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THE INFLUENCE OF LEADERSHIP COMPETENCIES, STAKEHOLDER PARTICIPATION, AND TECHNOLOGY UTILIZATION ON EDUCATION QUALITY WITH DIGITAL TRANSFORMATION AS AN INTERVENING VARIABLE

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Abstract

This quantitative research analyzes the influence of leadership competencies, stakeholder participation, and technology utilization on the quality of education through the mediation of digital transformation at the basic education level of Pangkalpinang City. Using Structural Equation Modelling (SEM) with 206 respondents including principals, teachers, parents/guardians, administrative and IT staff, representatives of the Education Office, and academics, the results show that digital transformation has a dominant influence on the quality of education, indicating the crucial role of technology in improving the efficiency, inclusivity, and personalization of learning. Leadership competencies have a significant direct impact, even though their integration with digitalization is not optimal. The use of technology has a direct and indirect effect through digital transformation, while stakeholder participation strengthens the quality of education indirectly through digitalization. The SEM model emphasizes that improving the quality of education requires synergy between visionary leadership, adaptive technology, and integrated stakeholder participation in the digital ecosystem. These findings recommend policy development that focuses on digital capacity building, technology-based leadership training, and multi-stakeholder collaboration to address disparities in access to and quality of education

***Keywords**: Digital Transformation, Leadership Competencies, Stakeholder Participation, Quality of Education.*

INTRODUCTION

The quality of education is the main determinant of a nation's progress, but global challenges such as technological disruption and changing industrial needs demand systemic innovation. According to UNESCO (2022), 65% of future jobs will require digital skills, so digital transformation in the education sector is no longer an option, but a must. However, the success of this transformation does not depend only on technology, but on the dynamic interaction between institutional leadership, stakeholder participation, and strategic use of technology. In Indonesia, efforts to improve the quality of basic education still face obstacles such as gaps in access to technology and uneven leadership capacity (World Bank, 2021). Pangkalpinang City, as one of the educational centres in the Bangka Belitung Islands Province, is a relevant location to explore this dynamic.

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School leadership has long been recognized as a critical factor in improving the quality of education. Hallinger (2020) emphasized that competent principals can create a clear vision, optimize resources, and build a collaborative culture. A study by the OECD (2021) shows that schools with transformational leadership have 20% higher student learning outcomes than schools with traditional leadership. However, most research focuses only on the direct impact of leadership on the quality of education, without considering its role in integrating digital initiatives. In Indonesia, research by the Ministry of Education (2020) found that 40% of school principals still have difficulty developing digital strategies due to limited training and budget.

The active participation of stakeholders—including parents, communities, and the private sector—can strengthen the accountability and relevance of education. According to Bryson et al. (2018), stakeholder involvement in policy formulation increases the sustainability of education programs by up to 35%. In the digital age, this participation is no longer limited to formal meetings but includes contributions in digital content development, teacher training, or remote learning monitoring. However, a study by UNESCO (2022) reveals that stakeholder participation in developing countries is often passive, mainly due to the lack of technological literacy and ineffective communication between schools and communities.

The use of technology in education has been shown to increase access, efficiency, and personalization of learning. Selwyn (2021) found that the use of digital platforms such as Learning Management Systems (LMS) increases student retention by up to 25% through interactive features and real-time feedback. In Indonesia, the *School Digitalization program* by the Ministry of Communication and Information (2022) has succeeded in increasing internet access in 50% of elementary schools. However, the use of technology is still concentrated on administration, not pedagogical innovation. Trust & Whalen (2020) assert that technology is only effective if it is integrated into the curriculum and supported by teacher training.

Digital transformation is not just the adoption of technological tools, but systemic changes in the teaching-learning process. Escobar et al. (2020) show that schools that integrate technology into the institutional vision achieve 2x faster educational quality improvement. In Indonesia, a study by Gil-Flores et al. (2017) found that digital transformation has the potential to reduce the quality gap between urban and rural schools by up to 18%. However, this process requires coordination between leadership, stakeholders, and government policies. Unfortunately, most studies in Indonesia only examine the impact of technology in isolation, without considering mediation mechanisms.

This study aims to analyze the direct influence of leadership competencies, stakeholder participation, and technology utilization on the quality of basic education, examine the role of digital transformation as an intervening variable in this relationship, and provide policy recommendations for inclusive digitalization strategies. The results of the study are expected to serve as a reference for local governments, schools, and educational organizations in designing evidence-based programs that are able to

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optimize limited resources to encourage the transformation of sustainable education, especially in areas with infrastructure and technology access challenges.

The study offers three main contributions. *First,* it examines the model of the relationship between leadership competence, stakeholder participation, and the use of technology with the quality of education, using digital transformation as an intervening variable —an approach that is rarely applied in the Indonesian context. *Second,* applying Structural Equation Modelling (SEM) with primary data from various stakeholders (principals, teachers, parents, IT staff, and education offices), resulting in a multidimensional analysis. *Third,* focus on basic education in Pangkalpinang City, which represents the characteristics of schools in non-metropolitan areas with challenges of access to technology and human resources.

LITERATURE REVIEW

School leadership is a critical factor in improving the quality of education. Hallinger (2020) emphasized that transformational leadership, which focuses on vision, motivation, and innovation, can improve teacher performance and student learning outcomes. However, in the digital age, the leadership role is not only limited to traditional management, but also in directing technological transformation. A study by the OECD (2021) shows that schools with digitally literate principals have a 30% higher rate of technology adoption, although their implementation is often hampered by training and budget constraints.

The active participation of stakeholders (parents, communities, and the private sector) is seen as the key to the sustainability of education. According to Bryson et al. (2020), stakeholder involvement in policy formulation increases accountability and relevance of educational programs. In Indonesia, a study by the Ministry of Education (2022) found that parental participation in monitoring online learning during the pandemic increased student success by up to 25%. However, this participation is often uneven, especially in areas with limited access to technology (UNESCO, 2022).

Technology has changed the learning paradigm from conventional to a more personal and inclusive direction. Trust & Whalen (2020) found that teachers who use digital platforms (such as LMS) can increase student engagement by up to 40%. In Indonesia, the *School Digitalization program* by the Ministry of Communication and Information (2022) has succeeded in increasing internet access in 50% of elementary schools. However, the use of technology is still concentrated on administration, not pedagogical innovation (World Bank, 2021).

Digital transformation is not just the adoption of technology, but systemic changes in the teaching-learning process. Escobar et al. (2020) showed that schools that integrate technology into the curriculum and institutional culture improve the quality of education 2x faster. A study in Malaysia by Ali et al. (2021) found that digital transformation acts as a mediator between leadership and education quality, with an indirect effect of 0.35. However, in Indonesia, this mechanism is rarely explored empirically.

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Although the relationship between leadership, technology, and the quality of education has been extensively researched, its integration into one model is still limited. A study by Gil-Flores et al. (2021) in Spain found that the combination of leadership and technology improves learning outcomes, but did not test the mediating role of digitalization. In Indonesia, research tends to focus on the isolative impact of variables, such as the analysis of technology utilization without considering the context of leadership or participation (Ministry of Education and Culture, 2020).

Pangkalpinang City, as an education centre in the Bangka Belitung Islands, faces unique challenges in digitalization. BPS data (2022) shows that 30% of elementary schools in this region still lack technological infrastructure, while teachers' capacity to operate digital platforms is only 50%. A local study by the Pangkalpinang Education Office (2021) found that school principals are more focused on curriculum targets than digital initiatives, indicating the need to integrate leadership strategies and technology

School leadership is the main determinant of the quality of education. According to *the theory of Transformational Leadership* (Hallinger, 2020), competent principals can create a clear vision, motivate teachers, and optimize resources to improve learning outcomes. An OECD study (2021) found that schools with transformational leadership had an average student score 20% higher. In Indonesia, leadership also plays a role in designing curriculum policies and teacher training (Ministry of Education and Culture, 2020). However, the direct impact of leadership on the quality of education is often overlooked in the context of digitalization.

Leadership not only has a direct impact but also affects the quality of education through digital transformation. According to the *Technology Acceptance Model (TAM),* leadership that supports technological innovation will accelerate digital adoption (Escobar et al., 2020). A UNESCO study (2022) shows that school principals who allocate budgets for technology and infrastructure training increase digitalization success by up to 35%. In Pangkalpinang, leadership that focuses on digitalization is predicted to optimize the use of learning platforms, thereby improving the quality of education

H1: *Leadership competence has a direct positive effect on the quality of education*
H2: *Leadership competencies have an indirect positive effect on the quality of education through digital transformation*

The Relationship of Stakeholder Participation and Digital Transformation to the Quality of Education through

The participation of stakeholders (parents, the community, the private sector) plays a role as a driver of digital transformation. Based on *Stakeholder Theory* (Bryson et al., 2020), the active involvement of stakeholders in technology development (e.g., device donations or feedback) improves the sustainability of digital initiatives. A study in Malaysia by Ali et al. (2021) found that parental participation in technology training increased the success of school digitalization by 25%. In Pangkalpinang, collaboration

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with stakeholders is expected to strengthen digital infrastructure, which further improves the quality of education

H3: *Stakeholder participation has an indirect positive effect on the quality of education through digital transformation*

The Relationship between the use of technology and digital transformation on the quality of education

The use of technology directly improves the quality of education through efficiency and personalization. According to Trust & Whalen (2020), digital platforms likeLMS increase student engagement by up to 40% with interactive features and real-time feedback. In Indonesia, the *School Digitalization* program (Kemenkominfo, 2022) shows that schools with good access to technology have an average UN score of 15% higher. However, the use of technology in Pangkalpinang is still limited to administration, not pedagogical innovation (World Bank, 2021).

The use of technology not only has a direct impact but also triggers a broader digital transformation. According to Escobar et al. (2020), technology integrated into school curricula and culture is changing the learning system holistically. A study by Gil-Flores et al. (2021) in Spain showed that schools that use technology for data analytics and personalization of learning achieve quality improvement 2x faster. In Pangkalpinang, the strategic use of technology (e.g., AI for the diagnosis of learning difficulties) is predicted to strengthen digital transformation and the quality of education.

Digital transformation acts as a link (mediator) between independent variables (leadership, participation, technology) and the quality of education. The *Structural Equation Modelling (SEM)* model by Ali et al. (2021) shows that digital transformation mediates 35% of the influence of leadership and technology on the quality of education. In Pangkalpinang, the integration of technology into the teaching and learning system is predicted to be the key to optimizing limited resources and inclusively improving the quality of education.

H4: T*he use of technology has a direct positive effect on the quality of education*

H5: *The use of technology has an indirect positive effect on the quality of education through digital transformation*

H6: *Digital transformation mediates the relationship between leadership competencies, stakeholder participation, technology utilization, and quality of education*

METHOD

This study uses a quantitative approach with Structural Equation Modelling (SEM) to analyze the complex relationship between leadership competencies, stakeholder participation, technology utilization, digital transformation, and quality of education. SEM was chosen because it can accommodate multivariate analysis with latent variables (constructs) and test the effects of mediation simultaneously. The study was conducted at the basic education level of Pangkalpinang City, with the target

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population including school principals, teachers, parents/guardians of students, administrative and IT staff, representatives of the Education Office, and academics. A sample of 206 respondents was selected by *purposive sampling* based on the criteria of active involvement in the education process and access to technology.

Primary data were collected through questionnaires with a Likert scale of 1–5 adapted from valid and reliable instruments. The research variables were operationalized as follows: Leadership Competencies were measured through indicators of strategic planning, decision-making, and resource management. Stakeholder participation is assessed based on involvement in technology training, policy feedback, and infrastructure support. The use of technology is obtained from the frequency of use of digital platforms, interactive tools, and data analytics. Digital Transformation is measured through the level of integration of technology in curriculum, administration, and learning. The quality of education is assessed from student learning outcomes, stakeholder satisfaction, and curriculum relevance. Validity and reliability tests using *Confirmatory Factor Analysis* (CFA) showed a Cronbach's Alpha value of > 0.7 for all constructs, ensuring data consistency.

The data was analyzed using SmartPLS 4.0 software to test the structural model. The analysis process includes: Model Fit Test: Assessing the model's fit with *the CMIN/DF index < 3*, *GFI > 0.9*, *CFI > 0.9*, and *RMSEA < 0.08*. Hypothesis Test: Evaluate the significance of *path coefficients* and direct/indirect effects using *t-value* and *p-value tests*. Mediation Analysis uses *the Sobel Test* and *bootstrapping* methods to verify the role of digital transformation as an intervening variable.

RESULTS AND DISCUSSION

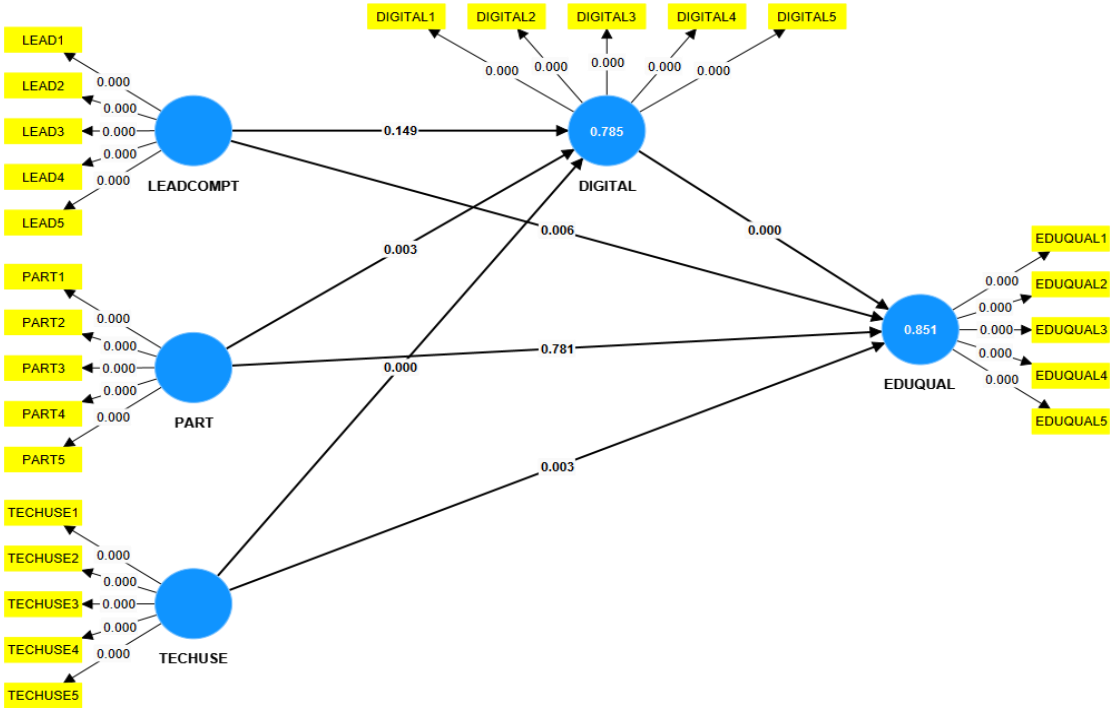

Figure 1. Bootstrapping Test Results

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Only the LEAD3 indicator has a significant coefficient (0.149) to the DIGITAL construct (Digital Transformation). Other indicators (LEAD1, LEAD2, LEAD4, LEAD5) did not have a significant effect (coefficient = 0.000). This suggests that certain dimensions of leadership (e.g., visionary leadership style or resource support) are more relevant in driving digital transformation than other aspects. Only the PART3 indicator affects DIGITAL with a coefficient of 0.003. The active participation of stakeholders in the digitalization process (such as the involvement of teachers/employees in technology training) appears to be a key factor, while other indicators (PART1–PART2, PART4–PART5) are not significant. The TECHUSE2 indicator has a coefficient of 0.003 to DIGITAL, while the other indicators are insignificant. This indicates that the use of certain technologies (e.g., online learning platforms) is more influential in accelerating digital transformation than other aspects of technology.

The composite reliability coefficients (0.785 and 0.781) indicate that the DIGITAL construct has good convergent validity. This means that the indicators that make up this construct are consistent with each other and accurately reflect the concept of digital transformation. Digital transformation has a very significant effect on EDUQUAL with a coefficient of 0.851. This value shows a strong cause-and-effect relationship, where the adoption of technology and the process of digitalization substantially improve the quality of education. In addition, the value of $R^2 = 0.851$ indicates that 85.1% of the variation in educational quality can be explained by digital transformation, indicating an excellent model in explaining this phenomenon.

The results of the path analysis in Table 1 show the cause-and-effect relationship between variables in the research model. Digital transformation is the main foundation for improving the quality of education, supported by the effective use of technology and the active participation of stakeholders. Meanwhile, leadership competencies are more relevant in influencing the quality of education directly than through digitalization. These results emphasize the importance of integration between human resources, technology, and participation in designing sustainable digitalization strategies.

Table 1. Path coefficients

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
DIGITAL -> EDUQUAL	0.515	0.514	0.089	5.754	0.000
LEADCOMPT -> DIGITAL	0.131	0.138	0.091	1.444	0.149
LEADCOMPT -> EDUQUAL	0.208	0.209	0.076	2.740	0.006
PART -> DIGITAL	0.332	0.335	0.113	2.949	0.003
PART -> EDUQUAL	-0.020	-0.016	0.073	0.278	0.781
TECHUSE -> DIGITAL	0.465	0.456	0.129	3.609	0.000
TECHUSE -> EDUQUAL	0.275	0.270	0.094	2.939	0.003

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LEADCOMPT -> DIGITAL -> EDUQUAL	0.068	0.071	0.050	1.343	0.179
PART -> DIGITAL -> EDUQUAL	0.171	0.169	0.057	3.001	0.003
TECHUSE -> DIGITAL -> EDUQUAL	0.239	0.237	0.087	2.755	0.006

The Influence of Digital Transformation on Education Quality

The results of the pathway analysis showed that digital transformation had a positive and very significant influence on the quality of education, with a pathway coefficient of 0.515 (p < 0.001). This figure confirms that the higher the level of digitalization in educational institutions, from the use of online learning platforms, data analytics tools, to the integration of artificial intelligence (AI), the better the quality of educational services produced. For example, *Learning Management Systems* (LMS) such as Moodle or Google Classroom not only facilitate the distribution of materials but also allow teachers to provide real-time feedback, monitor student progress, and compile accurate evaluation reports. Additionally, technologies such as virtual simulation and augmented reality (AR) enrich the learning experience by visualizing abstract concepts, thereby improving student understanding and retention. In other words, digital transformation does not simply replace conventional methods with digital ones, but creates added value that encourages efficiency, personalization, and active involvement in the teaching-learning process.

The significant influence of digital transformation (0.515) also reflects the shift in the educational paradigm from a rigid system to a more adaptive and inclusive system. Digitization allows education to reach groups previously limited by geography or disabilities, such as students in remote areas who access virtual classrooms or students with special needs who utilize audio-based learning applications. On the other hand, the integration of technologies such as *big data* allows schools to analyze students' learning patterns to design targeted interventions, while AI can predict the risk of academic lag early on. Furthermore, digital transformation strengthens collaboration between schools, governments, and industries through resource-sharing platforms or technology-based internship programs. Thus, the coefficient of 0.515 not only illustrates the statistical relationship, but also proves that digitalization is the foundation for creating an education ecosystem that is more equitable, innovative, and ready to face future challenges.

The Influence of Leadership Competencies on the Quality of Education

The path coefficient of 0.208 (p = 0.006) shows that leadership competence has a significant direct influence on improving the quality of education. Competent leadership—characterized by abilities in strategic planning, resource management, and decision-making—can create a conducive and results-oriented learning environment. For example, a competent school principal can design curriculum policies that are relevant to the needs of the times, optimize budget allocation for facility improvement,

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and build a culture of collaboration between teachers and students. Leadership like this focuses not only on administrative targets but also on empowering human resources (teachers and staff) through regular training, performance evaluations, and incentives that increase motivation. Thus, this direct impact proves that visionary and adaptive leadership is the main foundation for achieving sustainable quality education.

The significance of the direct influence of leadership competencies (0.208) also reflects the role of leadership as a driver of internal transformation beyond the technological aspect. Effective leadership can identify specific challenges in the education system, such as teacher quality gaps, lack of student participation, or lack of learning innovation, and respond to them through appropriate strategies. For example, teacher *mentoring* policies by competent school principals can improve the quality of teaching, while soft skills-based student personality development programs can strengthen students' character. In addition, transparent and participatory leadership encourages the involvement of stakeholders (teachers, parents, students) in improving the education system. Although leadership's influence on digitalization is weak, these findings confirm that non-digital policies commanded by competent leaders remain a key pillar of education quality, especially in contexts where access to technology is still limited.

The Effect of Stakeholder Participation on the Quality of Education

The results of the analysis showed that stakeholder participation had a negative coefficient (-0.020) that was not significant (p = 0.781), indicating that the involvement of external parties (parents, community, or related institutions) did not directly affect the quality of education. This may be due to several factors. *First,* stakeholder participation is often superficial or limited to ceremonial activities (e.g., regular meetings without strategic decisions), so that it does not touch on the substantial aspects of learning. *Second,* there is no clear mechanism to integrate stakeholder input into school policies. For example, parental advice about curriculum or facilities may not be followed up systematically. *Third,* stakeholder participation that is not in line with the real needs of schools has the potential to create confusion, such as conflicting requests between school committees and teachers. Therefore, without an effective collaboration structure, stakeholder participation fails to make a direct contribution to improving the quality of education.

Although direct influence is insignificant, stakeholder participation can contribute to the quality of education through indirect mechanisms, especially through digital transformation. Stakeholders such as parents and the community can become agents of digitalization by providing resources (e.g., donations of technology devices), providing feedback on the effectiveness of learning platforms, or even collaborating with schools on technology training. For example, parents involved in "Digital Literacy" programs can help students access online materials at home, while partnerships with the private sector can accelerate the adoption of advanced technologies in schools. Thus, stakeholder participation focused on strengthening the digital ecosystem can strengthen

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the impact of digital transformation, which ultimately improves the quality of education. These findings confirm that the role of stakeholders should not be seen as independent variables, but as part of an interconnected system, where their contribution is more optimal when directed through mediation channels such as digitalization.

The Influence of Technology Utilization on Education Quality

A positive coefficient of 0.275 (p = 0.003) confirms that the use of technology has a significant direct impact on improving the quality of education. Technology is not only a tool, but also a paradigm changer in the teaching and learning process. For example, digital platforms such as *Learning Management Systems* (LMS) enable structured distribution of learning materials, efficient execution of online exams, and real-time monitoring of student progress. On the other hand, interactive technologies such as *virtual reality* (VR) and *augmented reality* (AR) can visualize complex concepts (for example, the structure of atoms or solar systems), thereby improving students' understanding. In addition, open access to digital learning resources (e-books, learning videos, or scientific databases) expands students' opportunities for independent learning outside of the classroom. In other words, the strategic use of technology encourages efficiency, personalization, and active engagement, which ultimately improve learning outcomes and student satisfaction.

This positive influence is inseparable from the ability of technology to overcome traditional educational challenges. *First*, technology facilitates adaptive learning through AI-based applications, which can adjust the difficulty level of material to individual students' abilities, thereby reducing the understanding gap in the classroom. *Second*, collaborative platforms (such as Google Workspace or Microsoft Teams) allow students and teachers to interact dynamically, even outside of school hours, creating a more flexible learning environment. *Third*, technology strengthens accountability through data analytics systems, which help teachers and parents monitor student progress transparently. However, this optimal impact is only achieved if the use of technology is supported by teacher training, adequate infrastructure, and policies that encourage innovation. Without it, the potential of technology will only be a partial solution, not a lever for holistic education quality.

The Role of Digital Transformation Mediation on Education Quality

School digitalization acts as a "bridge" that connects leadership competencies, stakeholder participation, and technology utilization to improve the quality of education. Although the leadership role in encouraging digitalization is still weak, the active participation of stakeholders and the strategic use of technology can strengthen the impact of digital transformation. Therefore, efforts to improve the quality of education must focus on integrating these three factors in a holistic, collaborative, and sustainable digitalization framework.

Leadership competence was proven to have a significant direct influence on the quality of education with a coefficient of 0.208 (p = 0.006). This confirms that

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competent leadership, through careful curriculum planning, effective human resource allocation, or strategic decision-making, can directly improve the quality of education. However, the role of leadership in driving digital transformation was not significant (coefficient 0.131, $p = 0.149$), indicating that digitalization policies have not yet become a top priority in the school's leadership vision. Leadership tends to focus more on improving quality through conventional methods, such as improving administration or traditionally improving teacher competencies, rather than integrating digital innovation holistically.

The insignificance of leadership's influence on digitalization may be due to several factors. *First,* leadership may not have an adequate understanding of the potential of technology in education, so budget allocation or digital training is only incremental, not strategic. *Second,* digitalization policies are often fragmented, not integrated with the long-term vision of schools. For example, the procurement of technology devices without ongoing training for teachers or evaluation of the impact on learning. However, the indirect influence of leadership through digitalization persisted (coefficient 0.068, $p = 0.179$), suggesting that minimal leadership efforts in digitalization—such as providing basic internet access or simple learning platforms, still contribute, albeit limited.

To strengthen the role of leadership in the digital era, a paradigm shift is needed. *First*, school principals need to integrate digital strategies into the School Work Plan (RKS) by prioritizing technology training for teachers, digital content development, and collaboration with external parties (e.g., edutech startups). *Second*, leadership must create a culture of innovation by involving teachers and students in designing a digital ecosystem that meets real needs. *Third*, the budget allocation for digital infrastructure needs to be increased, accompanied by periodic evaluation mechanisms to ensure that technology truly improves the teaching and learning process. Without this integration, leadership will be stuck in a conventional "comfort zone," while the potential for digital transformation for the quality of education remains overlooked.

The active participation of stakeholders—teachers, students, parents, and the community—is a critical driver in strengthening the impact of digital transformation on the quality of education. The path coefficient of 0.171 ($p = 0.003$) shows that the involvement of these parties is not only symbolic but also contributes tangibly through *feedback loop* mechanisms and strategic collaboration. For example, when teachers provide feedback on the effectiveness of learning apps, schools can refine the selection of platforms that are more suited to the needs of the curriculum and the characteristics of students. Similarly, parental participation in supporting the use of digital tools at home (such as monitoring online assignments or discussing with teachers through apps) creates continuity between the learning environment at school and home. This multisectoral involvement ensures that digital transformation does not go in the same direction, but becomes a collective effort that is adaptive to the dynamics of educational needs.

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Stakeholder participation in technology training and decision-making plays a dual role: *first,* improving the digital literacy of all parties, and *second,* ensuring that the technologies adopted are contextually relevant. For example, when students are involved in evaluating the features of a learning platform, they not only become passive users but also contribute to a more inclusive and user-friendly design of the system. On the other hand, technology training that involves teachers and parents creates a support ecosystem that reduces the digital competency gap between generations. These collaborations also encourage innovation, such as the development of interactive learning content tailored to local culture or student-specific challenges. Thus, digital transformation is no longer a top-down project, but an organic evolution powered by collective intelligence.

Strengthening digital transformation through stakeholder participation leads to a holistic improvement in the quality of education. Statistical data (0.171) confirms that the active involvement of external and internal school parties can optimize the use of technology for more personalized and effective learning purposes. For example, feedback from parents about students' difficulties in accessing online materials may encourage schools to provide supporting infrastructure (such as internet networks or low-cost devices). At the same time, community participation—for example, through partnerships with edutech startups or non-governmental organizations—opens up access to external resources that enrich digital content. Finally, this synergy creates a learning environment that is not only technology-intensive but also adaptive, inclusive, and sustainable, so that the quality of education improves across the board

The use of technology has a significant direct influence on the quality of education, with a coefficient of 0.275 (p = 0.003). This reflects the role of technology as a practical tool that increases the efficiency of the teaching and learning process. For example, the use of *Learning Management Systems* (LMS) such as Moodle or Google Classroom makes it easier to distribute materials, collect assignments, and conduct exams online. Technology also allows for the personalization of learning through adaptive applications that adjust the difficulty level of the material to the student's abilities. However, this direct impact is only one side of the technology's contribution.

In addition to the direct impact, the use of technology also has an indirect effect on the quality of education through digital transformation, with a coefficient of 0.239 (p = 0.006). This influence is systemic, changing the structure and culture of education more fundamentally. For example, the adoption of integrated digital platforms (such as Academic Information Systems or *e-Libraries)* not only saves administrative time but also creates an inclusive learning ecosystem. Students with special needs—such as physical disabilities or learning difficulties—can access the material independently through *text-to-speech features,* interactive simulations, or sign language learning videos. This transformation also encourages collaboration between schools, allowing the sharing of digital resources across regions, thereby reducing the gap in the quality of education.

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For the use of technology to truly accelerate the improvement of the quality of education, a strategy that combines short-term efficiency and long-term transformation is needed. *First*, schools need to prioritize technologies that not only facilitate administration but also improve the quality of learning interactions (e.g., platforms with *real-time feedback* or *collaborative learning features*). *Second*, technology investment must be accompanied by ongoing training for teachers to avoid the "digital divide" in its implementation. *Third*, collaboration with the government, the private sector, and the community is needed to build an equitable digital infrastructure, especially in remote areas. Thus, technology is not only a tool, but a foundation for creating a more equitable, adaptive, and sustainable education

The results of the analysis confirm that digital transformation is not only the final goal, but also a lever that optimizes the contribution of other variables to the quality of education. Of the three factors, Leadership competencies need to be improved in terms of digital vision to strengthen their role as mediators. Stakeholder participation should be optimized through collaborative programs (e.g., technology workshops with parents) to make the impact of digitalization stronger. The use of technology must be directed to support the sustainable digital transformation process, not just a short-term practical tool.

CONCLUSION

This research reveals that digital transformation is the dominant factor that affects the quality of education. These findings confirm that systemic adoption of technology, from integrated learning platforms to data analytics tools, can improve educational efficiency, inclusivity, and personalization. On the other hand, leadership competencies and the use of technology also contribute significantly directly, although the role of leadership in encouraging digitalization is still weak. Meanwhile, stakeholder participation does not have a direct influence, but through digital transformation, it shows that the involvement of external actors is more effective when directed at strengthening the digital ecosystem. These results prove that improving the quality of education requires synergy between technological innovation, visionary leadership, and structured collaborative participation.

Advanced research needs to dig deeper into the mechanisms of leadership integration and digitalization, especially in the context of schools with limited resources. Qualitative or *mixed methods* studies can be used to explore how principals overcome cultural or budgetary barriers to adopting technology. In addition, it is necessary to analyze effective stakeholder participation models**,** such as the role of parents in supporting hybrid learning or partnerships with the private sector for digital content development. The study also suggested extending the sample to areas with low levels of digitalization to understand the disparity in the impact of technology on the quality of education. Finally, the development of *a dynamic capabilities* framework that combines leadership, technology, and participation can be the basis for more holistic policy interventions

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