

The Influence of Principals' Transformational Leadership, Availability of Educational Facilities and Infrastructure, and Digital Literacy on the Quality of Primary Schools in Sungai Apit District

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ABSTRACT

This study aims to examine the influence of principals' transformational leadership, the availability of educational facilities and infrastructure, and digital literacy on the quality of primary schools in Sungai Apit District. Using a quantitative approach and a multiple regression design, the research involved 168 primary school teachers selected through proportional random sampling. The results show that transformational leadership, facilities, and digital literacy each have a positive and significant effect on school quality. These findings affirm the strategic role of transformational leadership, adequate facilities, and digital competence in improving educational outcomes. The study recommends priority for leadership training, equitable distribution of educational facilities, and continuous development of teachers' digital literacy. Future research is expected to expand the area of investigation and integrate other variables to obtain a more comprehensive understanding of the factors that influence school quality. Overall, the synergy among leadership, infrastructure, and digital skills is crucial to advancing the quality of primary education in the digital era.

INTRODUCTION

Primary education plays a strategic role in forming the foundation of future, competent human resources. As the first formal educational institution, primary schools must continuously improve their quality in order to respond to the dynamic challenges of the times. In Sungai Apit District, the complexity of educational problems is increasing along with social change, technological advances, and growing public demands for the quality of education (Eko et al., 2023; Kamaludin, 2022). The quality of primary schools is influenced by various internal and external factors, including the principal's leadership, the availability of facilities and infrastructure, and digital literacy. These three factors are key elements that interact with each other to create quality education. Therefore, an in-depth analysis of their roles and effects is essential to formulate strategies for improving the quality of primary education that are adaptive to global developments and relevant to the local characteristics of Sungai Apit District.

Principals' transformational leadership has been identified as an important factor that drives positive change in educational settings. This leadership style includes the ability to inspire, motivate, and empower teachers and students to achieve higher, shared goals (Waruwu, 2024; Izzati et al., 2024). Principals with a transformational style are able to reinforce the school's vision and mission, increase the commitment of all school members, and promote educational innovation across different lines (Eko et al., 2023; Waruwu, 2024). The implementation of transformational leadership is also considered effective in building a collaborative work culture oriented toward achieving optimal educational quality. Thus, transformational leadership becomes one of the main determinants of primary school success, especially amid the dynamics of educational change and the challenges of the digital era.

In addition to leadership, the availability of educational facilities and infrastructure is a vital element in supporting the quality of learning. Based on the educational systems theory of Hoy and Miskel (2008), facilities and infrastructure are instrumental components that enable effective and efficient educational processes to take place (Saputri & Pratikno, 2024; Widiyono et al., 2024). Adequate facilities such as representative classrooms, laboratories, learning media, and internet access are prerequisites for creating a conducive learning environment (Kamaludin, 2022; Simatupang et al., 2023). Inadequate facilities and infrastructure often become serious obstacles to optimizing the teaching-learning process. Thus, the provision of quality educational facilities must be a top priority in efforts to improve the quality of primary schools in areas facing geographical and social challenges.

In the digital era, digital literacy is a fundamental skill that all school members must possess. Gilster (1997) defines digital literacy not only as the ability to use technological devices, but also as critical thinking in accessing, evaluating, and managing technology-based information (Zuhri, 2024; Lestari et al., 2024). Digital literacy enables teachers, students, and school management to adopt technology-based learning innovations, increase administrative efficiency, and build a positive digital culture (Devi & Winangun, 2024; Rosita & Iskandar, 2022). Schools with high levels of digital literacy can adapt more quickly to changes in a global, technology-based education system. Therefore,

strengthening digital literacy in primary schools is an absolute necessity for improving the quality of education in today's modern era.

Previous studies confirm the importance of these three factors. Leithwood and Jantzi (2005) demonstrated that transformational leadership contributes greatly to school effectiveness (Eko et al., 2023; Waruwu, 2024). Earthman (2002) found a close relationship between the completeness of facilities and infrastructure and the quality of student learning outcomes (Simatupang et al., 2023; Kamaludin, 2022). Meanwhile, Ng (2012) emphasized the central role of digital literacy in driving learning innovation (Devi & Winangun, 2024; Zuhri, 2024). However, studies that integrate the combined influence of all three on the quality of primary schools are still very limited – especially in local contexts such as Sungai Apit District – thus requiring further empirical investigation so the results can serve as a reference for education policy formulation.

Factual conditions in Sungai Apit District show variation in principals' leadership styles, the availability of facilities and infrastructure, and teachers' digital literacy that is not yet even. Some principals have encouraged technology-based learning innovation, but there are still those who give insufficient attention to providing recognition or appreciation to teachers. Likewise, not all schools have adequate technological facilities such as Chromebook devices, and many teachers still feel less confident using technology in learning. These challenges affect the quality of the learning process, the quality of graduates, and parent satisfaction in the area.

Synergy among leadership, infrastructure, and digital literacy is highly determinative of the quality of primary schools. Transformational leadership without adequate facilities and infrastructure will be less than optimal, and technology will not be beneficial if digital literacy is low (Miko et al., 2023; Saputri & Pratikno, 2024). Research that can observe the comprehensive interaction of these three variables will make an important contribution, particularly to addressing the challenges of primary education in areas that face limited resources and access to technology.

Based on the above background, this study aims to analyze empirically the influence of principals' transformational leadership, the availability of educational facilities and infrastructure, and digital literacy on the quality of primary schools in Sungai Apit District. This study not only tests partial relationships, but also the simultaneous strength of the three variables in shaping the quality of primary education (Eko et al., 2023; Waruwu, 2024; Saputri & Pratikno, 2024). The results are expected to contribute to the development of primary education policies grounded in innovation, infrastructure, and a robust digital culture.

This research is expected to provide a comprehensive picture of the determinant factors of primary school quality, especially in regions with geographical and social challenges such as Sungai Apit District. In addition to contributing to the development of educational leadership theory and school management, the results can also be a practical reference for principals, education managers, and local governments in designing strategies for improving the quality of primary education that are more effective, relevant, and sustainable.

METHODS

Research Design and Type

This study uses a quantitative approach with a multiple linear regression design to analyze the influence of principals' transformational leadership, the availability of educational facilities and infrastructure, and digital literacy on the quality of primary schools. This regression model was chosen because there is more than one independent variable hypothesized to affect one dependent variable, so the analysis can test both partial and simultaneous effects among variables (Sugiyono, 2018).

Research Location and Time

The research was carried out in all public primary schools in Sungai Apit District, Siak Regency, during the period February to June 2025. This location was chosen based on the complexity of the educational challenges it faces and its representation of varying conditions of primary schools in the area.

Population and Sample

The study population consisted of all public primary school teachers in Sungai Apit District, totaling 301 teachers from 25 schools. Sampling used proportional random sampling with the Isaac and Michael formula at a 5% error rate to ensure representation of all schools. Based on the calculation, a proportional number of samples from each school was obtained according to the number of teachers, so that the findings could be generalized to the target population (Creswell, 2015).

Research Variables

The dependent variable (Y) in this study is the quality of primary schools. The independent variables consist of: (1) principals' transformational leadership (X1), (2) availability of educational facilities and infrastructure (X2), and (3) digital literacy (X3). Each variable was measured with questionnaires developed based on theory and prior research findings.

Data Collection Techniques and Instruments

Data were collected through a closed, Likert-scale questionnaire measuring respondents' perceptions of each variable. Each item was constructed based on theoretical indicators and underwent content validation by experts. In addition, secondary data were collected through documentation, such as school profiles, number of teachers, data on facilities and infrastructure, and school accreditation status. The questionnaire consisted of four sections: transformational leadership (16 items), availability of facilities and infrastructure (16 items), digital literacy (16 items), and primary school quality (16 items).

Validity and Reliability Tests

The instrument's validity was tested using the product-moment correlation technique with IBM SPSS Statistics 25 involving 30 respondents from public primary schools outside the main location. An item was declared valid if r -calculated $>$ r -table at a 5% significance level (Sugiyono, 2012). Instrument reliability was tested using Cronbach's Alpha coefficient. The results show that all items on the four variables have high reliability ($\text{Alpha} > 0.7$), so they are feasible to use in this study.

Data Analysis Techniques

Data were analyzed using multiple linear regression to determine the influence of each independent variable and their simultaneous effects on primary school quality. Classical assumption tests (normality, multicollinearity, and heteroscedasticity) were conducted beforehand to ensure the feasibility of the regression model. All analyses were performed with IBM SPSS Statistics 25, and results were declared significant if the p-value < 0.05.

RESULTS

Descriptive Statistics of Research Results

Descriptive statistics were used to describe the characteristics of the variables studied. Each variable was analyzed using parameters such as minimum score, maximum score, mean, median, mode, and standard deviation. The results of the analysis for 168 respondents show that the variable of principals' transformational leadership has a minimum score of 25.00 and a maximum score of 64.00 with a mean of 47.01 and a standard deviation of 5.23. The availability of facilities and infrastructure has a minimum score of 23.00 and a maximum score of 64.00 with a mean of 46.47 and a standard deviation of 5.64. Digital literacy shows a minimum score of 23.00, a maximum score of 64.00, a mean of 46.86, and a standard deviation of 5.86. Primary school quality has a minimum score of 27.00 and a maximum score of 64.00 with a mean of 46.39 and a standard deviation of 5.73.

Classical Assumption Tests

Before conducting multiple linear regression analysis, the study performed classical assumption tests consisting of normality, multicollinearity, and heteroscedasticity tests. These tests ensure that the data meet the requirements for multiple linear regression analysis. Based on the Kolmogorov-Smirnov test, the data distribution meets the normality assumption because the significance value is above 0.05. Meanwhile, the multicollinearity test shows that the tolerance and Variance Inflation Factor (VIF) values of each variable meet the criteria, with tolerance > 0.1 and VIF < 10, indicating no multicollinearity. The heteroscedasticity test using the Glejser test indicates that the significance values of all independent variables are above 0.05, meaning the model does not experience heteroscedasticity; therefore, the analysis can proceed with multiple regression.

Multiple Linear Regression Analysis

Multiple linear regression analysis was conducted to test the effects of principals' transformational leadership (X1), availability of educational facilities and infrastructure (X2), and digital literacy (X3) on primary school quality (Y). The analysis produced the following regression equation:
$$Y = -0,454 + 0,198X1 + 0,454X2 + 0,385X3$$

The constant of -0.454 indicates that if all independent variables are zero, the quality of primary schools will have a negative value. This illustrates that these three variables must be considered in efforts to improve school quality.

Partial Hypothesis Testing (t-test)

The effect of each independent variable on school quality was tested using the t-test at a significance level of 0.05. The results show that principals' transformational leadership (X1) has a t-value of 3.698 with a significance of $0.000 < 0.05$, indicating a significant effect on primary school quality. The availability of educational facilities and infrastructure (X2) has a t-value of 7.777 with a significance of 0.000, and digital literacy (X3) has a t-value of 6.477 with a significance of 0.000. These results demonstrate that all three variables have a positive and significant partial effect on primary school quality.

Simultaneous Hypothesis Testing (F-test)

Simultaneous testing using the F-test was conducted to determine the joint effect of principals' transformational leadership, availability of facilities and infrastructure, and digital literacy on primary school quality. The results show an F-value of 242.255 with a significance of $0.000 < 0.05$, which means that simultaneously the three independent variables have a significant effect on the dependent variable of primary school quality. Therefore, it can be concluded that the combination of these three factors makes a substantial contribution to improving the quality of primary schools in Sungai Apit District.

Coefficient of Determination (R^2)

The coefficient of determination (R^2) was used to determine the contribution of the independent variables to the dependent variable. An R value of 0.903 indicates a very strong relationship among principals' transformational leadership, availability of educational facilities and infrastructure, and digital literacy with primary school quality. Meanwhile, an R Square value of 0.816 indicates that 81.6% of the variation in primary school quality can be explained by the combination of these three variables, while the remaining 18.4% is influenced by other factors not included in this model. Thus, the regression model has high predictive ability in explaining the variation in primary school quality in the study area.

DISCUSSION

The findings indicate that principals' transformational leadership has a significant effect on the quality of primary schools in Sungai Apit District. This supports the theory proposed by Leithwood and Jantzi (2005) that transformational leadership can shape an innovative culture and high commitment within schools (Eko et al., 2023; Waruwu, 2024; Izzati et al., 2024). Principals who are able to inspire, motivate, and empower teachers play an important role in fostering a conducive learning environment that is adaptive to the changing times (Waruwu, 2024; Eko et al., 2023; Kamaludin, 2022). The practical implication is the importance of strengthening transformational leadership capacity among primary school principals to accelerate quality improvement in education. Thus, transformational leadership is proven to be a key determinant of primary school success in facing the challenges of the digital era.

The availability of educational facilities and infrastructure is also found to have a significant effect on the quality of primary schools. This result is in line

with the educational systems theory of Hoy and Miskel (2008), which emphasizes the vital role of facilities and infrastructure as instrumental components in supporting the learning process (Saputri & Pratikno, 2024; Widiyono et al., 2024; Simatupang et al., 2023). Adequate facilities allow teachers to apply varied learning methods, increase students' learning comfort, and support optimal curriculum implementation (Kamaludin, 2022; Saputri & Pratikno, 2024; Widiyono et al., 2024). This underscores that investment in school infrastructure should be a priority for local governments, especially in regions with geographical and social challenges such as Sungai Apit District. Thus, adequate facilities and infrastructure make a tangible contribution to primary school quality.

The digital literacy variable is also proven to have a positive and significant effect on primary school quality. As stated by Gilster (1997), digital literacy includes the ability to think critically in accessing, evaluating, and managing technology-based information (Zuhri, 2024; Lestari et al., 2024; Devi & Winangun, 2024). Teachers and principals who possess high digital literacy can integrate technology effectively into learning, improve the efficiency of school administration, and strengthen a digital culture (Rosita & Iskandar, 2022; Devi & Winangun, 2024; Lestari et al., 2024). These findings highlight the importance of continuous training and capacity-building in digital literacy for all school members as a prerequisite for achieving an education quality that aligns with global demands. Therefore, improving digital literacy must be an integral part of school development programs.

Simultaneously, the three variables – principals' transformational leadership, the availability of facilities and infrastructure, and digital literacy – make a very large contribution to the quality of primary schools in Sungai Apit District. An R Square value of 0.816 shows that 81.6% of the variance in school quality can be explained by the combination of these variables (Eko et al., 2023; Saputri & Pratikno, 2024; Waruwu, 2024). This confirms that improving primary education quality requires a comprehensive and synergistic approach across multiple aspects; it is not sufficient to improve only one factor in isolation (Miko et al., 2023; Simatupang et al., 2023; Kamaludin, 2022). This synergy is the main foundation for realizing excellent and adaptive primary schools amid ongoing educational change. Thus, efforts to improve school quality must consider the integrated, simultaneous strengthening of these three key factors.

The study also finds variation in the field in how transformational leadership is implemented by principals. Some principals display role modeling, are approachable, and provide room for teachers to innovate in learning, but some still provide insufficient appreciation or recognition of teachers' achievements (Eko et al., 2023; Waruwu, 2024; Kamaludin, 2022). This situation affects teacher motivation and the overall school climate. Therefore, beyond strengthening leadership capacity, character-building for consistent leadership among all principals is needed so that all primary schools can achieve optimal and equitable quality in Sungai Apit District.

Regarding facilities and infrastructure, although most schools have adequate facilities, alignment of facilities with curricular needs remains challenging, especially in information technology (Simatupang et al., 2023; Saputri & Pratikno,

2024; Widiyono et al., 2024). Some schools still lack technological devices that support learning, such as Chromebooks, or stable internet access (Kamaludin, 2022; Simatupang et al., 2023; Saputri & Pratikno, 2024). This creates disparities in the quality of the learning process among schools. In conclusion, strengthening the provision and equitable distribution of information technology facilities is an urgent need to improve the quality of primary schools in the digital era.

Teachers' digital literacy in Sungai Apit District also varies depending on age, learning motivation, and school support (Zuhri, 2024; Lestari et al., 2024; Devi & Winangun, 2024). Some teachers are proficient in using computers, projectors, and data-processing applications, while others remain comfortable with conventional methods and feel less confident using technology (Rosita & Iskandar, 2022; Lestari et al., 2024; Zuhri, 2024). Therefore, sustained digital literacy training programs are necessary to strengthen teachers' competencies so they can keep pace with developments in educational technology. This will have direct implications for improving the overall quality of learning.

The quality of the learning process in primary schools in Sungai Apit District is strongly influenced by the quality of the principal's leadership, facilities and infrastructure, and teachers' digital literacy (Eko et al., 2023; Waruwu, 2024; Saputri & Pratikno, 2024). Schools that are strong in these three aspects tend to have enjoyable and objective learning processes that foster students' critical thinking skills (Kamaludin, 2022; Simatupang et al., 2023; Lestari et al., 2024). Therefore, investment in the development of these three main aspects will directly impact graduate quality and the sustainable competitiveness of primary schools.

This study also underscores the importance of active participation by parents and the community in supporting the quality of primary schools. The level of parental satisfaction with school services, involvement in school committees, and community support for school activities reflect the quality of school management (Triwiyanto et al., 2023; Sari, 2019; Ratiningsih et al., 2022). Schools with collaborative cultures that involve external stakeholders are proven capable of creating healthy, supportive educational environments (Devisiana et al., 2024; Marlana et al., 2023; Suandi et al., 2022). Thus, strengthening community involvement is a key supporting factor for educational quality.

This study also identifies challenges in achieving equitable quality among primary schools. Geographical and social factors as well as resource constraints are major obstacles to optimizing school quality across the region (Eko et al., 2023; Kamaludin, 2022; Saputri & Pratikno, 2024). Local governments and education managers need to formulate affirmative policies to ensure equity in facilities, teacher training, and managerial assistance across all primary schools (Widiyono et al., 2024; Simatupang et al., 2023; Kamaludin, 2022). In conclusion, achieving equity in educational quality must be a top priority in developing primary education in Sungai Apit District.

These findings are in line with previous studies that highlight the role of integrating leadership, infrastructure, and digital literacy in improving the quality of primary education (Leithwood & Jantzi, 2005; Earthman, 2002; Ng, 2012). However, this study enriches the literature by empirically examining the simultaneous influence of the three variables in a local context with particular

geographical and social characteristics (Eko et al., 2023; Waruwu, 2024; Saputri & Pratikno, 2024). Thus, this study makes a significant contribution to the development of theory and practice in primary education management.

The limitation of this study lies in the scope limited to a single district and the use of a self-report instrument, which is potentially subject to subjective bias (Saputri & Pratikno, 2024; Widiyono et al., 2024; Simatupang et al., 2023). Future research is recommended to expand the study area, use mixed methods, and include additional relevant variables to obtain more comprehensive findings (Eko et al., 2023; Waruwu, 2024; Kamaludin, 2022). In this way, the results can serve as a stronger basis for more effective educational policy making.

Based on the findings of this study, strategic recommendations include strengthening transformational leadership training for principals, equitable provision and distribution of educational facilities—especially educational technology devices—and continuous digital literacy training for teachers and education personnel (Kamaludin, 2022; Saputri & Pratikno, 2024; Zuhri, 2024). Policies that emphasize the integration of these three main variables are expected to accelerate the achievement of superior primary education quality in Sungai Apit District (Eko et al., 2023; Waruwu, 2024; Devi & Winangun, 2024). Thus, the results of this study are expected to serve as a reference for education stakeholders in designing relevant, effective, and sustainable development strategies for primary schools.

CONCLUSIONS

This study proves that principals' transformational leadership, the availability of educational facilities and infrastructure, and digital literacy have significant partial and simultaneous effects on the quality of primary schools in Sungai Apit District. These three variables explain 81.6% of the variation in primary school quality, while the remainder is influenced by factors outside the study model. Specifically, principals who apply a transformational leadership style can build a culture of innovation, increase motivation, and strengthen collaboration within the school. The availability of educational facilities and infrastructure—especially technology devices—is a prerequisite for optimizing learning and curriculum implementation. Teachers' and principals' digital literacy is crucial to improving the effectiveness of technology-based learning and digital school management. The synergy of these three factors is highly determinative of delivering educational services that are high-quality, adaptive, and aligned with the demands of the digital era.

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