

A Decade of Implementation and Integration of Technology in Curriculum Management in Modern Pesantren

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ABSTRACT

This research is important to do considering the rapid development of technology that requires educational institutions, including modern pesantren, to adapt in improving the quality of curriculum management and learning quality. In addition, the need for leadership strategies that are responsive to technological change is also a crucial aspect in encouraging teacher professionalism. This study aims to examine the implementation and integration of technology in curriculum management in modern pesantren over the past decade. The approach used is qualitative research with the Systematic Literature Review (SLR) method. Data sources were obtained from two main databases, namely Dimensions and Scopus, with a publication range of the last ten years to ensure the relevance and novelty of the data analyzed. The main focus of this study is on leadership strategies in encouraging teacher professionalism through the use of technology in curriculum management. The findings further indicate that effective technology integration requires strategic leadership, continuous teacher professional development, and adequate digital infrastructure to ensure sustainable curriculum transformation in modern pesantren. This study contributes to the development of a conceptual understanding of technology-based curriculum management by synthesizing leadership, curriculum innovation, and digital transformation into an integrated perspective. The study recommends that policymakers and pesantren leaders formulate comprehensive digital curriculum policies accompanied by systematic teacher capacity-building programs to support sustainable educational quality improvement.



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INTRODUCTION

Modern *pesantren* are currently undergoing a significant transformation in their education system, characterized by the adoption of general science and technology as part of the learning curriculum. This change not only reflects the efforts of *pesantren* in adjusting to the dynamics of globalization, but also a response to the demands of the community who expect *pesantren* graduates to have broader competencies, both in religion and science and technology. The integration of general knowledge in the *pesantren* education system allows santri to gain a more comprehensive insight, while the utilization of technology in learning opens opportunities for innovation in teaching methods, academic management, and access to wider learning resources. Thus, modern *pesantren* no longer only function as centers of religious education, but also as institutions that prepare their students to face the challenges of the times with relevant and adaptive skills (Mujahid, 2021, p. 185-212).

Technological advances have brought significant impacts in various aspects of life, including in the education sector, which also affects the learning system in the *pesantren* environment (Nikmatullah et al., 2023, p. 1-14). The integration of technology in *pesantren* education allows curriculum management to be more effective through digitizing academic administration, automating schedule preparation, and monitoring learning outcomes more systematically. In addition, technology also plays a role in accelerating the distribution of teaching materials with the existence of digital learning platforms, which allow santri to access learning materials anytime and anywhere without being limited by space and time (Siregar et al., 2023, p. 270-292). The utilization of information and communication technology in *pesantren* also expands access to more diverse learning resources, ranging from e-books, scientific journals, to multimedia-based Islamic studies that can support students' understanding of the material taught. Thus, the use of technology in curriculum management not only increases the efficiency of educational administration, but also provides a more dynamic, interactive, and needs-based learning experience.

The management of boarding school curricula is undergoing a significant paradigm shift, driven by strategic management practices, the integration of spiritual intelligence, and the demand for more responsive educational models. Effective strategic management plays a crucial role in enhancing educational quality, as demonstrated by a case study at MA Syaikh Zainuddin NW Anjani, which highlights the importance of internal and external environmental assessments, organizational structure, and continuous evaluation in meeting national education standards (Rasidi, 2022, p. 460–472). Additionally, involving all stakeholders, including teachers and school administrators, in the evaluation process fosters a collaborative environment that strengthens curriculum effectiveness. Another critical aspect of this transformation is the emphasis on spiritual intelligence development, with research showing that the boarding school model significantly influences students' spiritual growth, contributing to a 33.1% impact on their overall development (Bella et al., 2022, p. 226–236). This approach aligns with contemporary educational paradigms that emphasize emotional and spiritual well-being alongside academic success. Furthermore, the shift towards alternative educational models, as observed in Taiwanese aboriginal schools, underscores the importance of curriculum transformation led by school principals, enabling the integration of cultural values and community needs into educational frameworks (Hsieh et al., 2021, p. 53–66). However, while these changes offer opportunities for educational advancement, they also present challenges,

such as ensuring continuity and addressing resistance to change within well-established educational systems.

Traditional curricula in boarding schools often emphasize a teacher-centered approach, posing several challenges in curriculum management, including limited resources, the readiness of teaching staff, and resistance to technological change. Many boarding schools operate under constrained budgets, limiting access to essential teaching materials and technological tools necessary for modern education (Twining et al., 2021, p. 1–24). A study found that 60% of educators in boarding schools reported insufficient resources to implement innovative teaching methods (Abdigapbarova et al., 2022, p. 647–661). Additionally, the readiness of teaching staff remains a critical issue, as approximately 50% of teachers express discomfort with current educational formats, highlighting the need for professional development. Research further indicates that only 30% of teachers feel adequately prepared to integrate technology into their teaching practices. Resistance to technological change also presents a significant barrier, with 70% of teachers favoring traditional methods over modern approaches (Zakaria et al., 2023, p. 50–58). Moreover, the integration of technology in curricula has been slow, as only 25% of boarding schools have successfully implemented digital learning tools (Hasim, 2023, p. 40–55). Despite these challenges, some boarding schools are beginning to adopt innovative curricula that incorporate student-centered learning and technology, signaling a potential shift toward more progressive educational practices.

The digitization of the curriculum significantly enhances interactive and adaptive learning methods by leveraging technologies such as Learning Management Systems (LMS), interactive media, and artificial intelligence (AI). These advancements contribute not only to improved academic administration but also to more effective evaluation processes. Research indicates that digital technologies positively impact learning outcomes, with studies demonstrating a correlation between student engagement and final grades in online courses (Toktarova et al., 2022, p. 54–63). Furthermore, a digitalized curriculum has been associated with higher student satisfaction and improved exam performance, particularly through the implementation of cloud-based digital platforms (Stefanović et al., 2020, p. 213–232). In terms of administrative efficiency, AI integration enables more precise evaluations of teaching quality and classroom dynamics, reducing the workload associated with manual assessments (Jin et al., 2021, p. 1–8). Digital transformation models also highlight efficiency gains in educational processes, including streamlined communication and collaboration among stakeholders. Additionally, the concept of personalized learning has gained prominence, emphasizing flexibility and individualization in learning paths through digital tools (Viana & Peralta, 2020, p. 137–157). The COVID-19 pandemic further accelerated the adoption of digital curricula, underscoring the necessity for adaptive learning environments (Mpungose et al., 2020, p. 1–21). Despite these benefits, some educators express concerns regarding the potential loss of personal interaction in digital learning environments, which could affect student engagement and motivation. Therefore, balancing technological advancements with traditional teaching methods remains a crucial aspect of ongoing educational reform.

The integration of technology in Islamic education, particularly in the management of boarding school curricula, is an emerging field of interest. While research on its specific impact remains limited, various studies highlight both the potential benefits and challenges associated with curriculum innovation and management in Islamic boarding schools. Efforts to standardize

curricula, such as those in *Madrasah Diniyah Salafiyah*, have led to improved student achievements and skills; however, gaps in comprehension among teachers and students persist as a challenge (Hamdanah, 2024, p. 534–548). Additionally, the structured management of *Tahfizh Al-Qur'an* programs, which incorporates diverse teaching methodologies and systematic evaluations, has demonstrated enhanced learning outcomes (Larasati et al., 2024, p. 18–27). Beyond curriculum structuring, the application of organizational psychology has been found to play a vital role in improving teacher performance and student motivation, both of which are essential for effective curriculum management (Zuhaery & Badrudin, 2023, p. 1051–1063). Furthermore, in response to modern challenges, institutions such as the Islamic University of Indonesia have integrated religious moderation into their curricula to counteract radical ideologies, emphasizing the need for adaptable educational frameworks. Despite these advancements, the role of technology in enhancing curriculum management in Islamic boarding schools remains largely underexplored, underscoring the need for further research to fully understand its transformative potential.

A major gap in current research lies not only in the limited discussion of technology integration in modern pesantren curriculum management, but also in the absence of a comprehensive conceptual synthesis explaining how technology, educational leadership, curriculum innovation, and teacher professionalism interact within a unified curriculum management framework. Previous studies have generally examined these dimensions separately without providing an integrated perspective specifically for modern pesantren. Therefore, this study contributes by synthesizing evidence from the last decade of international literature to develop a comprehensive conceptual understanding of technology-based curriculum management in modern pesantren. This contribution extends beyond identifying existing trends by proposing an integrated perspective that connects digital transformation, leadership strategies, curriculum innovation, and teacher professional development as interrelated components for improving educational quality in modern Islamic boarding schools.

METHOD

This research is a qualitative research with Systematic Literature Review (SLR) approach. This method is used to identify, evaluate, and interpret all relevant research results regarding leadership strategies for teacher professionalism in modern Islamic boarding schools. This approach allows researchers to collect and analyze data from various relevant sources systematically, so as to provide a comprehensive understanding of the topic under study. The data in this study were sourced from the Dimensions database (<https://app.dimensions.ai>) and Scopus (<https://www.scopus.com>) with the latest 10-year interval publications to ensure that the data used is current and relevant to leadership strategies for teacher professionalism in modern Islamic boarding schools.

Data eligibility criteria in this study were established to ensure that only relevant and high-quality literature was analyzed. The criteria include (1) scientific articles published in reputable national and international journals; (2) studies that specifically address leadership strategies for teacher professionalism in modern Islamic boarding schools; (3) publications published in the last 10 years (2013–2024); (4) articles available in full text and in English or Indonesian. To ensure all selected articles met the eligibility criteria, a rigorous validation process was employed. This included a two-step review process. First, two independent

reviewers screened the articles based on their titles and abstracts, ensuring alignment with the predefined criteria. Discrepancies between reviewers were resolved through discussion or by consulting a third reviewer as a tiebreaker. Second, for articles deemed eligible after the initial screening, a full-text review was conducted to verify compliance with all criteria. Inter-rater reliability was assessed using Cohen's Kappa statistic to ensure consistency in the selection process. The research procedure is as shown in Figure 1.

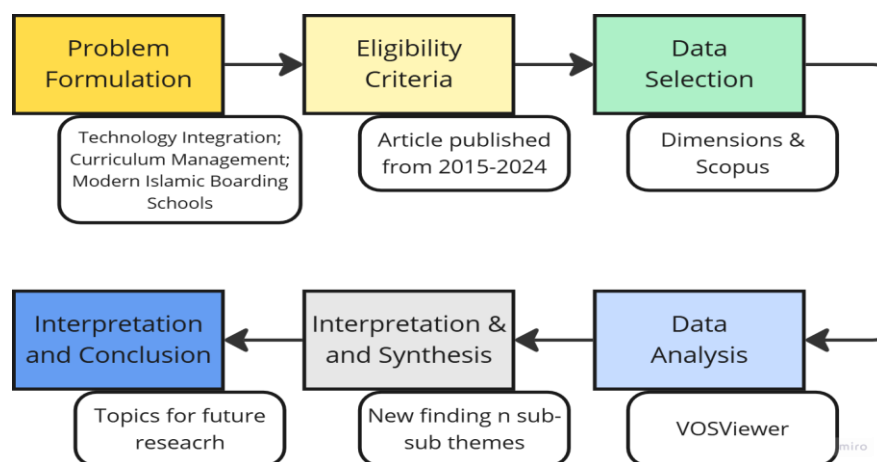


Figure 1. Research procedures

Figure 1 shows that this research was conducted in several stages, namely problem formulation, determining eligibility criteria, data selection, data analysis, data interpretation and synthesis, and drawing conclusions. The problem formulation stage is important to limit the topic discussed, namely leadership strategies for teacher professionalism in modern Islamic boarding schools. Eligibility criteria were determined to filter data that fit the topic with relevant keywords such as (Integrasi Teknologi AND Pengelolaan Kurikulum AND *Pesantren* Modern) OR (Technology Integration AND Curriculum Management AND Modern Islamic Boarding Schools)". Next, data were selected from the Dimensions database and a filter was applied for data published in the last 10 years (2013-2024). Next, the collected data was imported into VOSviewer software to create a visualization of the relationship between keywords and themes in the study, and R-Studio was used for descriptive statistical analysis and deeper data exploration such as calculating the frequency of themes and conducting trend analysis. The review process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and reproducibility throughout the literature selection process. The identification stage retrieved articles from the Scopus and Dimensions databases using predefined search strings. Duplicate records were removed prior to screening. During the screening stage, titles and abstracts were evaluated against the predefined inclusion and exclusion criteria. Studies were excluded if they (1) did not discuss curriculum management or technology integration in educational institutions, (2) were conference abstracts, editorials, book reviews, or non-peer-reviewed publications, (3) lacked full-text availability, or (4) did not provide sufficient methodological information. Eligible studies subsequently underwent full-text assessment before being included in the final synthesis. To ensure methodological rigor, each selected article was evaluated based on relevance to the research objectives, methodological clarity, data credibility, and contribution

to technology-based curriculum management in educational settings. The results of data visualization and analysis from VOSviewer and R-Studio were interpreted to explain the key variables in leadership strategies for teacher professionalism in modern islamic boarding schools. These results were used to formulate key findings and theoretical and practical implications of curriculum management in modern *pesantren*. Finally, the researcher formulated conclusions and studies for further research topics in the future.

RESULTS AND DISCUSSION

The results of data selection based on eligibility criteria found 26,077 data consisting of 21,300 open access data, the rest is close access. Furthermore, filtered based on the type of publication, 1,172 articles were found, the rest were books and proceedings. Of the 1,172 data, only 386 data were fulfilled in the 2015-2024 data interval. The distribution of the amount of data is as shown in Figure 2.

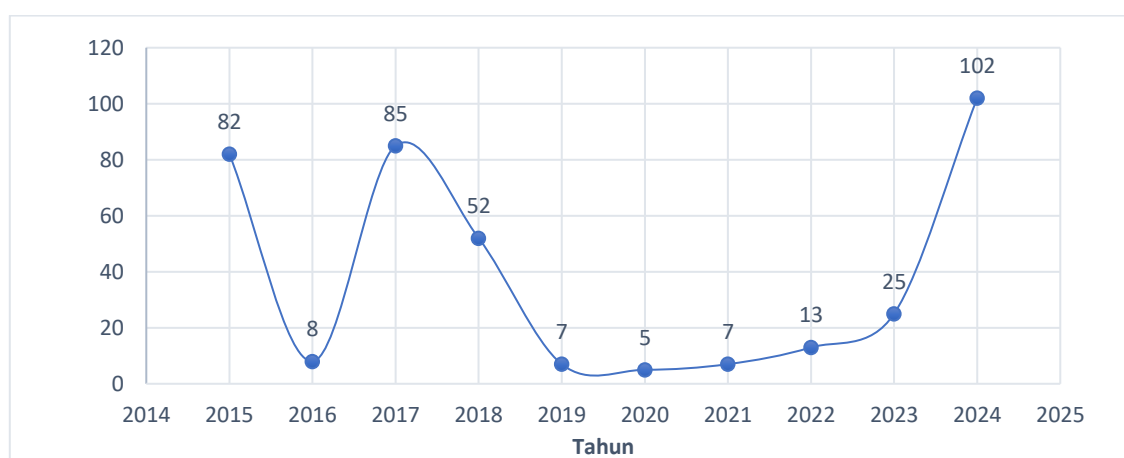


Figure 2. Distribution of data over a decade

Figure 2 shows the distribution of the number of search results from the indexing database over a decade (2015-2024). Figure 2 illustrates the fluctuation in the number of publications related to the topic within the observed time span. In 2015, the number of publications was quite high, reaching 82 documents, but experienced a drastic decline in 2016 to only 8 documents. 2017 saw a spike back to 85 documents, before declining again to 52 documents in 2018. The decline continued into 2019 and 2020, with a very low number of publications, only 7 and 5 documents respectively. The stagnant trend continued into 2021, with the number of publications remaining at 5 documents. In 2022, there was a slight increase to 7 documents, followed by a significant increase in 2023 with 13 documents. This trend continued exponentially until it reached 25 documents in 2024, before jumping sharply to a decade high of 102 documents. Interpretation of this pattern suggests that although the topic of technology integration in modern *pesantren* curriculum management experiences fluctuations in research interest, there is a significant upward trend in recent years. The spikes in 2023 and 2024 may indicate the increased attention of academics and researchers to digital transformation in Islamic education, driven by technological developments and the need for adaptation in the modern *pesantren* education system. The data that has gone through the selection process is then

visualized using VOSviewer to see the research variables and the relationship between variables. The visualization results are as shown in Figure 3.

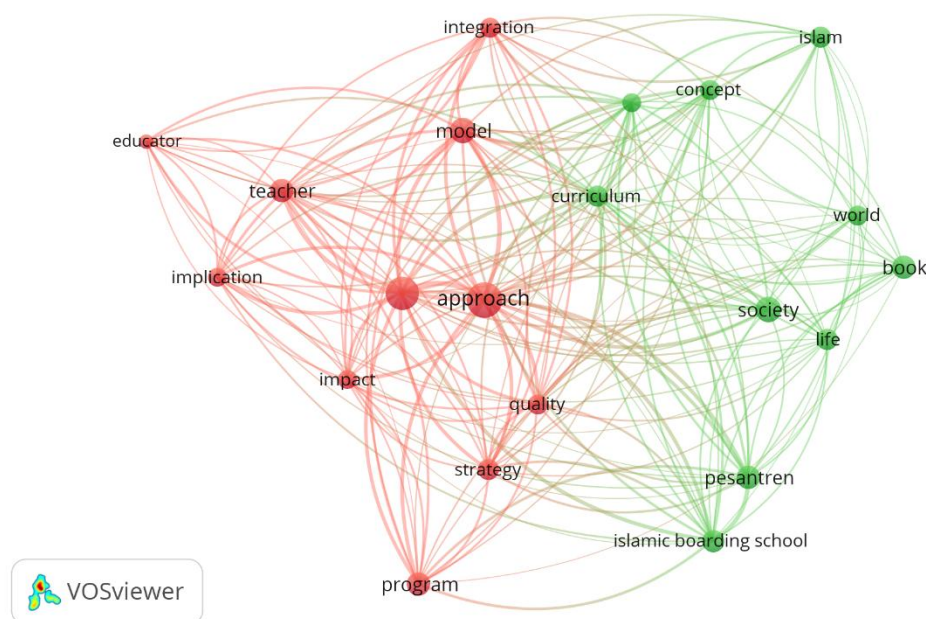


Figure 3. Network visualization of research variables

Figure 3 is a network visualization of all the variables studied over the past 10 years and depicts four different color groups: green, red, yellow, and blue. The interpretation of each variable is as follows. The red cluster highlights aspects of leadership, teacher professionalism, and strategic implications in the world of education, especially in modern *pesantren*. The main keywords in this cluster include: Approach, Strategy, Model, Integration, Implication, Impact, Program, Quality, Teacher, and Educator. This cluster shows that research in the field of teacher leadership and professionalism in modern *pesantren* focuses a lot on the approach model used, its impact on the quality of education, and how integration strategies are applied in teaching programs and management of Islamic education institutions.

The green cluster describes the Islamic aspects, value-based education, and the social influence of *pesantren* in society. The main keywords in this cluster include: Islam, Concept, Curriculum, Society, Life, *Pesantren*, Islamic Boarding School, Book, World. This cluster indicates that the research also highlights how the concept of Islam is applied in education, how the *pesantren* curriculum is designed, and how *pesantren* play a role in shaping the values of society and global life.

1. Analysis of Approach Models in Improving the Quality of Teachers and Educators in *Pesantren*

The competency-based approach in improving the quality of teachers and educators in *pesantren* emphasizes strengthening pedagogical capacity so that educators are able to develop more effective and adaptive learning methods in accordance with the needs of students and the development of modern educational science (Amrullah et al., 2025). In addition, the mastery of in-depth Islamic knowledge is a fundamental aspect in the *pesantren* education system to ensure that the learning process remains based on authentic Islamic sources, such as the Qur'an, hadith, and turats books which are the scientific heritage of Islam (Agustriani, 2023). Meanwhile, the

integration of local wisdom values in the *pesantren* education system plays an important role in maintaining the distinctive character of *pesantren*, such as the tradition of deliberation, togetherness, and exemplary-based character building, so that *pesantren* education remains relevant to the social dynamics and challenges of the times (Sauri et al., 2018).

The integration of technology in the *pesantren* education system is a strategic step to increase the effectiveness of learning without eliminating traditional methods that have long been applied. The use of e-learning and digital media allows access to wider learning resources and supports a more interactive and flexible learning process in accordance with the times (Khamparia & Pandey, 2017). Nevertheless, traditional methods such as sorogan and bandongan still have an important role in shaping character, depth of understanding, and emotional closeness between teachers and students that are difficult to replace by technology (Ulhaq et al., 2024). Therefore, the combination of technology and traditional methods is an effective solution in maintaining the quality of education in *pesantren*, so that it remains relevant to global demands without eliminating the distinctive values of *pesantren* (Nisa et al., 2024).

The competency-based approach model in *pesantren* focuses on strengthening pedagogical skills so that educators not only master Islamic knowledge in depth, but are also able to deliver the material effectively. The integration of local wisdom values helps maintain the character of *pesantren* amid external influences, while the utilization of technology expands access to learning resources and increases learning flexibility without eliminating traditional methods such as sorogan and bandongan. However, challenges in its implementation include the readiness of educators in adopting modern methods as well as the need for additional training for the use of technology. In addition, although local wisdom values strengthen the identity of *pesantren*, in some cases this may limit flexibility in the face of globalization. Therefore, systematic policies are needed that can balance the integration of modern and traditional methods to ensure the continuity and relevance of *pesantren* education in the global era.

The synthesis of these findings demonstrates that competency development, technology integration, and the preservation of *pesantren* values should not be viewed as separate educational initiatives but rather as interconnected components of strategic curriculum management. From the perspective of educational management theory, effective curriculum implementation depends on the alignment between institutional leadership, teacher professional development, organizational culture, and technological readiness. This finding extends previous studies by emphasizing that technology functions not merely as a supporting instructional tool but as a strategic mechanism for strengthening curriculum governance while preserving the distinctive identity of modern *pesantren*. Consequently, sustainable curriculum transformation requires institutional policies that simultaneously promote digital innovation, pedagogical competence, and the maintenance of Islamic educational traditions.

2. Evaluation of the Implementation of the Islamic Concept-Based Curriculum and its Impact on Society

Evaluation of the implementation of an Islamic-based curriculum should consider the extent to which it is able to equip learners with skills relevant to the needs of modern society. An effective curriculum should not only teach religious aspects in depth, but also integrate

practical skills such as entrepreneurship, technology, and communication that can increase the competitiveness of graduates in the world of work (Syarnubi et al., 2023). In addition, the Islamic-based curriculum needs to be adapted to the evolving social and economic dynamics, so that students not only understand Islamic values, but are also able to contribute actively in various industrial and professional sectors (Rofik et al., 2023). Therefore, the synergy between Islamic education and economic needs is a major factor in creating an adaptive learning system that is oriented towards improving the welfare of society (Baharun et al., 2022).

The Islamic-based curriculum has a crucial role in shaping the character of students to be able to understand Islamic teachings contextually and in accordance with the growing social reality (Moslimany et al., 2024). Through a comprehensive approach, this curriculum not only instills a text-based understanding of Islam, but also encourages critical analysis of various religious and social issues, so that students can apply Islamic values in their daily lives more relevantly (Cahyo et al., 2019). In addition, the integration of moderation values in the curriculum contributes to shaping thinking that is inclusive, tolerant and open to differences, which in turn can strengthen social harmony and prevent the emergence of extremism in social life (Aderibigbe et al., 2023).

The effectiveness of an Islamic-based curriculum depends not only on its religious content, but also on its ability to adapt to the times. By integrating practical skills, this curriculum can improve the quality of graduates to make them more competitive in the world of work. Text-based approaches and critical analysis in Islamic learning also allow for a more contextualized understanding, supporting the creation of an inclusive and tolerant society. However, challenges remain, especially in terms of adaptation to technology and industry needs, limited resources in some institutions, as well as differences in the application of Islamic values that can trigger inconsistencies in curriculum standards. Therefore, flexible and research-based design is needed to ensure a balance between Islamic values and modern socio-economic demands.

These findings indicate that the effectiveness of an Islamic-based curriculum should be evaluated not only from the perspective of religious content but also from its capacity to respond to contemporary educational, technological, and socio-economic challenges. Within the framework of curriculum management theory, curriculum effectiveness is reflected in its ability to integrate institutional values with stakeholders' evolving needs through continuous adaptation and innovation. The synthesis further suggests that technology integration provides an opportunity to strengthen curriculum flexibility without diminishing the fundamental principles of Islamic education. Therefore, curriculum transformation in modern pesantren should be understood as a dynamic process that balances religious values, technological advancement, and graduate competitiveness within an increasingly digital educational environment.

3. Leadership Strategies in Aligning Education Programs with Global Challenges

Leadership in educational institutions must have a global vision that allows adaptation to the dynamics of world change and increases the competitiveness of institutions in facing global challenges (Pucciarelli & Kaplan, 2016). One important aspect of educational leadership is to instill a culture of innovation in the learning process, so that teaching methods can be more creative, technology-based, and relevant to the needs of students in the digital era (Zahed-

Babelan et al., 2019). In addition, strengthening adaptive managerial capacity is needed to ensure that educational institutions are able to manage resources effectively, design responsive policies, and create a learning environment conducive to learners' academic and character development (Hammond & Harvey, 2018).

Effective leadership strategies in educational institutions include building partnerships with global educational institutions to broaden academic horizons and improve the quality of learning through knowledge and experience exchange (Hilliard, 2015). This international collaboration allows access to global best educational practices, which can be adapted to suit local needs to improve the competitiveness of graduates in the era of globalization (Knight, 2018). In addition, curriculum adaptation to international developments must maintain local identity by integrating cultural values and local wisdom so that students do not lose their traditional roots in the face of global changes (Wahyuni et al., 2024).

Leadership strategies in education to face global challenges emphasize the importance of global vision, innovation in learning, and strengthening local cultural values. Adaptive institutions can adjust the curriculum to international standards through global academic partnerships, so that graduates become more competitive without losing their national identity. Technological innovations in teaching methods allow for more interactive learning, but must still be balanced with local educational values. The main challenges in implementing this strategy include the readiness of educators, the risk of cultural shifts due to globalization, and limited access to educational resources and infrastructure. Therefore, training programs for educators as well as policies for equal access to technology are key factors in the success of educational leadership strategies that are aligned with global demands.

From a strategic educational leadership perspective, these findings highlight that successful curriculum transformation is largely determined by leaders' capacity to integrate digital innovation with institutional vision, organizational culture, and teacher professional development. Rather than focusing solely on technology adoption, educational leadership should facilitate systemic change through strategic planning, collaborative decision-making, and continuous organizational learning. This conceptual synthesis contributes to the understanding that technology-based curriculum management in modern *pesantren* requires leadership capable of balancing global educational demands with the preservation of Islamic values and local wisdom. Such an integrated leadership approach strengthens institutional adaptability while maintaining the unique educational identity of modern Islamic boarding schools.

CONCLUSION

Based on the research findings, it can be concluded that technology integration has a significant impact on curriculum management in modern *pesantren*, albeit with some challenges that need to be overcome. The analysis shows that technology plays a role in improving the efficiency of curriculum management, expanding access to learning resources, and facilitating more interactive learning approaches. However, its implementation has not been optimal due to the limited competence of teachers in operating technology, resistance to change from traditional methods, and infrastructure inequality in some *pesantren*. The analysis reinforces that technology not only affects the technical aspects of curriculum management, but also has an impact on the strategic approach and concept of Islamic education as seen in the

efforts to integrate Islamic values with digital-based learning innovations. Thus, it can be concluded that technology integration has great potential to transform the curriculum management of modern *pesantren*, provided that it is accompanied by an increase in teacher capacity, equitable provision of infrastructure, and the development of a curriculum model that is balanced between *pesantren* traditions and the demands of modernity. Theoretically, this study contributes by providing an integrated conceptual perspective that connects technology integration, educational leadership, curriculum innovation, and teacher professionalism within the context of modern *pesantren* curriculum management. Practically, the findings provide evidence for policymakers, *pesantren* leaders, and educational administrators to formulate sustainable digital curriculum policies, strengthen teacher digital competencies, and improve institutional readiness for technology-based educational transformation. Future research needs to expand the scope by analyzing the effectiveness of Islamic-based curriculum in preparing graduates to compete at the global level, including the role of educational leadership in encouraging innovation and collaboration at large.

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