (Fitriani et al., 2021; Maizah et al., 2024).

Analysis of the Simultaneous Influence of Variables X1, X2, and X3 on Variable Y (Quality of Education)

Simultaneously, the three variables contributed $R^2 = 0.089$ to educational quality. The simultaneous model, which showed teachers' ICT skills as the largest contributor, followed by infrastructure management, and the principal's role, which remained significant but relatively small, confirmed that educational quality arises from the synergy of leadership functions, educators' technological capacity, and facility management. This pattern is consistent with studies that emphasize the need for integration between school leadership, teacher competency, and resource management to achieve superior quality (Fachrudin, 2021; Fitriani et al., 2021; Setiawati, 2023).

The integrative analysis reveals two important points. First, these variables are complementary: principal leadership can accelerate ICT adoption and the implementation of good facility management, while ICT can increase the effectiveness of facility use (Ilham, 2021). Second, the low simultaneous R^2 value indicates that there are still many other important variables that are not included in the model, such as curriculum quality, student motivation and characteristics, parental and community involvement, and partnerships with the business world and industry (Dinayanti et al., 2024; Umam, 2020). Therefore, efforts to improve quality must be multi-dimensional and long-term.

From a policy and practice perspective, recommendations emerging from these findings include: strengthening leadership training and instructional supervision for principals; developing ongoing professional development programs to enhance teachers' digital literacy; implementing data-driven asset management and maintenance systems; and designing integrated interventions that engage parents, industry, and local stakeholders to support the learning process (Alhabsyi et al., 2022; Maizah et al., 2024; Permatasari et al., 2023).

The results of this study provide important theoretical and practical implications. Theoretically, this study enriches the literature on the determinants of educational quality by confirming that the synergy between principal leadership, teacher technological competence, and infrastructure management is a complementary factor in improving educational quality, particularly in the vocational high school context. These findings also emphasize the relevance of transformational leadership theory, the concept of teacher digital literacy, and the school resource management approach as conceptual foundations for understanding educational quality. Practically, the results of this study can serve as a reference for policymakers, principals, and teachers in designing more integrated quality improvement strategies. For principals, these results emphasize the importance of strengthening their roles as administrators and climate creators in order to build a conducive school environment. For teachers, the results imply the need for a sustainable digital literacy program so they can access, process, and integrate information into the learning process. At the same time, for school administrators, effective infrastructure management, which includes inventory, utilization, and evaluation activities, can increase efficiency while supporting the quality of educational services. Furthermore, this study suggests the need to develop a comprehensive education quality evaluation model that considers factors other than the variables studied.

This study has several limitations that should be noted. First, the relatively small contribution of the three variables, at 8.9 percent, indicates that there are still 91.1 percent of other factors that were not examined but influence the quality of education, such as student learning motivation, curriculum quality, school organizational culture, and parental involvement. Second, this study is limited to the context of State Vocational High Schools in Blora Regency, so generalizing the results to other regions or types of schools requires caution. Third, the quantitative approach with a cross-sectional design cannot explain causal relationships in depth or the dynamics of variable change over time. Fourth, the research instrument, which is based on respondents' perceptions, may contain subjective bias, which ultimately has the potential to affect the validity of the findings.

CONCLUSION

Based on the research results, it can be concluded that the principal's leadership, teachers' information and communication technology (ICT) competencies, and facility and infrastructure management have been proven to have a positive and significant influence on the quality of education at State Vocational High Schools in Blora Regency, both partially and simultaneously. This indicates that these three factors are important determinants in shaping the quality of education, although their contribution is still relatively small. In more detail, the principal's leadership influences through his strategic role as an educator, manager, administrator, supervisor, leader, entrepreneur, and creator of a conducive school climate. Teachers' ICT competencies contribute primarily to the aspects of internet utilization, online communication, and technology integration in learning, which are key demands in the digital era. Meanwhile, facility and infrastructure management influences the quality of education through the planning, procurement, inventory, utilization, and evaluation of facilities that support the teaching and learning process. However, this study also found that the quality of education is not only determined by these three variables. There are still other factors that influence, including student learning motivation, curriculum quality, school organizational culture, learning climate, parental involvement, and support from the industrial world. Therefore, improving the quality of education at State Vocational Schools in Blora Regency needs to be done comprehensively through strengthening the leadership of school principals, improving teachers' digital literacy, optimizing infrastructure management, and broad collaboration with various stakeholders.

Based on the limitations of this study, there are several suggestions that can be considered for further research. First, because the contribution of the three variables only amounted to 8.9 percent, future research is recommended to include other potentially more dominant variables, such as school organizational culture, transformational leadership, teacher work motivation, or parental support. Second, future research should expand the context to other types of schools, both public and private, and to a wider area to increase the generalizability of the results. Third, the use of a longitudinal design can be considered to be able to explain the dynamics of variable changes over time and more deeply understand causal relationships. Fourth, the development of more objective measurement instruments, for example, through field observations or analysis of school documents, can minimize the potential for respondent subjectivity bias.

AUTHOR'S NOTE

The author declares that there is no conflict of interest regarding the publication of this article. The author confirms that the data and content of the article are free from plagiarism.

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