Integrating Tradition and Technology: A PRISMA-Based Synthesis of Pesantren Curriculum Transformation

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Abstract. Traditional Islamic boarding schools (pesantren) in Indonesia confront the dual challenge of integrating digital technologies while preserving their spiritual mission. This systematic literature review—conducted in accordance with PRISMA guidelines across Scopus, Web of Science, and Google Scholar (2014–2024)—synthesizes findings from 43 peer-reviewed studies to identify optimal curriculum-management strategies in the digital era. Inductive thematic analysis reveals five interrelated dimensions: embedding e-learning platforms and diverse online resources into core instruction; cultivating digital competencies among santri and ustadz; implementing blended-learning models that harmonize traditional bandongan and sorogan methods with virtual modules; reinforcing pesantren values (faith, morality, service, simplicity) within digital curricula; and strengthening IT infrastructure alongside governance and quality-control mechanisms. These coordinated strategies enhance planning transparency, resource allocation, and learner engagement without diluting institutional ethos. We propose a "digital tarbiyah" framework—integrating pedagogical design, stakeholder capacity-building, and robust oversight—to guide policymakers and pesantren leadership. This holistic approach equips pesantren to sustain their distinctive ethos and advance educational excellence amid rapid digital transformation.

Keywords: pesantren, curriculum management, digital transformation.

1 Introduction

Pesantren—Indonesia's traditional Islamic boarding schools—remain a cornerstone of religious and moral education, with 25 938 institutions serving nearly 4 million santri in 2019[1]. However, in parallel with their enduring social role, Indonesia's digital landscape has transformed rapidly: by January 2025, 212 million Indonesians (74.6 % of the population) were online[2], up from 185.3 million (66.5 %) only a year earlier. This dual reality—a vast, digitally connected populace alongside a deep-rooted pesantren network—creates an imperative and an opportunity to rethink curriculum management in these institutions.

Pesantren is not only educational but also social hubs: they foster community service, preserve local culture, and instill values of simplicity, independence, and akhlāq (noble character)[3], [4]. The surge in internet and mobile connectivity (with over 126.8 % mobile penetration[5]

means santri can now access vast digital resources[6], yet many pesantren still lack the infrastructure, human capacity, and pedagogical models to capitalize on this connectivity while maintaining their distinctive ethos[7], [8].

Early studies on pesantren curriculum management emphasized character education and traditional religious instruction[9], [10]. More recent work has begun to explore digital integration: Shidiq and Mubin demonstrated how system digitalization modernizes pesantren governance[11], while El Zakir and Syam highlighted the development of media and learning resources for pesantren in the digital era[12]. Nuriyah and Afifi's systematic review further underscored the need for English-language digital literacy at pesantren-based schools[13]. Despite these advances, most research remains fragmented—either focusing on technology adoption, human resource capacity-building, or value integration in isolation—leaving a gap for a holistic framework that unites these dimensions under an optimized curriculum management strategy.

This study seeks to craft a holistic, digitally empowered curriculum management model for pesantren by examining technological and human dimensions. First, we will assess the current state of digital infrastructure—hardware, connectivity, and platform availability—and the competencies of pesantren educators and administrators in leveraging those tools. Next, we aim to distill best practices and pinpoint persistent challenges in implementing blended and value-based learning, exploring how e-learning platforms can harmonize with traditional band organ and slogan teaching methods. Building on these insights, we will synthesize earlier and contemporaneous studies findings into a unified framework that aligns pedagogical design, governance processes, and stakeholder capacity-building. Finally, the research will culminate in evidence-based recommendations for policymakers and pesantren leadership, ensuring that any proposed digital interventions enhance educational outcomes and preserve the institutions' core spiritual and moral ethos.

Drawing on the identified gaps in the literature, we propose three hypotheses. First, we expect that adopting a structured digital transformation strategy will lead to measurable improvements in the effectiveness of curriculum management—manifested in more transparent planning processes, efficient resource allocation, and stronger monitoring and evaluation mechanisms. Second, we hypothesize that a blended learning approach that thoughtfully integrates e-learning modules with the pesantren's time-honored bandongan and sorogan sessions will boost santri engagement, deepen comprehension of core subjects, and elevate digital literacy skills. Third, we anticipate that embedding pesantren values explicitly within digital curricula—through modules on akhlāq mulyā, community service projects, and local cultural heritage—will ensure that technological progress does not come at the expense of moral and spiritual development but rather reinforce the holistic formation that pesantren strive to achieve.

2 Method

This study uses the literature review method as the main approach, conducting a systematic literature review by the PRISMA 2020 guidelines. This approach was chosen because it provides a comprehensive foundation related to various concepts, theories, and results of

previous research. It allows researchers to identify gaps that can be opportunities for further development.

In collecting data, this study uses secondary literature consisting of academic books, scientific journal articles, research reports, and trusted online sources. We searched three electronic databases—Scopus, Web of Science, and Google Scholar—between 1 January 2014 and 31 December 2024. The search string combined controlled vocabulary and keywords related to "pesantren," "curriculum management," and "digital transformation" (e.g. (pesantren OR "Islamic boarding school") and ("curriculum management" or "curriculum optimization") AND ("digital" OR "e-learning" OR "blended learning")). The language was restricted to English and Bahasa Indonesia. Reference lists of included articles were hand-searched for additional studies.

The data analysis technique is carried out qualitatively using the content analysis method. The first step in this process is data organization, where each literature is classified based on key themes such as pesantren curriculum management, digital education transformation, and the use of technology in the curriculum. Furthermore, the collected literature is synthesized to identify the main ideas, theories, and findings and to see the relationships between the studies. Researchers also identify research gaps or limitations of the existing literature, which ultimately helps determine the unique contribution that this research can make.

Extracted data were imported into NVivo R1 for inductive thematic analysis. The first reviewer developed an initial codebook based on three a priori themes (technological integration, capacity building, and values reinforcement) and added emergent codes iteratively. A second reviewer independently coded 20% of the articles; inter-coder agreement (Cohen's $\kappa = 0.82$) indicated substantial reliability. Discrepancies were discussed until a consensus was reached. Themes were synthesized to identify patterns, gaps, and best practices.

The final stage of data analysis is drawing conclusions, where the synthesis results are used to understand trends, challenges, and opportunities in implementing digital transformation in the pesantren curriculum. To ensure rigor, we applied the four-criteria framework of Lincoln and Guba (credibility, transferability, dependability, confirmability): peer debriefing, audit trail, thick description of contexts, and reflexive journaling by both reviewers.

3 Result

3.1 Integration of Digital Technology in Learning in Islamic Boarding Schools

Pesantren is currently integrating digital technology into learning by applying e-learning and online learning resources. It is done to improve the quality and effectiveness of learning in the digital era.

3.1.1 The Use of E-learning Pesantren

Several forms of implementing e-learning in Islamic boarding schools include:

Table 1. Empirical Data on E-Learning Utilization in Pesantren

N.	Research	Findings
1.	Educational Management of Pesantren in Digital Era 4.0 (2020)	The paper examines how a modern Islamic boarding school in Indonesia implements e-learning and digital-era teaching methods, including the "Yadan-Biyadin" method[14].
2.	Alternative Approach Techniques to Support Home Islamic Boarding Schools Using Virtual Learning Technology (2021)	Virtual learning technology can be an alternative approach to support home-based Islamic boarding schools[15].
3.	E-Learning as A Learning Media Innovation Islamic Education (2023)	E-learning is implemented in Islamic boarding schools in three functions: additional, complementary, and substitute[16].
4.	Challenges of Online Boarding Schools In The Digital Era (2023)	Islamic boarding schools in Indonesia implement online learning platforms to satisfy people's desire for instant access to religious information through web-based "online pesantren"[17].
5.	Digital learning using Maktabah Syumilah NU 1.0 software and computer application for Islamic moderation in pesantren (2023)	Pesantren in Indonesia has implemented the Maktabah Syumilah NU 1.0 software for digital learning to cultivate Islamic moderation[18].
6.	A Systematic Literature Review of Islamic Boarding School (Pesantren) Education in Indonesia (2014-2024)	Islamic boarding schools in Indonesia have evolved from traditional to modern and integrated models, including virtual/online education[19].
7.	Utilization of Digital Technology in Islamic Boarding Schools: A Case Study in Samarinda (2024)	Islamic boarding schools in Samarinda, Indonesia, utilize digital technology, but due to a lack of resources, its use is limited to image—and video-based media [20].

However, there are several benefits and challenges in using e-learning in pesantren. The benefits of e-learning for students include increased flexibility in learning. In addition, access to learning resources becomes wider; interaction between students and Ustaz becomes easier, creating more personalized and adaptive learning.

However, implementing e-learning in Pesantren also faces challenges, such as the limited technological infrastructure, Ustaz and santri's lack of technology readiness, and the need to adapt learning materials into digital formats, which is still a challenge. On the other hand, Pesantren must maintain the direct interaction that has characterized it for a long time.

3.1.2 Utilization of Online Resources

In addition to e-learning, pesantren have begun utilizing various online resources to enrich the learning process. Some examples of online learning resources that can be used as stated below:

Table 2. Summary of key findings on the use of online resources in Pesantren

N.	Research	Findings
1.	Transformation of Santri (Pious Individuals) Perception about Learning via Online Media (2021)	Pesantren in Indonesia has begun to utilize various online learning resources, though santri perception of online learning is mixed[21].
2.	Transformation of The Pesantren Community's Therapeutic Relationship in Online Learning (2021)	Pesantren in Indonesia has begun using online learning resources to foster therapeutic relationships during the COVID-19 pandemic[22].
3.	The Existence of Pesantren Based Technology: Digitalization of Learning in Pondok Pesantren Darul Ulum Kudus (2021)	Pesantren in Indonesia has begun to utilize various online learning resources, which has impacted the authority of Kyai[23].
4.	The new identity of Indonesian Islamic boarding schools in the "new normal": the education leadership response to COVID-19 (2021)	Pesantren in Indonesia has begun to utilize various online learning resources in response to the COVID-19 pandemic but faces challenges in implementing blended learning[24].
5.	Challenges of Online Boarding Schools In The Digital Era (2023)	Pesantren (Islamic boarding schools) in Indonesia have begun to utilize online learning resources to satisfy people's desires for religious information[17].
6.	Digital learning using Maktabah Syumilah NU 1.0 software and computer application for Islamic moderation in pesantren (2023)	Pesantren in Indonesia has begun to utilize the Maktabah Syumilah NU 1.0 software and computer applications to cultivate religious moderation[18].
7.	Pesantren in the Digital Era: Looking for the Chances and the Challenges (2023)	Pesantren in Indonesia is adapting to the digital era by utilizing technology and digital resources in their teaching and learning activities[25].

Based on some previous research findings, online resources used in pesantren include E-books and e-journals, learning videos, online courses (MOOCs), interactive learning apps, and digital libraries.

3.1.3 Digital Content Development

In addition to utilizing external sources, pesantren also needs to develop their digital content according to the curriculum and characteristics of the pesantren. That can be done through digitizing reference books, making learning videos by Ustaz, developing interactive modules, and making special learning applications. Some examples of pesantren in Indonesia that have started to develop digital content include the following:

Table 3. Summary of Findings on the Development of Digital Learning Content in Pesantren

N.	Research	Findings

N.	Research	Findings
1.	Pesantren in Indonesia has developed digital content and learning methods to improve students' e-learning skills (2020)	Pesantren in Indonesia has developed digital content and learning methods to improve students' e-learning skills[14].
2.	Penanaman etika komunikasi digital di pesantren melalui pemanfaatan e-learning (2020)	In Indonesia, Pesantren (Islamic boarding schools) are developing digital content and e-learning to cultivate digital communication ethics[26].
3.	Maktabah syumila NU Fiha dan Maktabah Syamilah: digital transformation and contestation in pesantren (2021)	Pesantren in Indonesia has developed digital content like the Maktabah Syumila NU Fiha software to counter the influence of the Wahhabi-leaning Maktabah Syamilah software[27].
4.	Pesantren, the COVID-19 Pandemic and Digital Transformation: A Global Development Perspective (2022)	In Indonesia, Pesantren (Islamic boarding schools) have adapted to the COVID-19 pandemic by developing digital learning content [28].
5.	Religious Moderation in The Industrial Era 4.0: Deradicalization Through The Development of Intellectual Traditions at Fadhlul Fadhlan Islamic Boarding School Semarang (2023)	The Fadhlul Fadhlan Islamic Boarding School in Indonesia has developed digital content to facilitate deradicalization by disseminating intellectual traditions[29].
6.	Digital learning using Maktabah Syumilah NU 1.0 software and computer application for Islamic moderation in pesantren (2023)	Pesantren in Indonesia has developed the Maktabah Syumilah NU 1.0 software as a digital learning tool to cultivate religious moderation[18].
7.	Challenges of Online Boarding Schools In The Digital Era (2023)	In Indonesia, Pesantren (Islamic boarding schools) have developed digital content like pesantrenvirtual.com to provide online religious information [17].

Based on previous research findings, the forms of digital content developed in Pesantren include online videos, digital libraries, learning applications, etc.

3.1.4 Applications Integrated with Digital Technology in Islamic Boarding Schools

Integrating Digital Technology in Learning in Islamic Boarding Schools is a strategic step relevant to transforming education in the digital era. According to research on integrating technology in Islamic education management, digitalization can increase efficiency in

information management and support technology-based education in Islamic boarding schools.

Table 4. Findings related to the digital technology development in Pesantren

N.	Research	Findings
1.	Application Report Process Of Islamic School Based On Pesantren Boarding Using Waterfall Model (2020)	an information system application is used to process report cards for Islamic boarding schools that assess academic and religious abilities[30].
2.	Pesma Apps as Android-based Integrated Applications for Mahasantri Pesma KH Mas Mansur UMS (2020)	An Android-based application called "Pesma Apps" was developed to improve the shuttle booking system at an Islamic boarding school[31].
3.	Konsep Aplikasi E-Pesantren 4.0 di Pondok Pesantren Minhajul Haq Purwakarta (2021)	the development of an e-pesantren (Islamic boarding school) information system application to help manage student data, payments, curriculum, and facilities[32].
4.	Modernisasi Pendidikan Di Pondok Pesantren: Studi Tentang Pemanfaatan Sistem Aplikasi Pedatren dalam Meningkatkan Mutu Layanan Pondok Pesantren (2021)	The Pedatren application system helps Islamic boarding schools modernize and improve service quality by digitizing student records and processes[33].
5.	Pemahaman Aplikasi E-Bekal bagi Wali Asuh Santri sebagai Upaya Pencegahan Penyalahgunaan Uang Belanja Santri di Pesantren (2021)	The E_BEKAL application helps manage student spending money and prevent misuse at an Islamic boarding school[34].
6.	Increasing the Excellence of Pesantren in Digital Era: The Study of Management Information System Development at Pondok Modern Darussalam Gontor (2022)	Pesantren (Islamic boarding school) Pondok Modern Darussalam Gontor has developed digital applications and systems to enhance educational management and learning processes[35].
7.	Challenges of Online Boarding Schools In The Digital Era (2023)	Islamic boarding schools are developing online platforms to provide religious information and learning in the digital era[17].

3.2 Development of Digital Skills in Pesantren

Developing digital skills in Pesantren includes increasing the digital competence of both students and Ustaz.

Table 5. Findings related to the digital skills development in Pesantren

N.	Research	Findings

N.	Research	Findings
1.	Educational Management of Pesantren in Digital Era 4.0 (2020)	The effort to improve the digital competence of santri and Ustaz in a pesantren through innovating the learning method[14].
2.	Strategy of Fadhlul Fadhlan Pesantren in Developing Media Literacy (2022)	Pesantren (Islamic boarding school) uses strategies like optimizing social media, forming media centers, and training programs to develop media literacy for santri (students)[36].
3.	Creative Economy Development in Islamic Boarding Schools Through Student Entrepreneurship Empowerment Towards the Digital Era 5.0 (2022)	Pesantren (Islamic boarding schools) develop students' digital competence through entrepreneurship training, qualified teachers, and competency-focused learning strategies[37].
4.	Pesantren and madrasa-based digital literacy practices: The case of the Darunnajah Islamic Boarding School, Jakarta (2022)	Islamic boarding schools in Indonesia are implementing digital literacy training for students, emphasizing moral values and traditions[38].
5.	Digital Pesantren: Revitalization of the Islamic Education System in the Disruptive Era (2023)	The ways to improve the digital competence of santri and Ustaz in Pesantren include expanding extracurricular activities, utilizing technology for information and knowledge transfer, and adapting the Islamic education system to the digital age[6].
6.	The Empowering Digital Literacy in Islamic Boarding School Environments Through Computer and Information Technology Training (2024)	Providing computer and information technology training can improve the digital competence of students and teachers in Islamic boarding schools[39].
7.	Digital Literacy of Millennials Santri: A Case Study In Pondok Pesantren Tahfidzul Quran Al-Jihadul Chakim Mojokerto (2024)	These efforts take the form of madrasa programs such as ICT-based learning, assistance in managing social media wisely, coaching in graphic design skills, and photo/videography [40].

Pondok Pesantren Gontor is one example of an Indonesian pesantren who has been active in developing the digital skills of students and ustadz through various programs, including information technology training, digital marketing classes, and digital content creation[35]. These programs aim to improve technical skills and prepare students to face the challenges of the modern world.

3.3 Strengthening Islamic Boarding School Values in the Digital Curriculum

In adopting digital technology, Islamic boarding schools still need to maintain and strengthen Islamic boarding school values as the core outcome. Some of the main values that characterize pesantren include faith and devotion, akhlāq, independence, simplicity, knowledge, and service to the community[41]. Other values that characterize the pesantren culture are honesty

and tolerance[42]. These values need to be maintained and strengthened in the digital pesantren curriculum. The following is how pesantren strengthen their original cultural values while implementing the digital era curriculum.

Table 6. Findings related to Pesantren's values reinforcement in the digital curriculum

N.	Research	Findings
1.	Islamic Boarding School Response to the Impact of COVID-19 in Maintaining the Pesantren Values (2021)	Islamic boarding schools maintained pesantren values during COVID-19 by adapting learning methods and internalizing morals in students[43].
2.	Strategi Pembelajaran Lembaga Pendidikan Pesantren Dalam Mengahadapi Era Digitalisasi: (Studi Kasus di Pondok Pesantren Minhajut Thullab Jombang) (2022)	strategies for Islamic boarding schools to strengthen pesantren values in the digital curriculum, including core values, human resources, infrastructure, and curriculum development[44].
3.	Strategi Pendidikan Pesantren Menjawab Tantangan Sosial di Era Digital (2022)	Islamic boarding schools (pesantren) use strategies to reinforce religious values in their digital curriculum, including digital literacy, extracurricular programs, teacher training, and teaching practices[45].
4.	Pesantren in the Digital Era: Looking for the Chances and the Challenges (2023)	Pesantren (Islamic boarding schools) can strengthen their values in the digital era by adapting and maximizing the use of technology[25].
5.	The Role of Pesantren Leaders in the Digital Age (2023)	Pesantren leaders must adapt to the digital era while maintaining traditional pesantren values through curriculum revitalization, infrastructure, and stakeholder engagement[46].
6.	Manajemen Pemasaran Pendidikan Berbasis Kearifan Lokal: Upaya Peningkatan Kuantitas Santri di Era 4.0 (2024)	Integrating local cultural values with digital technology can help strengthen a pesantren's identity and attract more students[47].
7.	Pengembangan Strategi Pembelajaran Kreatif dan Inovatif Pendidikan Agama Islam (PAI) di Era Digital (2024)	Integrating Islamic ethical and moral values with technology-based learning methods can reinforce religious values in the digital curriculum[48].

Some strategies for integrating pesantren values in digital learning include developing digital content based on Islamic values[6], applying ethics in the use of technology according to Islamic teachings, utilizing technology to strengthen worship and morals, utilizing technology for community service, and strengthening Ustaz-santri interaction in online learning.

By strengthening the values of pesantren in the digital curriculum, pesantren can ensure that the adoption of technology does not eliminate the essence and uniqueness of pesantren

education. TechnologyTechnology can be a means to strengthen and expand the spread of Islamic boarding school values in the digital era.

4 Discussion

4.1 Shifting Functions of E-Learning: From Supplement to Core

Early studies portrayed e-learning in pesantren largely as an additional resource—simple digitization of readings or recorded lectures—meant to complement face-to-face instruction. However, more recent research (2023–2024) positions e-learning as a complementary and even substitutive mode, particularly under pandemic pressures, where whole courses migrated online. This evolution reveals a trend: pesantren are moving beyond pilot projects toward systemic adoption, where digital platforms are no longer optional extras but integral to curriculum delivery.

Despite the enthusiasm, a stark resource divide persists. The Samarinda case study (2024) found that most digital uses were limited to lightweight media (images/videos), with deeper interactive tools underutilized due to weak bandwidth and hardware shortages. Parallel surveys report that neither Ustaz nor santri consistently possesses the digital skills needed for robust online pedagogy, leading to superficial usage of platforms rather than transformative pedagogical change. This "readiness gap" suggests that e-learning risks remain a fragile add-on rather than a sustainable innovation without targeted investment in infrastructure and capacity-building.

Relevant to these findings, Matete found that investments in infrastructure and capacity building are needed for e-learning to become a sustainable innovation and not just a fragile addition, especially during the COVID-19 pandemic[49]. In line with that view, Saleh et al. stated that the lack of infrastructure, ICT skills, and technology capabilities are the main barriers to the sustainable adoption of e-learning[50].

Across the six identified e-learning models, we see clustering around three pedagogical patterns:

Table 7. Overview of Three Identified Pedagogical Patterns

N.	Patterns
1.	Asynchronous self-study (e.g., recorded modules in the "Yadan-Biyadin" method)
2.	Synchronous virtual classrooms (e.g., "online pesantren" web platforms)
3.	Adaptive/interactive apps (e.g., Maktabah Syumilah NU 1.0)

The third pattern is the most recent, reflecting a shift toward personalized learning pathways and software-driven moderation practices. However, these sophisticated apps remain confined to a few modernized pesantren, underscoring a two-tier innovation landscape.

Several applications are examples of how pesantren are starting to utilize technology to improve communication, transparency, and guardians' involvement in their children's education. Some pesantren use digital platforms like WhatsApp, Facebook, Instagram, and YouTube for education, communication, and outreach[23]. These adoptions of technology are

improving the visibility of pesantren and changing the traditional authoritarian role of Kyai (religious leaders) to a more dialogic approach[51], [52].

4.2 Resources Diversification and Its Impact on Authority and Power Dynamics

Studies conducted between 2021 and 2023 have documented a clear adoption pattern, from e-books, e-journals, and learning videos to MOOCs, interactive apps, and digital libraries. This resource diversification reflects institutional initiatives and the growing expectation among santri (students) for more flexible, multimedia-rich learning environments.

From the different types of online resources identified, we see a clustering around the following four patterns:

Table 8. Types of Online Resources Utilized in Islamic Boarding School Values (Pesantren)

N.	Patterns	Examples
1.	Core e-learning systems	LMS platforms for course delivery
2.	Supplementary media	video lectures, podcasts, infographics
3.	Specialized apps	e.g., Maktabah Syumilah NU 1.0 for religious moderation
4.	Open-access repositories	Digital Libraries Aggregating Global Islamic Scholarship

Beyond learner attitudes, another significant pattern emerges around institutional authority. Studies show that the introduction of online resources can subtly erode the traditional role of the Kiai (religious teacher) as the sole gatekeeper of knowledge[53], [54]. While digital platforms democratize access—allowing santri to consult global Islamic scholarship—they also challenge pesantren leadership to redefine their pedagogical and spiritual guidance roles[6], [55], balancing technological innovation with preserving core values.

Moreover, the COVID-19 pandemic accelerated the therapeutic use of online learning to maintain community bonds and support mental well-being [56], [57]. Research into "therapeutic relationships" forged via digital channels highlights how pesantren had leveraged video conferencing and social-media tools to sustain emotional support networks when physical gatherings were impossible[24], [58]. This adaptive resilience suggests that beyond academic content delivery, digital technologies can play a vital role in nurturing pesantren's holistic care for santri[59], [60].

This reconfiguration raises critical questions: How do pesantren ensure doctrinal integrity when digital materials present conflicting viewpoints? What new forms of accountability and quality control are needed? And to what extent might this power shift fuel generational divides or debates over curriculum content?

In sum, while integrating digital technology in pesantren learning environments offers unprecedented opportunities for resource enrichment, flexibility, and community resilience, it also surfaces complex challenges around perception, equity, and the renegotiation of authority.

4.2 Preserving Pesantren Ethos in Digital Modalities

The "Strengthening Islamic Boarding School Values in the Digital Curriculum" section highlights a concert of strategies deployed across seven recent studies to ensure that pesantren

values remain central even as schools go online. A thematic analysis of Table 6 reveals that pesantren are balancing technological adoption with deliberate reinforcement of core communal ethics—faith and devotion, akhlāq (morality), independence, simplicity, knowledge, service, honesty, and tolerance—by embedding them into every layer of the digital curriculum.

From the different strategies deployed across seven recent studies, we see clustering around the following patterns:

Table 9. Typology of Pesantren Strategies for Balancing Technology Integration

N.	Patterns	Examples
1.	Curricular-development	the creation of bespoke digital content grounded in Islamic values
2.	Capacity-building	teacher training and human-resources initiatives
3.	Infrastructure-and-support	investments in reliable connectivity, device provisioning, and platform maintenance
4.	Community-engagement	extracurricular programs leverage digital channels for service-learning and social-welfare projects

First, Minhajut Thullab Jombang developed modules integrating moral reflection prompts within e-lessons. At the same time, other pesantren digitized classical texts alongside commentary exercises to foster knowledge and spiritual formation. That points to an in-house content-creation trend[61] that safeguards ideological alignment and deepens learners' connection to pesantren heritage.

Meanwhile, studies report workshops on digital-pedagogy ethics, peer-mentoring schemes for ustāẓ–santri interaction, and upskilling programs in which senior instructors learn not only how to operate platforms but also how to model Islamic etiquette online. This dual focus on technical fluency and moral conduct suggests that pesantren view educators as digital guides and ethical exemplars[46]. Leaders and educators are responsible for integrating technology into education while preserving moral and spiritual teachings.

Besides the two patterns earlier, infrastructure becomes a moral imperative, not merely a logistical one. Without robust IT foundations, the risk is twofold: a purely cosmetic adoption of tech tools[62] and an erosion of communal rituals[63]—such as halaqah circles or collective dhikr—when learners struggle to connect.

After all, community engagement programs are also still essential. Examples include virtual Qur'an study tours supporting orphanages, online charity drives, and digital storytelling workshops that frame technology as a means of community service. These initiatives reframe digital literacy as a component of *khidmah* (service)[64], reinforcing the pesantren's outward-facing values alongside inward ethical formation.

5 Conclusion

This study demonstrates that pesantren can achieve a sustainable blend of tradition and technology by embedding tailored e-learning modules within their core instructional practices. Success hinges on strategic capacity building—through targeted ICT training, peer mentoring,

and digital pedagogy workshops—that develops technical fluency and models the noble character (akhlāq) central to pesantren education. Equally important is the deliberate reinforcement of core values—faith, morality, service, simplicity, and community engagement—through curriculum design features such as moral-reflection prompts, provenance metadata, and virtual khidmah projects, ensuring that each digital activity advances spiritual and scholarly goals.

Robust governance and quality-control frameworks are essential to safeguard doctrinal integrity as santri gains access to global Islamic scholarship. We recommend multi-stakeholder source-vetting committees, transparent resource tagging, and analytics dashboards that monitor ethical engagement alongside learning outcomes. For policymakers and pesantren leaders, coordinated investment in reliable connectivity, hardware provisioning, and ongoing professional development will be critical. Future research should empirically assess the impact of blended-learning models on academic and spiritual literacies, evaluate long-term shifts in institutional authority, and explore scalable governance mechanisms across diverse pesantren contexts.

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