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THE EFFECTIVENESS OF FACILITIES AND INFRASTRUCTURE MANAGEMENT IN SUPPORTING DIGITAL-BASED LEARNING AT PUBLIC ELEMENTARY SCHOOLS IN NGAWEN DISTRICT

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Abstrak. Digital transformation in education requires elementary schools to manage facilities and infrastructure effectively in order to support digital-based learning processes. This study aims to describe the management process of digital facilities and infrastructure, which includes planning, procurement, and maintenance, as well as the effectiveness of such management in supporting the success of digital-based learning at Public Elementary Schools in Ngawen District, Klaten Regency. This study employed a quantitative approach using a survey method. Data were collected through the distribution of questionnaires to 78 respondents consisting of principals, teachers, and administrative staff from several Public Elementary Schools in Ngawen District. The data analysis techniques employed were descriptive statistics and simple linear regression. The findings indicate that the management of digital facilities and infrastructure falls within the good category, with an achievement percentage of 78.6%. The planning aspect obtained the highest score compared to procurement and maintenance. Digital-based learning also demonstrated a high level of effectiveness, particularly in the indicators of material accessibility and student engagement. The results of the regression analysis indicate that facilities and infrastructure management has a significant effect on the effectiveness of digital-based learning, with a coefficient of determination of 64.2%. This study confirms that the success of digital learning is determined not only by the availability of technology, but also by the quality of systematic and sustainable management of educational facilities.

Keyword : facilities and infrastructure management, digital learning, elementary schools, learning effectiveness, educational transformation

I. INTRODUCTION

Background of the Study

The development of information technology has shifted the educational paradigm from conventional learning to digital-based learning. Schools no longer function solely as spaces for transferring knowledge, but also as digital ecosystems that support access to information, learning interaction, and the development of 21st-century competencies. This situation has encouraged primary educational institutions to adapt by providing adequate digital facilities and infrastructure.

In the context of primary education in Indonesia, the implementation of digital-based learning still faces various obstacles, particularly those related to the management of educational facilities. Many schools already possess technological devices such as computers, projectors, internet connections, and digital learning media, yet these resources have not been managed optimally. These problems include a lack of focus on planning, procurement that is not based on actual needs, and unsustainable facility maintenance. Consequently, the use of technology in learning has not been able to maximize the quality of the teaching and learning process.

Klaten Regency, particularly Ngawen District, is one of the regions that has begun developing digital-based learning at the elementary school level. However, the implementation of digitalization in education in this region still demonstrates disparities among schools, both in terms of the availability of devices and the quality of their management. Several schools have been able to integrate technology effectively into learning, while others still face limitations in infrastructure and facility management.

Previous studies generally focused on the availability of technological resources or the effectiveness of digital learning in general. Research conducted by Jannah et al. (2025) demonstrated that innovation in facility management can improve the quality of digital learning; however, the study employed a qualitative descriptive approach and therefore did not statistically measure the magnitude of such influence. Another study by Khodijah and Setiawan (2025) highlighted the importance of digital facilities in elementary schools, yet did not specifically examine the relationship between facility management processes and learning effectiveness.

Based on these conditions, there remains a research gap in the limited quantitative studies that empirically measure the effect of facilities and infrastructure management on the effectiveness of digital-based learning at the elementary school level. Therefore, this study was conducted to analyze the effectiveness of digital facilities and infrastructure management in supporting the success of digital-based learning at a public elementary school in Ngawen District, Klaten Regency.

II. METHOD

Type and Research Design

This study employed a quantitative approach with a descriptive survey design. The quantitative approach was selected because the research objective focused on measuring levels of effectiveness that can be quantified, compared across dimensions, and generalized to a certain extent to the research population (Sugiyono, 2019). The survey design enabled efficient and systematic data collection from a large number of respondents.

Population and Sample

The research population included all school personnel directly involved in the management and use of digital infrastructure at 18 public elementary schools in Ngawen District, Klaten Regency, totaling 312 individuals (principals, teachers, and administrative staff). The sample was determined using the Slovin formula with a 5% margin of error, resulting in 120 respondents. The sampling technique employed was proportional stratified random sampling to ensure proportional representation from each respondent group: 18 principals, 72 teachers, and 30 administrative staff.

Instruments and Data Collection Techniques

Data were collected using a structured questionnaire with a four-point Likert scale (1 = Strongly Disagree, 4 = Strongly Agree) consisting of 40 statements. The instrument was developed based on the adaptation of the infrastructure management theory proposed by Barnawi and Arifin (2016) and the management effectiveness standards proposed by Mulyasa (2019). The instrument was subsequently validated by two educational management experts. Validity was tested using Pearson Product Moment correlation (all items were valid with r-count > r-table = 0.195), while reliability was tested using Cronbach's Alpha, resulting in a coefficient of $\alpha = 0.893$ (highly reliable). Supporting data, including the physical condition of equipment, were obtained through observation sheets and school inventory documentation.

Data Analysis Techniques

Data analysis was conducted using descriptive statistics, including: (1) calculating mean scores and percentages for each management dimension; (2) categorizing effectiveness based on score conversion (3.26–4.00 = Effective; 2.51–3.25 = Moderately Effective; 1.76–2.50 = Less Effective; 1.00–1.75 = Ineffective); and (3) comparative analysis across dimensions to identify management strengths and weaknesses. Furthermore, trend analysis based on documentation data was conducted to observe changes in digital learning indicators during the 2025–2026 period.
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III. RESULTS AND DISCUSSION

Description of Digital Facilities and Infrastructure Management

The results of the study indicate that the management of digital facilities and infrastructure at Public Elementary Schools in Ngawen District falls within the good category.

Table 1. Percentage of Facilities and Infrastructure Management

Aspect	Percentage	Category
Planning	82%	Very Good
Procurement	77%	Good
Maintenance	76%	Good
Average	78.6%	Good

The data indicate that the planning aspect obtained the highest score. Schools have formulated digital facility development programs based on learning needs. However, maintenance remains an aspect that requires improvement because several devices experienced damage due to intensive use.

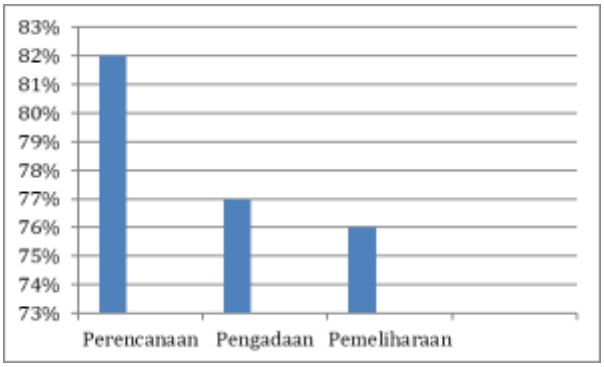

Figure 1. Percentage of Facilities and Infrastructure Management

The findings indicate that most schools have developed awareness regarding the importance of systematic digital facility management. This finding is in line with the study conducted by Hanif (2026), which stated that the success of educational digitalization is strongly influenced by educational facility governance.

Effectiveness of Digital-Based Learning

Table 2. Effectiveness of Digital Learning

Indicator	Percentage	Category
Material Accessibility	84%	Very Good
Student Engagement	79%	Good
Learning Efficiency	81%	Very Good
Learning Outcomes	78%	Good
Average	80.5%	Good

The data indicate that digital learning provides easier access to learning materials for students. Teachers are able to utilize digital learning media such as interactive videos, multimedia presentations, and online platforms to improve learning quality.

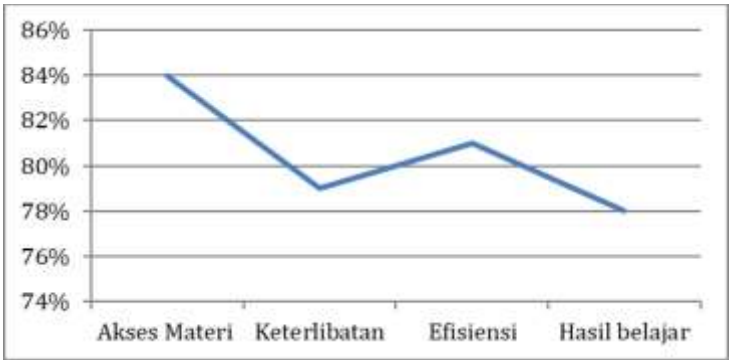

Figure 2. Distribution of Digital Learning Effectiveness

Nevertheless, student engagement still faces obstacles in several schools due to limitations in devices and internet networks. This finding demonstrates that the success of digital learning depends not only on teacher competence, but also on adequate facility support.

The Effect of Facilities and Infrastructure Management on Digital Learning

The results of the regression analysis indicate that facilities and infrastructure management has a significant effect on the effectiveness of digital-based learning.

Table 3. Results of Linear Regression Test

Variable	Coefficient	Sig.
Constant	12.541	0.001
Facilities and Infrastructure Management	0.742	0.000

The significance value of 0.000 < 0.05 indicates a significant effect between facilities and infrastructure management and the effectiveness of digital learning.

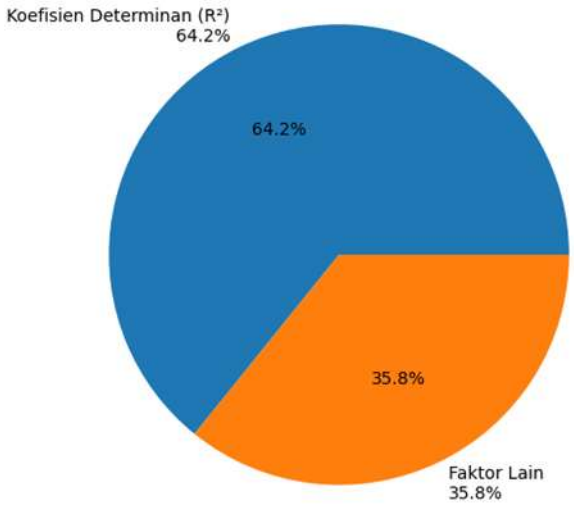

Figure 3. The Effect of Facilities and Infrastructure Management on Learning Effectiveness

The results indicate that 64.2% of the effectiveness of digital learning is influenced by the quality of facilities and infrastructure management, while the remaining percentage is influenced by other factors such as teacher competence, parental support, and student readiness. The findings of this study reinforce educational management theory, which states that educational facilities constitute a strategic factor in improving learning quality. Effective facility management enables the learning process to become more interactive, efficient, and adaptive to technological developments. In addition, this study provides empirical evidence that the maintenance aspect of facilities exerts a substantial influence on the sustainability of digital learning. Many schools focus on procuring new devices but pay less attention to long-term maintenance. Consequently, devices experience rapid functional decline. om the perspective of educational economics, the findings indicate that investment in educational technology will produce optimal impacts when accompanied by an effective management system. Procurement of devices without proper planning and maintenance will merely increase operational costs without generating significant improvements in learning quality.

V. CONCLUSION

This study demonstrates that the management of digital facilities and infrastructure at Public Elementary Schools in Ngawen District, Klaten Regency, falls within the good category, with an average achievement score of

78.6%. The planning aspect became the most optimal component compared to procurement and maintenance. The effectiveness of digital-based learning also falls within the good category, with an average percentage of 80.5%. Digital learning has proven to improve material accessibility, learning efficiency, and student engagement. The results of the regression analysis indicate that facilities and infrastructure management has a significant effect on the effectiveness of digital-based learning, with a contribution of 64.2%. This finding confirms that the success of digital educational transformation depends not only on the availability of technology, but also on the quality of educational facility management that is planned, efficient, and sustainable. This study recommends that schools improve digital facility maintenance systems, conduct periodic evaluations of technological needs, and strengthen facility management competencies among educational personnel..

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