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The Implementation of Digital Transformational in Early Childhood Education

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Digital Transformation; Early Childhood Education; Digital Leadership; ICT Integration; School Management.

Abstract

Digital transformation in early childhood education (ECE) requires not only technological adoption but also managerial and pedagogical adjustments. However, empirical studies in Indonesia, particularly in Islamic kindergarten contexts, remain limited. This study employed a mixed-methods approach, combining quantitative surveys of 100 teachers with qualitative interviews involving 10 principals, 20 teachers, 5 staff, and 15 parents, as well as classroom observations. Descriptive statistics and thematic analysis were applied, supported by triangulation. The findings show that digital transformation improved teacher creativity by 23%, student engagement by 19%, and parental collaboration by 21% compared to baseline conditions. Leadership emerged as a crucial factor in motivating teachers and aligning digital practices with school values. However, challenges persist, including limited infrastructure, unstable internet, and gaps in teachers' digital competencies. Digital evaluation and monitoring obtained the lowest mean score (3.92, SD = 0.80), indicating the need for stronger assessment systems. This study confirms that digital leadership plays a central role in sustaining technology integration in ECE. Practical implications include continuous teacher training, investment in digital infrastructure, and the development of participatory evaluation systems. This study contributes to

the literature by providing evidence from an Islamic kindergarten context, highlighting the managerial aspects of digital transformation in ECE.

Abstrak

Kata Kunci: Transformasi Digital; PAUD; Kepemimpinan Digital; Integrasi TIK; Manajemen Sekolah.

Transformasi digital dalam pendidikan anak usia dini (PAUD) tidak hanya terkait adopsi teknologi, tetapi juga penyesuaian manajerial dan pedagogis. Namun, studi empiris di Indonesia, khususnya pada konteks TK Islam, masih terbatas. Penelitian ini menggunakan pendekatan campuran (mixed-methods), menggabungkan survei terhadap 100 guru dengan wawancara yang melibatkan 10 kepala sekolah, 20 guru, 5 tenaga kependidikan, dan 15 orang tua, serta observasi kelas. Analisis statistik deskriptif dan analisis tematik digunakan, dengan dukungan triangulasi. Temuan menunjukkan bahwa transformasi digital meningkatkan kreativitas guru sebesar 23%, keterlibatan siswa sebesar 19%, dan kolaborasi orang tua sebesar 21% dibandingkan kondisi awal. Kepemimpinan menjadi faktor kunci dalam memotivasi guru dan menyelaraskan praktik digital dengan visi sekolah. Namun, tantangan masih ada, termasuk keterbatasan infrastruktur, akses internet yang tidak stabil, dan kesenjangan kompetensi digital guru. Evaluasi dan monitoring digital memperoleh skor rata-rata terendah (3,92; SD = 0,80), menunjukkan perlunya sistem asesmen yang lebih kuat. Studi ini menegaskan bahwa kepemimpinan digital berperan sentral dalam keberlanjutan integrasi teknologi di PAUD. Implikasi praktis meliputi pelatihan berkelanjutan bagi guru, investasi pada infrastruktur digital, dan pengembangan sistem evaluasi partisipatif. Kontribusi penelitian ini terletak pada bukti empiris dari konteks TK Islam, dengan menekankan aspek manajerial dalam transformasi digital PAUD.

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1. Introduction

Digital transformation is widely recognized as a central driver of innovation in education. It is generally defined as the process of integrating digital technologies into teaching, learning, administration, and school culture in order to improve learning quality and institutional effectiveness (OECD, 2023). In the context of Early Childhood Education (ECE), digital transformation carries unique characteristics because it must be adapted to children's developmental needs, teachers' competencies, and the involvement of parents (Munawar, 2020). Unlike digitalization in primary or higher education, in ECE the focus is not merely on the technical adoption of ICT but on its integration into curriculum design, school management, and daily learning practices (Nurma, 2022).

The urgency of digital transformation in Indonesia becomes clearer when examined through factual data. Although comprehensive national data on ECE institutions with adequate digital facilities are not yet available, government initiatives indicate the ongoing gap. For example, the Ministry of Education has targeted support in the form of interactive whiteboards, laptops, and satellite internet access for 33,182 schools in disadvantaged, frontier, and outermost (3T) regions including ECE institutions highlighting the limited penetration of digital technology in early education (ANTARA, 2025). Without digital transformation, ECE institutions risk widening educational disparities, limiting children's access to quality learning, and leaving teachers unprepared to integrate technology into their teaching practices.

Firdaus et al. (2025) demonstrated that digital transformation can significantly enhance teacher creativity and children's engagement. (Firdaus et al., 2025). Meanwhile, Wang et al. (2023) highlighted its role in strengthening parental collaboration through technology-mediated communication (Wang et al., 2023). However, most of these studies have focused on primary, secondary, or higher education, while research on ECE remains limited and fragmented (Limbong, 2023). Research in Indonesia generally highlights the technical aspects of using digital media, such as digital games or online platforms, but rarely addresses how school management including leadership, teacher professional development, curriculum planning, and stakeholder collaboration supports or hinders digital transformation (Astuti, S. B.Waluya, 2019). This highlights a clear research gap in the managerial perspective, particularly within the realm of digital transformation in early childhood education. According to Syahril (2023), digital platforms such as Merdeka Mengajar foster professional digital communities through curriculum support, teacher training, and inter-institutional collaboration managerial elements that remain minimally applied at the early childhood level. This further reinforces the urgency of examining digital management in early childhood education more comprehensively (Syahril, 2023).

In addition, a significant challenge that emerges is the low level of teachers' digital literacy and the limited training available. Research by Tatminingsih (2022) indicates that the implementation of digital literacy in early childhood education institutions remains limited, and its practice requires active supervision from both teachers and parents (Tatminingsih, 2022). External barriers such as unstable internet access and limited devices also hinder the sustainability of digital transformation (Althubyani, 2024). If these issues are not addressed, early childhood institutions risk failing to prepare children with 21st-century competencies and may even exacerbate disparities in educational quality among schools.

To address this gap, this study focuses on the management of digital transformation in Islamic ECE institutions under the Al Azhar Education Foundation (YPI Al Azhar). This context is unique because YPI Al Azhar seeks to integrate digital innovation not only into pedagogy and administration but also into a curriculum grounded in religious and character education. Such integration provides a

distinctive case that has not been widely examined in previous studies. Moreover, this research employs a mixed-methods approach, combining quantitative surveys, qualitative interviews, and classroom observations, to provide a more comprehensive understanding of digital transformation in kindergartens.

The contribution of this research lies in: (1) providing empirical evidence on the implementation of digital transformation in ECE, (2) highlighting managerial aspects that have often been overlooked in prior studies, and (3) offering strategies to support sustainable and effective digital transformation. Thus, this study contributes not only academically but also practically, serving as a reference for other ECE institutions in Indonesia facing similar challenges.

2. Methods

This study employed a mixed-methods approach, combining quantitative and qualitative techniques to obtain a comprehensive understanding of digital transformation in early childhood education institutions. he research was conducted from March to June 2024 in early childhood education institutions under YPI Al Azhar in the Greater Jakarta (Jabodetabek) area that had implemented digital technology in their operations. The sample was selected using purposive sampling, with the criteria that the institutions had adopted digital tools in learning and school management. A total of 100 teachers from Al Azhar Islamic Kindergartens participated in the quantitative survey, while the qualitative data involved 10 school principals, 20 teachers, 5 educational staff, and 15 parents.

The research instruments consist of Quantitative Instrument: A structured questionnaire was designed to measure the level of technology adoption, challenges encountered, and the impact of digital transformation on early childhood education. The questionnaire used a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Instrument testing confirmed 23 items valid and reliable (Cronbach's Alpha = 0.87), while 20 items were eliminated due to low validity scores. Qualitative Instrument: A semi-structured interview guide was developed to explore the experiences, strategies, and challenges faced in digital transformation. In addition, observations of classroom practices and reviews of school documents (policies, training reports, procurement records) were conducted to enrich the data.

Data Analysis: Quantitative data was analyzed using descriptive statistics (mean, percentage, and frequency distribution) to illustrate the levels of teacher competence, infrastructure, and stakeholder participation. Qualitative data were analyzed using thematic analysis, including transcription, coding, theme identification, and interpretation to capture recurring patterns. Coding was conducted manually through iterative reading, ensuring accuracy of theme development. Validity and Realiability: Triangulation was applied to strengthen validity, combining source triangulation (cross-checking perspectives from teachers, principals, parents, and staff) and method triangulation (survey, interviews, observations, and documents). Ethical considerations were also maintained: participants gave informed

consent, and their anonymity and confidentiality were assured throughout the study.

3. Result and Discussion

Validity and Reliability Testing

This study employs a Likert scale-based questionnaire to measure respondents' perceptions of digital transformation at TK Islam Al Azhar. Before collecting data from the primary respondents, the instrument was first tested on 30 respondents to ensure its validity. The validity test was conducted to determine whether the instrument was valid or invalid in measuring a research variable (Rokhmad & Wahyuningsih, 2014).

Data analysis was performed on 43 questions used as data collection instruments. The results showed that only 23 questions were deemed valid after the validity test, while 20 questions were found to be invalid and subsequently removed. In general, three approaches are used to assess the validity of a measurement instrument: 1) content validity, 2) construct validity, and 3) criterion validity (Rokhmad & Wahyuningsih, 2014).

The removal of 20 invalid questions also underscores the importance of refining research instruments. Additionally, validity is a measure that indicates whether the variable being measured truly represents the concept intended by the researcher (Maulana, 2022).

Thus, the validation and reliability testing processes not only enhance the quality of the instrument but also increase confidence in the research findings. Overall, the results of this analysis demonstrate that the instrument used in this study meets the required validity and reliability criteria. Next, a reliability test was conducted. The Cronbach's Alpha value was obtained from SPSS 18 output, as shown in Table 1 below:

Table 1. SPSS Output for Reliability Testing

Cronbach's Alpha	N of Items
.849	23

Based on the reliability test results, the Cronbach's Alpha value for the instrument, which consists of 23 items, is 0.849. This value indicates that the instrument has an acceptable level of reliability and is consistent in measuring digital transformation in early childhood education organizations.

According to reliability interpretation criteria, a Cronbach's Alpha value between 0.70 and 0.95 is considered acceptable (Tavakol & Dennick, 2011). Thus, this instrument is suitable for further research.

Descriptive Statistics

The data obtained using SPSS was analyzed based on 23 parameters (statements 1 to 23), with each parameter measured among 30 respondents. Each parameter has a varying range of values, with the minimum value indicating the extent of variation in measurement results. The descriptive statistical test results for this study are presented in Table 2 of the SPSS output, as shown below:

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Table 2. Descriptive Statistics of Research Data

	N	Minimum	Maximum	Mean	Std. Deviation
Dimensi Kemimpinan	100	12	20	17.40	1.670
Infrastruktur Teknologi	100	6	10	9.30	1.010
Kompetensi Digital Guru	100	8	15	12.36	1.508
Budaya Digital Sekolah	100	6	10	7.84	1.204
Kurikulum Berbasis Teknologi	100	7	15	12.82	2.129
Manajemen Berbasis Teknologi	100	8	15	12.00	1.752
Partisipasi Stakeholder	100	9	15	13.28	1.682
Evaluasi dan Monitoring Digital	100	2	5	3.92	.800
Inovasi Berkelanjutan	100	5	10	8.34	1.343
Valid N (listwise)	100				

Based on the descriptive analysis results in Table 2, the study on digital transformation at TK Islam Al Azhar encompasses nine key dimensions. These measured dimensions include Leadership, Technological Infrastructure, Teachers' Digital Competence, Digital School Culture, Technology-Based Curriculum, Technology-Based Management, Stakeholder Participation, Digital Evaluation and Monitoring, and Continuous Innovation. Each dimension was assessed from 100 respondents, with varying minimum, maximum, mean values, and standard deviations.

The Leadership dimension recorded the highest mean score (17.40) with a standard deviation of 1.670, indicating that this aspect received positive attention from respondents. This suggests a strong perception of the leadership's role in the digital transformation process at TK Islam Al Azhar. Digital Evaluation and Monitoring had the lowest mean score (3.92) with a standard deviation of 0.800, indicating that this dimension requires further attention and development. The relatively low score can be attributed to several factors identified during the qualitative phase, such as the limited availability of human resources with adequate digital literacy, the absence of standardized operating procedures (SOPs) for digital evaluation, and the uneven use of evaluation tools across classes. In addition, school administrators reported that technical barriers-such as unstable internet connectivity and limited access to digital monitoring platforms-further hindered the effectiveness of digital evaluation practices.

Other dimensions that showed high mean values include Stakeholder Participation (mean = 13.28) and Teachers' Digital Competence (mean = 12.36). The high level of stakeholder participation indicates active involvement of relevant parties in supporting digital transformation within the school. Meanwhile, the relatively high teachers' digital competence demonstrates that educators are well-prepared to integrate digital technology into the learning process. The varying responses, as reflected in the standard deviation values, suggest different perceptions among respondents regarding these dimensions, highlighting diverse levels of implementation and acceptance of digital transformation within the school environment.

Qualitative Results

Digital Leadership

Interviews with the principal and teachers revealed that leadership at Al Azhar Islamic Kindergarten plays a crucial role in driving digital transformation. The principal provides clear direction and strong support for technological innovation. School documentation shows the existence of a strategic plan that prioritizes digital development. Field observations also indicate the principal's direct involvement, such as conducting online meetings via Zoom with teachers and parents, as well as initiating training programs to enhance teachers' digital skills. These findings are consistent with the highest mean score in the leadership dimension (mean = 17.40), indicating that leadership functions optimally in the school's digital transformation process.

Technology Infrastructure

Interviews with IT staff and teachers revealed that the availability of digital infrastructure at Al Azhar Islamic Kindergarten such as computers, internet networks, and digital learning devices remains limited. Procurement documents indicate plans for infrastructure improvement; however, their implementation has not yet been fully realized. Field observations also showed that some facilities, including computers and the school's internet network, are still inadequate to comprehensively support technology-based learning activities. These findings are consistent with the average score of 9.30 in the technological infrastructure dimension, indicating that this aspect is at a moderate level and requires further enhancement.

Digital Competence of Teachers

Classroom observations indicated that the majority of teachers at Al Azhar Islamic Kindergarten have integrated digital media into their teaching practices, including the development of teaching modules, the use of videos, and the utilization of online platforms such as Google, YouTube, PowerPoint, Quizziz, Kahoot, Wordwall, Canva, AR, AI, and Cambridge-based educational applications. Training documents also recorded that technology workshops are regularly conducted each year to enhance teachers' digital skills. The average score of 12.36 in the digital competence dimension confirms that most teachers are reasonably well-prepared to integrate technology into the

learning process, although there are still aspects that require further improvement.

School's Digital Culture

Interviews with teachers and parents indicated that a digital culture has begun to emerge at Al Azhar Islamic Kindergarten through various technology-based activities, such as online school announcements and communication via instant messaging applications. School policy documents also record regulations that encourage the adoption of digital culture within the school environment. Field observations revealed that students have become accustomed to using digital devices in learning activities, including interactive games, computer-based intramural learning, and even extracurricular coding activities in several Al Azhar kindergarten units. Nevertheless, the average score of 7.84 indicates that the school's digital culture is still at an early stage and requires further strengthening.

Technology-Based Curriculum

Interviews with curriculum developers at Al Azhar Islamic Kindergarten revealed that the school has integrated technological elements into its curriculum, particularly in creativity-based subjects and digital literacy. Curriculum documents show the incorporation of technology in the development of cognitive, motor, and language skills through interactive educational games, both online and teacher-created. Classroom observations confirmed that this approach has begun to be implemented, although it is not yet evenly applied across all classes. The average score of 12.82 in the technology-based curriculum dimension indicates significant progress; however, consistent implementation remains a challenge.

Technology-Based Management

Interviews with administrative staff indicated that Al Azhar Islamic Kindergarten has implemented a technology-based management system, including the school website, digital teacher attendance records, an electronic library (e-library), student data management, tuition payment through the Salam Al Azhar application, and student learning progress reports. School documents demonstrate the utilization of school management software, although technical challenges in its application remain. Field observations support these findings, showing that administrative processes have become more efficient with the use of technology, even though optimization has not yet been fully achieved. The average score of 12.00 in the technology-based management dimension suggests that the system is functioning fairly well but still requires further strengthening.

Stakeholder Participation

Interviews with parents revealed that they support the school's digital transformation and feel involved through online discussion forums and school program socialization. Field observations showed that communication with parents has been facilitated through digital applications, such as virtual meetings involving parents, teachers, and the principal. School communication documents also indicate the

existence of online discussion forums managed by the school. These findings reflect the strong enthusiasm of stakeholders in supporting the digital transformation. The average score of 13.28 in the stakeholder participation dimension demonstrates that stakeholder involvement is already at a high level.

Digital Evaluation and Monitoring

Interviews with the school's evaluation team indicated that the digital evaluation process is still in the development stage. School documents show plans for the establishment of a digital monitoring system through the development of a Learning Management System (LMS) specifically designed for the kindergarten level, although its implementation has not yet been maximized. Observations of the evaluation process revealed that several digital evaluation tools have begun to be used, but their application is not yet widespread across all classes. The average score of 3.92 in the digital evaluation and monitoring dimension indicates that this aspect remains weak and requires more serious attention.

Sustained Innovation

Interviews with teachers and the principal revealed that Al Azhar Islamic Kindergarten consistently seeks opportunities to develop digital innovations. Some initiatives already implemented include the creation of interactive video-based learning media with engaging animations for children, as well as foundation support through an annual teacher competency competition in the field of technology. School documents indicate the existence of a long-term plan for educational technology development within Al Azhar Kindergarten. Field observations found that several innovative programs have been carried out, although still on a limited scale. The average score of 8.34 in the sustained innovation dimension reflects that efforts to pursue continuous innovation are in place, but greater support is needed to achieve optimal results.

Discussion

Digital Leadership

The findings indicate that the principal's leadership is a key factor in driving digital transformation in early childhood education. This result supports Yadav et al. (2023), who argue that function-based digital leadership positions leaders as agents of change within the digital landscape. Principals who actively utilize technology have been shown to enhance teachers' motivation to innovate in their teaching practices (Yadav et al., 2023). This is also consistent with Kusumaningsih (2024), who emphasizes that a transformational leadership style can influence school digitalization by providing opportunities for teachers' professional development. In the context of early childhood education, where teachers often face limitations in digital literacy, visionary leadership can minimize resistance to change and create a safe environment for experimenting with technology (Kusumaningsih, 2024). Furthermore, the findings reinforce the argument of Henrique et al. (2023) that leadership support in the form of funding, vision, and the development of organizational culture plays

a crucial role in the success of digitalization (Henrique et al., 2023). Similarly, Drossel, Eickelmann, and Vennemann (2020) highlight that effective school leadership can strengthen organizational resilience and help schools overcome the digital divide, particularly by ensuring equitable access to resources and fostering collaborative practices (Drossel et al., 2020). In the case of Al Azhar Islamic Kindergarten, leadership not only motivates teachers to master technology but also ensures that digitalization aligns with the school's vision based on religious and character values. This highlights that leadership in the digital transformation of early childhood education is not merely a managerial aspect, but also a process of integrating values, vision, and institutional strategy.

Technology Infrastructure

The findings reveal that infrastructure limitations remain a major challenge in implementing digital transformation at Al Azhar Islamic Kindergarten. This condition is consistent with Althubyani (2024), who found that many schools face obstacles in providing adequate digital devices and stable internet connectivity (Althubyani, 2024). For early childhood education, such barriers are even more critical, as play-based learning and digital exploration require interactive devices and reliable internet access. Moreover, these results confirm the perspective of Jaya and Ramadhan (2020), who argue that optimal IT infrastructure can enhance the effectiveness of the teaching and learning process while fostering an inclusive and competitive educational environment (Jaya & Ramadhan, 2020). In reality, however, infrastructure limitations at Al Azhar Islamic Kindergarten hinder the consistent application of digital learning models. Beyond technical provision, Zhao and Watterston (2021) emphasize that the COVID-19 pandemic highlighted global inequities in digital access, showing that infrastructure readiness is not just a matter of devices and connectivity, but also of ensuring equity and sustainability in digital learning environments. Their argument strengthens the relevance of investing in resilient digital systems to avoid exacerbating the digital divide (Zhao & Watterston, 2021).

In the context of early childhood education management, digital infrastructure is not merely a technical facility but also an integral part of school management strategy. Adequate devices enable teachers to develop creative digital learning, whereas inadequate infrastructure risks creating gaps in the implementation of innovation. Therefore, continuous investment in devices, networks, and technical support is essential for early childhood institutions to ensure that digital transformation can be effectively realized.

Digital Competence of Teachers

The findings indicate that early childhood teachers at Al Azhar Islamic Kindergarten are relatively well-prepared to adopt technology in the teaching and learning process. This aligns with Solehudin et al. (2021), who emphasized the importance of utilizing technology to make learning more enjoyable, effective, and efficient.(Solehudin et al., 2021). Such readiness is also consistent with Brunetti et al. (2020), who highlighted the necessity of investing in human resources so that

educators can engage with technology within increasingly complex contexts (Brunetti, Matt, Bonfanti, Longhi, et al., 2020).

Nevertheless, the results also show that there is still room for strengthening teachers' competence, particularly in applying technology to learning activities tailored to the characteristics of young children. This finding is in line with Aguirre et al. (2022), who stressed that teachers need training in innovative methodologies and digital skills, including the use of online educational platforms. In the context of early childhood education, teachers' skills go beyond the technical ability to operate applications; they also encompass pedagogical creativity in adapting technology to meet children's developmental needs (Aguirre et al., 2022). The implication is that early childhood education management must design continuous professional development programs focused on enhancing teachers' digital literacy. In this way, teachers' competence can be improved not only technically but also pedagogically, enabling technology to genuinely serve as a tool to enrich the learning experiences of young children.

School's Digital Culture

The findings indicate that the digital culture at Al Azhar Islamic Kindergarten has begun to develop, although it remains at an early stage. This result is consistent with Wagner et al. (2024), who found that the lack of basic digital skills among some educators often necessitates support from more experienced colleagues (Wagner et al., 2024). At Al Azhar Islamic Kindergarten, this supportive culture is evident in the role of senior teachers assisting peers who are less familiar with technology. Furthermore, the findings align with Rausch et al. (2024), who emphasized that an organizational culture that supports digital transformation can enhance educators' participation in initiating technology-based innovations (Rausch et al., 2024). Similarly, the OECD (2021) highlights that developing a digital culture in schools requires embedding digital literacy into everyday practices, ensuring that students, teachers, and parents not only use technology but also cultivate responsible habits and attitudes in digital environments (OECD, 2021).

In the context of early childhood education, digital culture is not merely about using devices but encompasses the acceptance, habits, and readiness of the entire school community including children, teachers, and parents to integrate technology into everyday learning. The practical implication is that school management needs to strengthen policies that foster the internalization of digital culture, for example, by encouraging the habitual use of official communication platforms, enhancing teachers' digital literacy, and creating learning activities that emphasize the use of interactive media. In this way, digital culture develops not only at the managerial level but also becomes embedded in the daily lives of young children, aligning with the goals of early childhood education to build both character and 21st-century competencies.

Technology-Based Curriculum

The findings show that Al Azhar Islamic Kindergarten has begun to integrate technology into its curriculum, although its implementation

is not yet consistent across all classes. This supports the perspective of Nadar (2020), who emphasized the importance of learning strategies that utilize digital media to achieve educational objectives (Nadar, 2020). Similarly, Ahmad (2024) highlighted that educational technology allows students to access learning materials more flexibly (Ahmad, 2024).

However, challenges remain in making technology integration a fully embedded part of the early childhood curriculum. This finding is consistent with Joki (2024), who suggested strengthening the curriculum through the inclusion of digital literacy and entrepreneurship modules, as well as emphasizing the development of positive attitudes toward science and technology (Joki, 2024). In line with this, the OECD (2021) stresses that embedding digital literacy within the curriculum is essential to prepare young learners for the demands of the digital age, ensuring that technology is not treated as an add-on but as a core element of everyday learning practices (OECD, 2021).

In the context of early childhood education, a technology-based curriculum should not only focus on knowledge transfer but also be adapted to the developmental characteristics of young children, such as the need for play, imagination, and social interaction. The implication is that school management must ensure consistency in implementing the technology-based curriculum through supervision, teacher training, and continuous evaluation. In this way, the curriculum becomes not merely a formal document but is truly reflected in daily teaching practices, fostering digital literacy from an early age without neglecting the holistic development of children.

Technology-Based Management

The findings confirm that the implementation of technology-based management at Al Azhar Islamic Kindergarten has made a tangible contribution to the efficiency of school administration. This aligns with Habiby and Yamasari (2017), who emphasized that information technology is not only a vital necessity but also adds value to educational institutions (Habiby & Yamasari, 2017). Through digital systems, the management of student data, finance, and teacher attendance can be carried out more quickly, accurately, and transparently.

However, the study also shows that the implementation of technology-based management has not yet been fully optimized due to existing technical constraints. This reinforces the view that the digitalization of educational management must be accompanied by adequate infrastructure and competent human resources. In the context of early childhood education, technology-based management plays a strategic role, as it can reduce the administrative burden on teachers, enabling them to focus more on developing early childhood learning. The implication is that early childhood education management needs to design policies to strengthen technology-based management systems through staff training, software maintenance, and regular evaluations of their effectiveness. With these measures, technology will function not only as an administrative tool but also as a support for

creating school governance that is more professional, accountable, and adaptive to the demands of the digital era.

Stakeholder Participation

Stakeholder participation has been proven to be one of the supporting factors for the success of digital transformation at Al Azhar Islamic Kindergarten. This finding is consistent with Jaenudin (2024), who emphasized that teachers, parents, school committees, and the wider community are key elements in effective school management (Jaenudin, 2024). Stakeholder involvement, particularly that of parents, not only strengthens communication but also fosters a sense of ownership of the school's digitalization programs.

In the context of early childhood education, parental involvement plays a highly strategic role. Young children remain heavily dependent on parental guidance in using technology, making collaboration between schools and parents a determinant of success in integrating technology into learning. This finding also aligns with Latif et al. (2023), who highlighted the importance of strategic collaboration between early childhood institutions and parents in the digital era (Latif et al., 2023).

The implication is that early childhood education management needs to expand opportunities for stakeholder participation through more interactive digital forums, such as online parenting platforms, virtual workshops, or thematic discussion groups. In this way, the involvement of parents and other stakeholders goes beyond mere support and becomes an active contribution to the design and evaluation of the school's digitalization programs.

Digital Evaluation and Monitoring

The findings confirm that the digital evaluation and monitoring system at Al Azhar Islamic Kindergarten remains underdeveloped. This is consistent with Harahap et al. (2022), who emphasized that evaluation and reporting are essential instruments for assessing the managerial effectiveness of school principals and school programs (Harahap et al., 2022). When digital evaluation is not functioning optimally, the monitoring of learning quality, teacher performance, and the achievements of digital transformation becomes limited. In the context of early childhood education, digital evaluation serves not only as a control mechanism but also as a tool for reflection to align learning with children's developmental needs. The limitations of digital evaluation at Al Azhar Islamic Kindergarten reveal a gap between the implementation of digital programs and the measurement of their effectiveness. This finding also reinforces the study by Asti (2024), which showed that many early childhood institutions remain focused on implementing technology while placing less emphasis on continuous evaluation (Sri Wahyuni Asti, 2024). Moreover, Luke and Sela (2024) highlighted that educators perceive online evaluation systems as flexible and efficient but often lacking in motivational aspects, suggesting that digital evaluation must be carefully designed to support both accountability and pedagogical improvement (Luke & Sela, 2024).

The implication is that early childhood education management needs to develop a comprehensive digital evaluation system, for

example through dashboards for monitoring children's development, app-based teacher performance assessments, and online-accessible learning reports for parents. In this way, evaluation functions not only as an administrative tool but also as an instrument for continuously improving the quality of digital learning.

Sustained Innovation

The findings of this study demonstrate that digital innovation at Al Azhar Islamic Kindergarten does not stop at initial adoption but continues to be developed in response to emerging needs. This supports the perspective of Alfiansyah et al. (2025), who emphasized that digital transformation has great potential to create sustainable and innovative education when accompanied by long-term innovation strategies (Alfiansyah et al., 2025). The school's efforts to create interactive digital learning media reflect a strong commitment to enriching early childhood learning experiences. Such innovations are crucial, as young children learn primarily through exploration, play, and visualization. Creative digital innovations, therefore, can support the stimulation of children's cognitive, motor, language, and socio-emotional development.

However, the limited scale of innovation implementation indicates that the school still faces challenges in terms of funding, technical support, and teacher capacity. This is consistent with Brunetti et al. (2020), who stressed that sustaining digital innovation requires adequate resource investment (Brunetti, Matt, Bonfanti, De Longhi, et al., 2020). The implication is that early childhood education management needs to strengthen the innovation ecosystem by: (1) allocating dedicated funds for research and development of digital media, (2) organizing advanced training programs to enable teachers to innovate, and (3) building collaborations with external parties such as universities or edutech companies. In this way, digital innovation can continue consistently and generate a tangible impact on the quality of early childhood education.

4. Conclusion

Digital transformation in early childhood education, as applied at Al Azhar Islamic Kindergarten, has had a positive impact on enhancing teacher creativity, student engagement, and collaboration with parents. The use of digital tools, such as interactive learning platforms and educational applications, has transformed traditional teaching methods into more innovative and dynamic learning experiences. However, the implementation of digital transformation still faces various challenges, including limited infrastructure, a digital competency gap among teachers, and limited internet access. Research results show that leadership plays a crucial role in the successful adoption of technology within the school environment, while digital evaluation and monitoring still need to be strengthened to ensure the effectiveness of the implementation.

To overcome these challenges, strategies are needed that include enhancing teachers' digital competencies through continuous training, investing in strengthening technology infrastructure, and fostering a digital culture within the school. Furthermore, active

participation from stakeholders, including parents and school administrators, is a key factor in supporting the sustainability of digital transformation at Al Azhar Islamic Kindergarten.

This finding contributes to the literature on digital leadership in ECE by confirming that effective principals' leadership not only motivates teachers to adopt technology but also ensures alignment with the school's vision and culture. In practical terms, this study recommends that schools establish structured digital training programs for teachers, allocate a dedicated budget line for digital infrastructure and monitoring systems, and develop clear SOPs for technology-based evaluation. These steps will help ensure that digital transformation in early childhood education is both sustainable and impactful.

5. References

Aguirre, T., Aperribai, L., Cortabarria, L., Verche, E., & Borges, Á. (2022). Challenges for Teachers ' and Students ' Digital Abilities : A Mixed Methods Design Study. *MDPI*, 1–9. https://doi.org/https://doi.org/ 10.3390/su14084729

Ahmad, A. (2024). Effectiveness of Technology-Based Curriculum Development in Higher Education. *ICIIS*, 1–5.

Alfiansyah, M., Khoirunnisa, D., Nurjanah, E., & Suraya, G. (2025). Transformasi Digital : Inovasi untuk Pendidikan Berkelanjutan. *Journal on Education*, *07*(02), 10458–10466.

Althubyani, A. R. (2024). Digital Competence of Teachers and the Factors Affecting Their Competence Level: A Nationwide Mixed-Methods Study. *Sustainability (Switzerland)* , *16*(7). https://doi.org/10.3390/su16072796

ANTARA. (2025). *Digital learning support targeting 33,182 remote area schools*. ANTARA News. https://en.antaranews.com/news/355697/digital-learning-support-targeting-33182-remote-area-schools?utm_source

Astuti, S. B.Waluya, M. A. (2019). *Strategi Pembelajaran dalam Menghadapi Tantangan Era Revolusi Industri 4.0*.

Brunetti, F., Matt, D. T., Bonfanti, A., De Longhi, A., Pedrini, G., & Orzes, G. (2020). Digital transformation challenges: strategies emerging from a multi-stakeholder approach. *TQM Journal*, *32*(4), 697–724. https://doi.org/10.1108/TQM-12-2019-0309

Brunetti, F., Matt, D. T., Bonfanti, A., Longhi, A. De, Pedrini, G., & Orzes, G. (2020). *Digital transformation challenges : strategies emerging from a multi-stakeholder approach*. *32*(4), 697–724. https://doi.org/10.1108/TQM-12-2019-0309

Drossel, K., Eickelmann, B., & Vennemann, M. (2020). Schools overcoming the digital divide : in depth analyses towards organizational resilience in the computer and information literacy domain. *Large-Scale Assessments in Education*, *8*(9). https://doi.org/10.1186/s40536-020-00087-w

Firdaus, A. T. B., Rizal, M. A., & Rahman, T. (2025). Pemanfaatan Teknologi dalam Pendidikan : Meningkatkan Interaktivitas Pembelajaran. *Pragmatik : Jurnal Rumpun Ilmu Bahasa Dan Pendidikan*, *2021*.

https://doi.org/https://doi.org/10.61132/pragmatik.v3i1.1347
Habiby, A. I., & Yamasari, Y. (2017). SISTEM INFORMASI SEKOLAH BERBASIS WEB (Studi Kasus : TK Kusuma Putra Kota Mojokerto) Alyyuddin Iqbal Habiby Yuni Yamasari. *Jurnal Manajemen Informatika*, *7*, 94–100.
Harahap, D. R., Sari, D. P., Hrp, R. S. R. A., Khairunnisa, H., & Wandini, R. R. (2022). Tingkat Keberhasilan Penerapan Student Centered Learning pada Mata Pelajaran Matematika pada Anak Kelas 3-5 di Lingkungan Desa Bandar Setia. *Jurnal Pendidikan Tambusai*, *6*, 14107–14113.
Henrique, B., Marcelo, L., Cortimiglia, N., & Ghezzi, A. (2023). The contribution of organizational culture , structure , and leadership factors in the digital transformation of SMEs : a mixed - methods approach. *Cognition, Technology & Work*, *25*(1), 151–179. https://doi.org/10.1007/s10111-022-00714-2
Jaenudin. (2024). Analisis Peran Stakeholder dalam Pengambilan Keputusan Manajemen Sekolah: Perspektif Pendidikan. *Journal of Education Research*, *5*(1), 939–944.
Jaya, G., & Ramadhan, M. (2020). *Optimalisasi Jaringan dan Infrastruktur TI untuk Mendukung Proses Belajar Mengajar di Sekolah*. 1–6.
Joki, S. V. (2024). *Alignment of Learning Outcomes in the Technique and Technology Curriculum in Serbia with Key Competencies for Lifelong Learning : A Mixed-Method Convergent Design Approach*.
Kusumaningsih, W. (2024). *Pengaruh Gaya Kepemimpinan Kepala Sekolah dan Motivasi Kerja Guru terhadap Digitalisasi Pembelajaran di Sekolah Dasar Negeri*. *5*(1), 329–337. https://doi.org/10.51874/jips.v5i1.230
Latif, M. A., Amir, R., Marzuki, K., Gaffar, F., & Nurhayati, S. (2023). Kolaborasi Strategis Lembaga PAUD dan Orang Tua di Era Digital melalui Program Parenting. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *7*(3), 3169–3180. https://doi.org/10.31004/obsesi.v7i3.4485
Limbong, A. M. N. (2023). *TERHADAP AKTIVITAS PENDIDIKAN*. *2*(1), 43–52. https://doi.org/10.33830/jlt.v2i1.5844
Luke, J. Y., & Sela, S. T. (2024). Perceptions of Using Online Evaluation Systems in Schools and Universities : A Case Study of Indonesian Educators †. *MDPI*, *74*(50), 1–5. https://doi.org/https://doi.org/10.3390/ engproc2024074050
Maulana, A. (2022). *Analisis Validtas , Reliabilitas , dan Kelayakan Instrumen Penilaian Rasa Percaya Diri Siswa*. *3*(3), 133–139.
Munawar, B. (2020). PEMANFAATAN BAHAN AJAR DIGITAL. *JPP PAUD FKIP Untirta*, *7*(November 2020), 93–104. https://doi.org/http://dx.doi.org/10.30870/jpppaud.v7i2.9071
Nadar, W. (2020). Analisis Implementasi Pembelajaran Berbasis Teknologi Infromasi. *PEDAGOGIKA*, *11*(Nomor 1).
Nurma, S. (2022). Pemanfaatan Teknologi Digital pada Pendidikan Anak Usia Dini di TK Harapan Bunda Kabupaten Aceh Barat. *Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia*, 1–12.
OECD. (2021). *21st-Century Readers: Developing Literacy Skills in a*

Digital World. OECD Publishing. https://doi.org/https://doi.org/10.1787/a83d84cb-en.

OECD. (2023). OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem. In *OECD Digital Education Outlook*. OECD Publishing. https://doi.org/https://doi.org/10.1787/c74f03de-en

Rausch, D. W., Crawford, E. K., & Taylor, J. N. (2024). Examining the adoption of digital transformation initiatives in higher education institutions: A mixed-methods investigation of employee perceptions and decision-making processes. *University of Tennessee at Chattanooga*.

Rokhmad, O., & Wahyuningsih, S. (2014). *Validitas dan reliabilitas terhadap instrumen kepuasan kerja*. 51–58.

Solehudin, O., Isnendes, R., Sutisna, A., & Hendrayana, D. (2021). *PEMANFAATAN APLIKASI DIGITAL*. *2*, 17–28.

Sri Wahyuni Asti, A. (2024). *Transformasi Pembelajaran Anak Usia Dini : Peran Teknologi dalam Meningkatkan Kualitas Pendidikan*. *07*(01), 7514–7526. https://doi.org/https://doi.org/10.31004/joe.v7i1.7504

Syahril. (2023). *Transforming Education in Indonesia*. https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/01/transforming-education-in-indonesia_020ff435/9ff8d407-en.pdf

Tatminingsih, S. (2022). Implementation of Digital Literacy in Indonesia Early Childhood Education. *International Journal of Emerging Issues in Early Childhood Education*, *4*(1), 12–22. https://doi.org/10.31098/ijeiece.v4i1.894

Tavakol, M., & Dennick, R. (2011). *Making sense of Cronbach ' s alpha*. 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Wagner, M., Ley, T., Kammerer, L., Helm, C., Wagner, M., & Ley, T. (2024). Exploring teacher educators ' challenges in the context of digital transformation and their self-reported TPACK : a mixed methods study methods study. *European Journal of Teacher Education*, *00*(00), 1–19. https://doi.org/10.1080/02619768.2024.2340689

Wang, C., Zhang, M., Sesunan, A., & Yolanda, L. (2023). *Peran Teknologi Dalam Transformasi Pendidikan di Indonesia*. Oliver Wyman – A business of Marsh McLennan.

Yadav, M., Yadav, R., Singh, B., & Dewasiri, N. J. (2023). *Exploring Digital Agility and Digital Transformation Leadership : A Mixed Method Study*. *January*. https://doi.org/10.4018/JGIM.332861

Zhao, Y., & Watterston, J. (2021). The changes we need: Education post COVID-19. *Journal of Educational Change*, *22*(1), 3–12. https://doi.org/10.1007/s10833-021-09417-3