



## Sustaining the Digital Shift: The Role of LMS Standardisation and Interactive Pedagogy in Islamic Higher Education

**Muhammad Munif\***

Universitas Nurul Jadid,  
INDONESIA

**Titi Kadi**

Universitas Islam Negeri Sultan Aji Muhammad Idris  
Samarinda, INDONESIA

**Zamroni Zamroni**

Universitas Islam Negeri Sultan Aji Muhammad Idris  
Samarinda, INDONESIA

**Hasan Baharun**

Universitas Nurul Jadid,  
INDONESIA

**Dinda Febrianti Putri**

Universitas Nurul Jadid,  
INDONESIA

### Article Info

#### Article history:

Received: June 6, 2026

Revised: August 18, 2026

Accepted: September 16, 2026

#### Keywords:

Digital Inclusion;  
Digital Pedagogy;  
Institutional Governance;  
Islamic Higher Education;  
Learner Engagement.

### Abstract

The growing reliance on digital learning in higher education has exposed a critical challenge: expanding technology use does not necessarily translate into meaningful learner engagement, inclusive participation, or sustainable learning practices. Accordingly, this study examines how digital pedagogy, inclusive digital access, and institutional support interact to shape technology-enabled learning in Islamic higher education. A qualitative instrumental case study involved nineteen institutional leaders, lecturers, and students. Data were collected through classroom observations, semi-structured interviews, focus group discussions, and institutional document analysis, and analysed using open, axial, and selective coding. The findings reveal three interconnected dimensions. First, interactive digital pedagogy enhanced learner engagement through collaborative learning, reflective questioning, and continuous feedback. Second, equitable digital access supported inclusive participation through stable internet connectivity, digital literacy, and accessible learning platforms, reducing barriers to discussion, collaboration, and assignment completion. Third, institutional support strengthened digital learning sustainability through standardised Learning Management System (LMS) procedures for course management, learning documentation, assessment, and academic continuity. Overall, meaningful digital transformation depends on the interaction of pedagogical practices, equitable digital access, and institutional governance, not technology adoption alone. The study provides empirical evidence and practical implications for strengthening digital pedagogy, improving accessibility, and developing institutional policies for sustainable digital learning.

**To cite this article:** Munif, M., Kadi, T., Zamroni, Z., Baharun, H., & Putri, D. F. (2026). Sustaining the digital shift: The role of LMS standardisation and interactive pedagogy in Islamic higher education. *Online Learning in Educational Research*, 6(3), 103-115. <https://doi.org/10.58524/oler.v6i3.1429>

## INTRODUCTION

Changing the way knowledge is produced, accessed, and shared across the academic community has become a defining feature of digital transformation in higher education. The scale of this transformation is reflected in the widespread adoption of digital technologies across educational systems (Mekić et al., 2024; Sarker et al., 2021; Susilowati et al., 2025; Tunjera et al., 2022). UNESCO reports that higher education has become the education subsector with the highest level of digital technology adoption, with online management platforms increasingly supporting teaching, learning, and institutional administration. At the same time, however, UNESCO emphasises that the effects of

\* Corresponding Author

Muhammad Munif, Universitas Nurul Jadid, INDONESIA ✉ [m.munifmpdi@gmail.com](mailto:m.munifmpdi@gmail.com)

digital technology remain uneven across socioeconomic contexts, levels of technological readiness, and institutional capacities, indicating that technology adoption alone does not automatically produce meaningful educational transformation (UNESCO, 2023). In this context, expanding learning opportunities beyond the conventional classroom requires not only reliable internet connectivity but also the effective integration of Learning Management Systems (LMS), mobile applications, and interactive communication platforms to support flexible, collaborative, and continuous learning (Drampalou et al., 2024; Firman et al., 2024; Firouzi et al., 2022; Rallapalli & Dileep, 2023; Ritonga et al., 2024). Research on LMS implementation has also shown that students' perceptions of the platform are an important consideration in technology-enabled learning (Khan & Ali, 2023). UNESCO further argues that digital transformation in higher education should extend beyond introducing technological tools to encompass changes in pedagogy, governance, management, and quality assurance (UNESCO, 2024). Thus, the central challenge is no longer simply whether higher education institutions adopt digital technologies, but how these technologies are pedagogically integrated, made accessible to diverse learners, and institutionally governed to sustain meaningful learning over time (Siregar et al., 2025; Suwendi et al., 2025).

Zamroni et al. (2025) primarily emphasised the functional role of digital platforms, showing that they were used mainly to distribute learning materials, manage assignments, and facilitate online communication. By comparison, Fawaid et al. (2025) focused more on the flexibility and accessibility of digital learning, reporting that technology-supported learning expanded students' opportunities to access learning resources and communicate with lecturers. Their findings, however, differ from Suherni et al. (2023), who found that the availability of digital platforms did not necessarily lead to active learner participation because differences in digital competence and technological readiness could limit students' engagement. The same distinction is evident in research on digital inclusion. Hosna et al. (2025) and Najiburrohman et al. (2026) identified digital readiness and accessibility as key conditions influencing participation.

In contrast, Aimah et al. (2025) and Mundiri et al. (2025) emphasized infrastructure and digital literacy as determinants of equitable engagement. Sain (2025), Sanjani et al. (2025), and Surahman et al. (2022) also emphasized infrastructure and digital literacy as determinants of equitable engagement. In contrast, one study focused on differences in technological preparedness among learners, showing that unequal readiness could produce different learning experiences even when the same digital system was institutionally available. However, these perspectives remain fragmented, as previous studies have generally examined platform functionality, access, learner readiness, or participation separately rather than explaining how digital pedagogy and institutional support interact with inclusive access to produce meaningful and sustainable learning in Islamic higher education.

Beyond technology access, previous studies have also produced divergent findings on how digital learning affects educational outcomes. Yaqin et al. (2023) and Khomairotusshiyama et al. (2025) emphasised the positive contribution of technology-supported learning to student motivation, access to academic resources, and interaction between lecturers and students. Student satisfaction in Indonesian Islamic universities has also been associated with teaching quality, educational facilities, social interaction, and faculty leadership (Fauzan & Nasution, 2026). Similarly, Yakubu et al. (2025) reported that well-designed digital learning environments can support learner autonomy and collaborative knowledge construction. Evidence from flipped classroom research also indicates that digitally supported instructional approaches can influence students' cognitive engagement and attitudes toward learning (Elzainy & Sadik, 2022). However, these positive findings contrast with studies showing that digital environments do not consistently generate meaningful engagement when pedagogical interaction and learner support are insufficient. In such contexts, digital platforms may expand access to learning resources without necessarily strengthening active participation or deeper interaction. This divergence suggests that the educational value of digital technology depends not only on its availability but also on how technology is pedagogically designed and institutionally supported. A similar tension appears in research on sustainable digital education. Anisaturrizqi et al. (2025) and Chaika (2025) linked sustainable digital learning to institutional readiness, adaptive pedagogical practices, and organisational support. In contrast, Kamardeen et al. (2020) emphasised the importance of long-term institutional capacity and responsible management in maintaining digital learning effectiveness. These divergent findings indicate that existing research

provides valuable insights but remains fragmented across pedagogical, accessibility, and institutional perspectives, creating a need for a more integrated explanation of digital transformation in higher education.

This fragmentation reveals three specific gaps that the present study seeks to address. First, a theoretical gap exists because learner engagement, digital inclusion, and institutional sustainability are generally conceptualised and examined as separate dimensions, leaving limited theoretical explanation of how these dimensions interact as components of a single digital transformation process. Second, an empirical gap exists because previous studies tend to examine digital platforms, learner readiness, accessibility, pedagogical practices, or institutional support independently; consequently, empirical evidence remains insufficient to show how interactive pedagogy, inclusive digital access, and standardised digital governance operate simultaneously within the same learning environment. Third, a contextual gap exists because relatively few studies integrate these dimensions within Islamic higher education, particularly in pesantren-based institutions where digital transformation is shaped not only by technological and pedagogical requirements but also by distinctive religious values, cultural practices, and institutional governance structures.

Building on these gaps, this study examines digital transformation in Islamic higher education through an integrated framework that links interactive digital pedagogy to learner engagement, inclusive digital access to equitable participation, and institutional governance through LMS standardisation to sustainable digital learning. Accordingly, RQ1 focuses on how interactive digital pedagogy shapes learner engagement, RQ2 examines how inclusive digital access supports or constrains equitable participation, and RQ3 investigates how institutional governance, particularly LMS standardisation, contributes to sustainable digital learning practices.

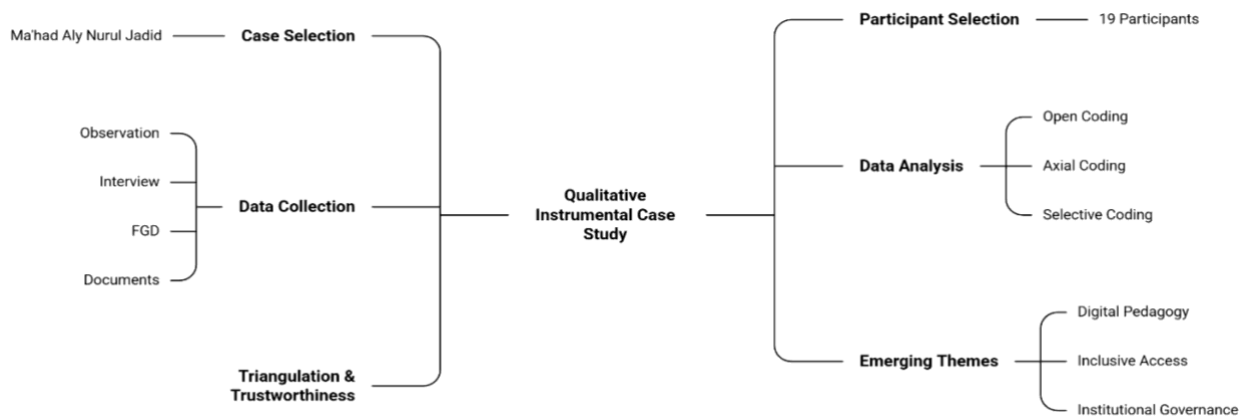
This study is primarily grounded in Constructivist Learning Theory, which views learning as an active process in which learners construct knowledge through interaction, collaboration, reflection, and engagement with their learning environment. Accordingly, technology becomes educationally meaningful only when embedded within pedagogical structures that promote participation, inclusivity, and sustainable learning. Other studies have emphasised equitable access, digital literacy, and accessibility as key determinants of inclusive participation ([Kyriazopoulou et al., 2023](#); [Sun et al., 2023](#); [Sari et al., 2025](#)). However, researchers have generally examined these dimensions independently. Existing studies rarely explain how pedagogical engagement, inclusive access, and institutional governance interact within a single analytical framework, particularly in Islamic higher education, where digital transformation is intertwined with faith-based educational values and institutional culture. To address this gap, the present study develops an integrated perspective that explains how structured digital pedagogy, inclusive access, and institutional governance collectively shape technology-enabled learning in Islamic higher education, extending existing scholarship beyond isolated examinations of these three dimensions.

This study offers a novel integrated perspective by connecting learner engagement, inclusivity, and sustainability within a single analytical framework for digital learning in Islamic higher education. Unlike previous studies that predominantly examine these dimensions separately or focus on technology adoption as an operational issue, this study explains how interactive digital pedagogy, inclusive digital access, and institutional governance jointly shape meaningful and sustainable digital learning. Instead, this study positions the institutional culture, pedagogical interactions, and social participation shaped by digital learning as a multidimensional process. This research aims to be more inclusive, participatory, and sustainable, namely by providing practical insights for policymakers, institutional leaders, and educators in designing digital learning environments.

## METHOD

This study employed a qualitative instrumental case study design to investigate how digital transformation shapes learner engagement, inclusivity, and sustainability within Islamic higher education ([Kekeya, 2023](#)). An instrumental case study was selected because the purpose was not merely to provide an in-depth description of Ma'had Aly Nurul Jadid, but to use the institution as a bounded case to develop broader insights into the interaction of digital pedagogy, inclusive access, and institutional governance. This design was considered more appropriate than a phenomenological approach, which primarily focuses on individuals' lived experiences, or an

ethnographic approach, which emphasises cultural practices and prolonged immersion in a social setting. The study was conducted at Ma'had Aly Nurul Jadid, Indonesia, which was purposively selected because it actively implements technology-supported learning within a pesantren-based higher education environment. The case was considered information-rich for examining how institutional practices, pedagogical interactions, and stakeholder experiences collectively influence digital learning transformation. Thus, the instrumental case study design enabled the researchers to examine the case in depth and use its findings to develop broader analytical insights into technology-enabled Islamic higher education, rather than merely describing the institution itself (R. Cole, 2024). The research process followed a systematic sequence from case selection and participant recruitment to data collection, analysis, and interpretation, as illustrated in Figure 1.



**Figure 1.** Research Flowchart

The subjects in this study were purposively sampled to ensure all informants had prior experience using digital learning. Specific inclusion criteria were specified for each subject group. We included those in leadership positions within the institutions who were directly responsible for digital learning policies, academic administration, or implementing technology-based learning. Lecturers were included if they had at least two years of experience in technology-based teaching and were involved in delivering or administering technology-based learning activities. We included those who served as students (*mahasantri*) if they were currently enrolled in the institutions and had prior experience in technology-based learning. The study included nineteen participants, comprising institutional administrators, lecturers, and students who met the above criteria and actively engaged in technology-based teaching and learning practices. This sample size was adequate because data collection continued until thematic saturation was reached. This happened when no new themes, categories, or interpretations emerged after several interviews, observations, and focus group discussions. Table 1 presents participant characteristics, including stakeholder category, number of participants, selection criteria, and research role.

**Table 1.** Participant Characteristics

| Participant Category           | Number | Selection Criteria                                                       | Research Role                     |
|--------------------------------|--------|--------------------------------------------------------------------------|-----------------------------------|
| Institutional leaders          | 2      | Responsible for institutional digital learning policy and implementation | Institutional perspective         |
| Lecturers                      | 5      | Minimum of two years of experience in technology-supported teaching      | Pedagogical perspective           |
| Students ( <i>Mahasantri</i> ) | 12     | Active participants in digital learning activities                       | Learner perspective               |
| Total                          | 19     | Purposive sampling                                                       | Multiple stakeholder perspectives |

Data were collected using four complementary techniques (Cole, 2024; Fadli, 2021). The authors developed the data collection instruments based on the research's theoretical framework, which included an integrated perspective on learner engagement, inclusive access, and institutional

governance. First, participatory observations were conducted using an observation checklist to examine classroom interaction, learner engagement, digital platform use, and teachers' instructional strategies. Second, semi-structured interviews were conducted using the interview guide to examine participants' experiences, perceptions, and challenges associated with digital learning. Third, the researchers analyzed institutional documents using a document analysis approach, focusing on digital learning policy, LMS guidelines, learning archiving, activity reporting, and digital documentation, with the LMS Guideline of Ma'had Aly Nurul Jadid as the key document.

The researchers conducted data analysis using the interactive method suggested by Soesana et al. (2023). The researchers did not use any qualitative data analysis software when coding and organising the qualitative data obtained during the research. The analysis procedure involved four interrelated stages. First, they open-coded all interviews, observations, FGDs, and documentary data for issues related to learner engagement, inclusiveness, and sustainability. Second, similar codes were grouped through axial coding into larger conceptual categories reflecting recurring institutional practices and participants' experiences. Third, categories were further synthesised through selective coding to formulate themes related to the connections between digital pedagogy, inclusiveness, and institutional sustainability.

The study ensured trustworthiness through methodological triangulation using interviews, observation, institutional documents, and focus groups. Member checking, peer debriefing, audit trails, prolonged engagement, and reflective memos further increased the credibility, dependability, confirmability, and validity of the results.

## RESULTS AND DISCUSSION

This study identified three interrelated themes explaining how digital transformation supports learning in Islamic higher education at Ma'had Aly Nurul Jadid: (1) digital pedagogy strengthens learner engagement, (2) inclusive access reduces participation barriers, and (3) institutional support promotes the sustainability of digital learning. These themes emerged through iterative analysis of classroom observations, semi-structured interviews, focus group discussions, and institutional document analysis using open, axial, and selective coding. Figure 1 summarises the relationships among the three themes, while the following sections present the empirical evidence supporting each finding.

### Digital Pedagogy Strengthened Learner Engagement

Classroom observations consistently showed higher learner engagement when teachers used structured digital pedagogy than when they used teacher-led instruction. Throughout the observed learning process, learners were highly engaged whenever teachers incorporated explanation and discussion questions, reflection, collaboration, and follow-up feedback. Learner engagement was observed through learner behaviour such as class presence, participation in discussions, task completion, interaction with peers, and engagement with the lecturer's facilitation. Table 2 summarises the main observational indicators of learner engagement and their thematic interpretations.

**Table 2.** Observational Evidence of Learner Engagement in Digital Learning

| Theme                    | Coding Categories       | Representative Observation                                                                                            | Thematic Interpretation                                                                                 |
|--------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Attendance continuity    | Sustained participation | Students remained present throughout the learning sessions with minimal disengagement.                                | Consistent attendance reflected behavioural engagement supported by structured digital learning.        |
| Discussion participation | Active interaction      | Students voluntarily responded to questions, shared opinions, and extended discussions beyond the lecturer's prompts. | Interactive instructional design encouraged active participation rather than passive content reception. |
| Task responsiveness      | Learning responsibility | Students completed reflective tasks and collaborative                                                                 | Timely task completion demonstrated sustained academic engagement.                                      |

| Theme                 | Coding Categories       | Representative Observation                                                                                                                   | Thematic Interpretation                                                                   |
|-----------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Peer interaction      | Collaborative learning  | assignments within scheduled timelines.<br>Students exchanged feedback and completed learning activities together through digital platforms. | Digital learning facilitated collaborative knowledge construction among learners.         |
| Lecturer facilitation | Pedagogical scaffolding | Lecturers consistently used questioning, reflection, and guided discussion to sustain interaction.                                           | Learner engagement emerged through pedagogical facilitation rather than technology alone. |

However, the observation data repeatedly indicated that learners' engagement was characterized by participation in learning through collaboration, reflection, and continuous lecturer feedback. Learners actively participated in learning activities through interaction, reflection, and feedback. As a result of the digital pedagogy, learners were not seen as passive recipients of digital content but as participants in interactive learning activities. Sustained attendance, prompt task completion, active responses to the lecturer's prompts, and interactions with peers were among the patterns observed throughout the learning process. Similar trends emerged in interview and focus group data, where both lecturers and learners identified opportunities for interaction and collaborative, reflective processes that led to active participation. Thus, technology did not promote learner engagement; rather, the interaction it facilitated through participation and collaboration did ([Rahmadani et al., 2025](#)).

### **Inclusive Access Reduced Participation Barriers Substantially**

Observations and interviews revealed that learners' participation in technology-mediated learning was directly linked to the provision of inclusive digital access. Among the factors noted, internet reliability was the most influential for learner participation, as it directly affected students' participation, discussion, interaction with other students and lecturers, and assignment submission. Other factors participants cited included device availability, experience with digital learning platforms, and digital skills. Learners with reliable internet access and sufficient technological skills participated more in online discussions and collaboration and submitted assignments on time. In contrast, learners with unreliable internet access participated less despite similar levels of academic motivation, and limited digital skills and experience further reduced their participation. Lecturers observed that participation varied more with access than with students' willingness to participate in learning processes.

Interview findings further confirmed that both students and lecturers perceived inclusive access as an important factor supporting meaningful participation in digital learning. One student explained, "I feel more confident joining discussions, asking questions, and submitting assignments on time when the internet connection is stable and the platform is easy to use. It really helps me, who was previously less active in class." Another participant stated, "Sometimes I understand the lesson, but weak connectivity makes me hesitate to participate because I am worried about missing parts of the discussion." A lecturer similarly observed, "Students often remain silent not because they are passive, but because technical barriers reduce their willingness to respond." Another lecturer added, "When learning materials are accessible through various formats and flexible time, more students can stay engaged. This helps them prepare better for subsequent learning activities." Across interviews, participants consistently linked accessible digital infrastructure, flexible learning resources, and user-friendly platforms to higher participation and more consistent engagement.

The correspondence between the information gained through observation and interviews proved that, apart from the availability of technologies, inclusive access was also evident in how students used the resources available to learn. Students with little difficulty using technology participated in class discussions, submitted assignments on time, and kept in touch regularly with lecturers and fellow students. However, students with connectivity and digital proficiency challenges chose to participate less actively, despite their drive to learn. This means that differences in digital

access and technological preparedness among students were consistent with differences in learner participation.

### **Sustainable systems supported long-term learning continuity.**

The documentary analysis of the institutional Learning Management System (LMS) Guideline showed that Ma'had Aly Nurul Jadid has developed a standardised LMS procedure for implementing digital learning through academic activities. The guidelines explained institutional rules for course organisation, learning material distribution, online discussion, assignment submission, assessment procedures, and digital documentation. The guidelines also explained each party's responsibilities to ensure the continuity of digital learning through the LMS. Documentary results were validated through interviews in which lecturers and students expressed that, through standardised LMS procedures, course management, learning materials, assignment submission, and the assessment process became more systematic. Moreover, observations supported the implementation of LMS procedures, showing that the LMS is used systematically for learning materials, instruction, assignments, and academic record-keeping. Based on the convergence of documentary, interview, and observation, it can be concluded that the standardisation of LMS procedures is not only an institutional rule but is also practiced in daily academic activities. Therefore, the findings clearly show that digital learning is organised through formal institutional governance rather than individual teaching initiative.

Further analysis of the document also highlighted that the LMS guideline stressed the importance of consistency in the digital learning management process by creating common operating procedures for both lecturers and students throughout the learning process. Learning materials were organized efficiently on the platform, and communication, assignments, attendance, and assessment were all conducted digitally. The guideline also highlighted the need to maintain digital academic records as part of the institution's documentation to ensure access to learning resources and activities throughout the academic semester.

The documentary analysis results were similar to those from interviews with lecturers and students. From their explanations, it is clear that standardised LMS procedures made digital learning activities easy to understand, since all learning resources, class announcements, discussion boards, assignments, and assessment information were presented on a single institutional platform. Standardisation also helped lecturers by reducing administrative inconsistencies and simplifying digital course management. On the other hand, students explained that access to learning materials in the archives helped them review previous lessons whenever needed.

In general, based on the document analysis, one may conclude that institutional governance contributed to the sustainability of digital learning in Ma'had Aly Nurul Jadid by standardizing the Learning Management System. The LMS functioned not only as a technical means of delivering instructional content, but also as an institutional means of organizing the learning process, documenting it, storing instructional content, and sustaining digital learning over time. In particular, digital learning requires not only digital technologies but also institutional practices that regulate and document the educational process. In Islamic higher education, LMS guidelines may be regarded as such an institutional practice.

### **Discussion**

Results suggest that learner participation improved through interactive digital pedagogy, not just through technology use. These results align with recent findings showing that successful online and flipped learning requires educators to have digital pedagogical skills such as instructional transparency, guided autonomy, and multimodal feedback, not just technical skills (Limbong et al., 2026). Classroom observations suggested that combining synchronous explanations with reflective questions, collaborative work, and lecturer feedback created multiple opportunities for participation. This result is consistent with constructivist learning theory, suggesting that knowledge formation is based on active interaction and cooperation rather than information transmission (Abildinova et al., 2024; Muhammad et al., 2023; Mulyani et al., 2025). Nevertheless, existing literature mostly addresses interactive digital pedagogy in general higher education settings and its effects on participation, collaboration, and learning outcomes, without considering the interplay between these techniques and the dialogue tradition in the pesantren-based education system. This

study addresses this limitation by showing that interactive digital pedagogy can strengthen learner engagement when it is adapted to the dialogical and reflective learning practices embedded in the pesantren context. Theoretically, these findings broaden constructivist perspectives within faith-based higher education; practically, they suggest that lecturers should prioritise interactive instructional design over technology-centred teaching approaches (Darwanto et al., 2024; Firmansyah et al., 2024; Suresman et al., 2026; Manaf et al., 2026).

Another way the positive impact of digital pedagogy was achieved was through the incorporation of collaborative learning strategies that fostered constant communication between lecturers and students throughout the learning process. In contrast to traditional digital teaching, which often focuses on conveying information, participants in this study were more actively involved, as digital technologies helped them engage in dialogue and reflection and solve problems collectively. Previous studies have found that integrating synchronous and asynchronous learning promotes learner engagement (Benjelloun, 2023; Marzuki et al., 2020; Tejera et al., 2023). However, this study also provides further empirical evidence that collaborative digital learning in Islamic higher education includes the traditions of reflective and dialogic learning inherent in pesantren culture.

These results also show that inclusive digital access has promoted participation by giving learners a chance to communicate and collaborate more confidently. Consistent Internet access, appropriate learning platforms, digital literacy skills, and device availability have enabled learners to participate actively in discussions, collaboration sessions, and assignment completion. These results align with research showing that digital inequality is a key barrier to participation in education (Bae et al., 2021; Marisa et al., 2024). Yet, the existing literature has mostly focused on factors that contribute to digital inequality and hinder learners' participation, such as technology access, connectivity, and digital literacy (Hosna et al., 2025; Mundiri et al., 2026). This research helps fill the gap by showing that inadequate digital access can negatively affect learners' willingness to communicate, even when they remain motivated by academic progress. From a theoretical perspective, these findings expand understanding of digital inclusion as not only technological but also as learners' readiness to participate (Izzah et al., 2024; Lin et al., 2021; Saad et al., 2023).

In this context, institutional governance emerges when a standard governance framework supports digital learning, rather than relying on individual initiatives such as lecturers'. Recent research indicates that e-learning can support a more effective learning experience when systematically integrated into the educational process, rather than treated as an isolated technological application (Salim et al., 2026). Document analysis of the Learning Management System guideline indicated that institutional policies managed course organization, digital documentation, learning resources, and records to ensure continuity of the learning process. Existing literature generally links technological innovation and curriculum development to sustainable digital education (Dede et al., 2023; Farias et al., 2023; Marcellus et al., 2021). These results provide additional insight into the dimensions of sustainable digital education as they relate to institutional governance in the context of Islamic education.

In general, this paper provides a comprehensive analysis of digital transformation in higher education institutions in Islam by showing that learner engagement, inclusive access, and institutional governance function as complementary dimensions rather than independent ones. The study enhanced learner engagement through interactive pedagogical approaches, promoted inclusive access to support equal participation while reducing technological barriers, and strengthened institutional governance by standardizing LMS implementation to support continuous learning. Unlike other studies that address these dimensions separately, this study reveals their interrelatedness within a pesantren-based higher education system. From a theoretical perspective, this paper contributes to developing a holistic approach to digital transformation across pedagogical, technological, and institutional aspects.

## LIMITATIONS

The study has certain limitations that readers should consider when interpreting the results. First, the study used a qualitative instrumental case study design in one pesantren-based Islamic higher education institution, namely Ma'had Aly Nurul Jadid; therefore, the results cannot be transferred directly to other Islamic higher education institutions with different organizational,

technological, and educational contexts. Second, the total number of selected participants was only nineteen, and there were more students than lecturers and institutional leaders, which may reduce the diversity of views expressed by participants. Third, some findings came from interviews and focus group discussions, so they may have been affected by participants' perceptions or socially desirable answers. Although observations and document analysis were used to triangulate the data, this potential bias cannot be ruled out.

## CONCLUSION

This paper provides evidence that digital transformation in Islamic higher education institutions should be viewed from an integrative perspective in which pedagogical practice, access to learning, and institutional governance form a synergy to support learning processes. Rather than viewing digital transformation as technological development, this paper emphasizes the need to coordinate the use of technological tools for teaching and learning, learners' participation in learning activities, and the organizational aspects of digital learning at Islamic HEIs. The paper's main contribution is an integrative approach that combines the concepts of learner engagement, inclusive access, and institutional governance in relation to Islamic higher education institutions.

The approach may guide the design of digital learning spaces by supporting lecturer involvement in using digital tools for teaching, learner inclusion in the learning process, and standardized institutional management of digital learning processes. Future research can investigate the approach's transferability to other Islamic HEIs. Such research could further test the relationships among learner engagement, inclusive access, and institutional governance and refine the framework developed from this case.

## AUTHOR CONTRIBUTIONS

MM contributed to the conceptualisation of the study, development of the research framework, investigation, and interpretation of findings related to Islamic education and learner-centred pedagogy. TK contributed to the study's conceptual development, investigation, and interpretation of findings related to educational innovation and Islamic higher education. Z contributed to the research methodology, investigation, and interpretation of findings concerning digital learning, educational policy, and institutional practices. HB contributed to the study's conceptualisation, interpretation of findings, and critical evaluation of the manuscript, particularly regarding Islamic education and educational management. DFP contributed to data collection, data analysis, interpretation of findings, and manuscript preparation. All authors contributed to the critical revision of the manuscript, approved the final version, and agreed to be accountable for all aspects of the work.

## ACKNOWLEDGMENT

The authors express their deepest gratitude to the academic leaders, lecturers, and students who participated in and supported this research through their insights and cooperation. We also thank the institution for providing access to documents and learning activities. We want to thank our colleagues and reviewers for their constructive feedback. Their support and contributions were crucial to completing this research.

## REFERENCES

- Abildinova, G., Mukhtarkyzy, K., & Abykenova, D. (2024). Preparing educators for the digital age: teacher perceptions of active teaching methods and digital integration. *Frontiers in Education*, 9. <https://doi.org/10.3389/feduc.2024.1473766>
- Anisaturrizqi, R., & Yulianti, R. R. (2025). Global trends and transformative insights in artificial intelligence (AI) research : A bibliometric analysis of the dynamics of education, ethics, and innovation. *Indonesian Journal of Progressive Pedagogy*, 01(01), 34–48. <https://doi.org/10.61987/ijpp.v1i1.665>
- Bae, Y. S., Kim, K. H., Choi, S. W., Ko, T., Lim, J. S., & Piao, M. (2021). Satisfaction and usability of an information and communications technology-based system by clinically healthy patients with

- covid-19 and medical professionals: Cross-sectional survey and focus group interview study. In *JMIR Formative Research* (Vol. 5, Issue 8). <https://doi.org/10.2196/26227>
- Aimah, S., Faishol, R., Qushwa, F. G., & Maulidy, A. (2025). Conceptualizing authenticity in generative ai-driven e-learning: A critical examination of generative artificial intelligence in educational systems. *2025 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies, 3ICT 2025*. <https://doi.org/10.1109/3ict68299.2025.11442128>
- Benjelloun, W. (2023). Bridging the digital divide in higher education: North African challenges and initiatives. In *Higher Education in the Arab World: E-Learning and Distance Education* (pp. 169–189). [https://doi.org/10.1007/978-3-031-33568-6\\_10](https://doi.org/10.1007/978-3-031-33568-6_10)
- Chaika, O. (2025). Educational policy and reforms: The impact of globalization. In *Educational Policy and Reforms: the Impact of Globalization*. <https://doi.org/10.15587/978-617-8360-20-7>
- Cole, R. (2024). Inter-rater reliability methods in qualitative case study research. *Sociological Methods and Research*, 53(4), 1944–1975. <https://doi.org/10.1177/00491241231156971>
- Cole, R. E. (2024). Work, mobility, and participation: A comparative study of American and Japanese Industry. In *Work, Mobility, and Participation: A Comparative Study of American and Japanese Industry*. <https://doi.org/10.2307/589462>
- Darwanto, A., Prahmana, R. C. I., Susanti, A., & Khalil, I. A. (2024). Transformation of boarding school management models in enhancing student accessibility and educational quality. *Jurnal Pendidikan Agama Islam*, 21(1), 145–164. <https://doi.org/10.14421/jpai.v21i1.8632>
- Dede, C., & Lidwell, W. (2023). Developing a next-generation model for massive digital learning. *Education Sciences*, 13(8). <https://doi.org/10.3390/educsci13080845>
- Drampalou, S. F., Uzunidis, D., Vetsos, A., Miridakis, N. I., & Karkazis, P. (2024). A user-centric perspective of 6g networks: A survey. In *IEEE Access* (Vol. 12, pp. 190255–190294). <https://doi.org/10.1109/ACCESS.2024.3516194>
- Elzainy, A., & Sadik, A. El. (2022). The impact of flipped classroom: Evaluation of cognitive level and attitude of undergraduate medical students. *Annals of Anatomy*, 243. <https://doi.org/10.1016/j.aanat.2022.151952>
- Fadli, M. R. (2021). Understanding qualitative research method design. *Humanika: Kajian Ilmiah Mata Kuliah Umum*, 21(1), 33–54.
- Farias-Gaytan, S., Ramirez-Montoya, M. S., & Aguaded, I. (2023). Educational innovation with alternative credentials as a driver of the digital transformation of the University: A Case study in Latin America. *Journal of Interactive Media in Education*, 2023(1), 1–18. <https://doi.org/10.5334/jime.793>
- Fauzan, A., & Nasution, S. I. (2026). Determinants of student satisfaction in higher education: Evidence from Indonesian islamic universities. *Munaddhomah: Jurnal Manajemen Pendidikan Islam*, 7(2), 386–399. <https://doi.org/10.31538/munaddhomah.v7i2.2390>
- Fawaid, A., Hamzah, M., Rohimah, & Munawwaroh, I. (2025). AI-based career management to improve the quality of decision making in higher education. *2025 15th IEEE Integrated STEM Education Conference, ISEC 2025*, 1–8. <https://doi.org/10.1109/ISEC64801.2025.11147274>
- Firman, M., Berliana, B., Sauri, R. S., & Wasliman, I. (2024). Manajemen pembelajaran terintegrasi dalam model pembelajaran blended learning, learning management system. *Munaddhomah: Jurnal Manajemen Pendidikan Islam*, 4(4), 1038–1046. <https://doi.org/10.31538/munaddhomah.v4i4.869>
- Firmansyah, SA, R., & Munir. (2024). The urgency of social ethics in santri tradition at Muhammadiyah's Pesantren. *Tafkir: Interdisciplinary Journal of Islamic Education*, 5(1), 153–170. <https://doi.org/10.31538/tijie.v5i1.991>
- Firouzi, F., Farahani, B., & Marinšek, A. (2022). The convergence and interplay of edge, fog, and cloud in the AI-driven Internet of Things (IoT). *Information Systems*, 107. <https://doi.org/10.1016/j.is.2021.101840>
- Hosna, R., Hery Qusyairi, L. A., Mualimin, M., & Fauzi, A. (2025). Utilization of digital advertising strategy in marketing educational programs. *2025 11th International Conference on Education and Technology (ICET)*, 34–39. <https://doi.org/10.1109/ICET67257.2025.11290729>
- Izzah, I., Walid, M., Padil, M., & Wahyudin, A. (2024). Strategic management of schools for excellence: Integrating quality culture and character development in leading educational institutions. *Al-Ishlah: Jurnal Pendidikan*, 16(4), 4654–4668. <https://doi.org/10.35445/alishlah.v16i4.5953>

- Kamardeen, I., & Samaratunga, M. (2020). Digiexplanation driven assignments for personalising learning in construction education. *Construction Economics and Building*, 20(3), 103–123. <https://doi.org/10.5130/AJCEB.v20i3.7000>
- Kekeya, J. (2023). Qualitative case study research design: The commonalities and differences between collective, intrinsic and instrumental case studies. *Contemporary PNG Studies*, 36(2008), 29–30.
- Khan, R. A., & Ali, A. (2023). Students' perceptions of EvalTools LMS: A case study. *International Journal of Technologies in Learning*, 30(1), 91–105. <https://doi.org/10.18848/2327-0144/CGP/v30i01/91-105>
- Khomairotusshiyama, U., & Diana, E. (2025). Utilization of artificial intelligence for recruitment of the best educational talent. *Indonesian Journal of Progressive Pedagogy*, 01(01), 12–23. <https://doi.org/10.61987/ijpp.v1i1.653>
- Kyriazopoulou, M., Karalis, T., Magos, K., & Arvanitis, E. (2023). Key principles of inclusive education and main challenges of implementing inclusive practice at preschool level in Greece. *Mediterranean Journal of Education*, 3(1), 63–80.
- Limbong, E., Irawati, I., Wadham, B., Muluk, S., Suryanto, S., & Limbong, M. E. R. (2026). Building digital pedagogical expertise in online and flipped learning: Insights from a visiting scholar experience. *Jurnal Ilmiah Peuradeun*, 14(2), 1349–1372. <https://doi.org/10.26811/peuradeun.v14i2.2483>
- Lin, J., Stoltz, A., Aruch, M., & Rappeport, A. (2021). Decolonization and transformation of higher education for sustainability. *Journal of Comparative & International Higher Education*, 13(Summer), 134–156. <https://doi.org/10.32674/jcihe.v13iSummer.3255>
- Manaf, S., Mulazid, A. S., Arief, H., & Darajat, M. H. (2026). Examining the effects of kiai leadership, institutional support, and educational technology on student satisfaction in Indonesian pesantren. *Munaddhomah: Jurnal Manajemen Pendidikan Islam*, 7(2), 465–481. <https://doi.org/10.31538/munaddhomah.v7i2.2698>
- Marcellus, L., Jantzen, D., Humble, R., Sawchuck, D., & Gordon, C. (2021). Characteristics and processes of the dedicated education unit practice education model for undergraduate nursing students: A scoping review. *JBIE Evidence Synthesis*, 19(11), 2993–3039. <https://doi.org/10.11124/JBIES-20-00462>
- Marisa, S., Gunawan, & Susilawati, E. (2024). Global education development plan to build sustainable education based on artificial intelligence. *Qubahan Academic Journal*, 4(2), 38–46. <https://doi.org/10.48161/qaj.v4n2a207>
- Marzuki, I., Syahrial, Z., & Rusmono. (2020). How to develop blended learning educational evaluation courses islamic religious education study program. *Universal Journal of Educational Research*, 8(3 A), 24–34. <https://doi.org/10.13189/ujer.2020.081404>
- Mekić, E., Jovanović, M., Kuk, K., Prlinčević, B., & Savić, A. (2024). Enhancing educational efficiency: Generative AI chatbots and devops in education 4.0. *Computer Applications in Engineering Education*. <https://doi.org/10.1002/cae.22804>
- Muhammad, I., Rusyid, H. K., Maharani, S., & Angraini, L. M. (2023). Computational thinking research in mathematics learning in the last decade: A bibliometric review. *International Journal of Education in Mathematics, Science and Technology*, 12(1), 178–202. <https://doi.org/10.46328/ijemst.3086>
- Mulyani, H., Kurniati, F., & Arlinda, H. (2025). Transforming education: Exploring the influence of generative AI on teaching performance. In *Cogent Education* (Vol. 12, Issue 1). <https://doi.org/10.1080/2331186X.2024.2448066>
- Mundiri, A., Munawwaroh, I., Hadi, M. I., Shudiq, W. J. F., & Maulidy, A. (2025). Artificial intelligence (ai) innovation in education: From data-driven learning to automated teaching. *Proceedings of the 2025 IEEE International Conference on Industry 4.0, Artificial Intelligence, and Communications Technology, IAICT 2025*, 173–180. <https://doi.org/10.1109/IAICT65714.2025.11100623>
- Mundiri, A., Najiburrohmah, N., & Jali, H. (2026). Beyond the motive: Lessons learned from work commitment based on pesantren. *Jurnal Ilmiah Peuradeun*, 14(1), 97–122. <https://doi.org/10.26811/peuradeun.v14i1.1825>
- Najiburrohmah, Mualimin, Jali, H. B., & Maulidy, A. (2026). Generative AI Policy-oriented framework

- for risk-aware technology management in higher education e-platforms. *2026 International Conference on Enterprise and Industrial System (ICOEINS)*, 1–7. <https://doi.org/10.1109/ICOEINS69996.2026.11605438>
- Rallapalli, S., & Dileep, M. R. (2023). Deep learning framework for student course recommender system for higher educational institutions. in *IEEE 1st International Conference on Ambient Intelligence, Knowledge Informatics and Industrial Electronics, AIKIE 2023*. <https://doi.org/10.1109/AIKIE60097.2023.10390085>
- Rahmadani, A., Candra, O., Perdima, F. E., Ali, S. K. S., Lobo, J. T., & Gazali, N. (2025). Integration of eye-tracking technology in virtual reality applications for basketball training: A mixed methods needs assessment. *Journal of Coaching and Sports Science*, 4(2), 146–160. <https://doi.org/10.58524/jcss.v4i2.912>
- Ritonga, M., Mudinillah, A., Ardinal, E., Tauhid, T., & Nurdianto, T. (2024). Enhancing Arabic language learning in higher education: Leveraging E-Campus as an online learning and evaluation platform. *Jurnal Ilmiah Peuradeun*, 12(2), 491–516. <https://doi.org/10.26811/peuradeun.v12i2.1103>
- Saad, M., Shah, N. A., Supian, K., Rani, A. A., & Abidin, I. (2023). Emotional and spiritual quotient for sustainable education's service quality. *International Journal of Evaluation and Research in Education*, 12(4), 1781–1790. <https://doi.org/10.11591/ijere.v12i4.25434>
- Sain, Z. H. (2025). From chalkboards to chatbots: Revolutionizing education with AI-driven learning innovations. *Educative: Jurnal Ilmiah Pendidikan*, 3(1), 1–10. <https://doi.org/10.70437/educative.v3i1.823>
- Salim, A., Narongraksakhet, I., Hayani, A., Rouzi, K. S., Putri, M. A., Hassama, A., & Abdullah, A. A. (2026). Outcome-based education, e-learning, and student satisfaction: Evidence from Indonesia and Thailand. *Jurnal Ilmiah Peuradeun*, 14(1), 531–550. <https://doi.org/10.26811/peuradeun.v14i1.1285>
- Sanjani, M., & Aisyah, E. N. (2025). Role of Artificial Intelligence-based machine learning in improving the quality of students' academic writing. *ICE3IS 2025 - Conference Proceedings: 5th International Conference on Electronic and Electrical Engineering and Intelligent System*, 24–29. <https://doi.org/10.1109/ICE3IS66769.2025.11281284>
- Sari, I. M., Ghinatri, N., Saepuzaman, D., & Amsor, A. (2025). Gamification in learning newton's laws: Enhancing students' problem-solving skills. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, 14(1), 21–31. <https://doi.org/10.24042/jipfalbiruni.v14i1.24829>
- Sarker, I. H., Hoque, M. M., Uddin, M. K., & Alsanoosy, T. (2021). Mobile data science and intelligent apps: Concepts, AI-based modeling and research directions. *Mobile Networks and Applications*, 26(1), 285–303. <https://doi.org/10.1007/s11036-020-01650-z>
- Siregar, H. S., Nurhamzah, N., Munir, M., & Fikri, M. (2025). Enhancing Islamic education through technology integration: A study of teaching practices in Indonesia. *Jurnal Ilmiah Peuradeun*, 13(2), 959–986. <https://doi.org/10.26811/peuradeun.v13i2.1875>
- Soesana, A., Subakti, H., Salamun, S., Tasrim, I. W., Karwanto, K., Falani, I., Bukidz, D. P., & Pasaribu, A. N. (2023). *Metodologi Penelitian Kualitatif*.
- Suhermi, E. S., Wahyudin, A., & Gunawan, A. (2023). Analysis of adaptive and participatory leadership models study of educational institutional leadership models. *Journal of Educational Analytics*, 2(4), 495–502. <https://doi.org/10.55927/jeda.v2i4.6732>
- Sun, C. C., Lee, C. Y., & Kung, H. Y. (2023). A remedial instruction program in a rural junior high school through an inclusive evaluation approach. *Journal of Research in Education Sciences*, 68(3), 141–178.
- Surahman, E., & Nur Aisyah, E. (2022). Investigating elementary teachers' understanding, beliefs, and intentions toward STEM and computational thinking in education. *Proceedings - 2022 2nd International Conference on Information Technology and Education, ICITE and E 2022*, 175–180. <https://doi.org/10.1109/ICITE54466.2022.9759837>
- Suresman, E., & Faqihuddin, A. (2026). From traditional religious leader to actor of social change: A comprehensive systematic literature network analysis the role of a Kyai in Indonesia based on Scopus database. *Cogent Arts and Humanities*, 13(1), 2625597. <https://doi.org/10.1080/23311983.2026.2625597>
- Susilowati, N. E., Okiri, P. O., Efendi, R., & Arifiyanti, F. (2025). Ready to boost adolescents ' creative

- thinking ? how problem-based blended learning empowers 15-17-year-old students. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, 14(1), 83–97. <https://doi.org/10.24042/jipfalbiruni.v14i1.26616>
- Suwendi, S., Mesraini, M., Bakti Gama, C., Rahman, H., Luhuringbudi, T., & Sangsawang, T. (2025). Lecturers' digital readiness in the context of digital scholarchy. *Munaddhomah: Jurnal Manajemen Pendidikan Islam*, 6(2), 208–222. <https://doi.org/10.31538/munaddhomah.v6i2.1674>
- Tejera Techera, A., & Cabrera Borges, C. (2023). Development and Quality management to achieve equity in higher education: Policies and tools. *Journal of Latinos and Education*, 22(5), 2038–2050. <https://doi.org/10.1080/15348431.2022.2084097>
- Tunjera, N., & Chigona, A. (2022). Educators synchronously using multiple platforms and devices for teaching and learning during covid-19 lockdown. *Journal of Educational Technology Development and Exchange*, 15(1), 81–101. <https://doi.org/10.18785/jetde.1501.06>
- Yakubu, M. A., & Hakim, R. (2025). Student perceptions of artificial intelligence as a virtual tutor and its relation to self-efficacy in learning. *Indonesian Journal of Progressive Pedagogy*, 01(01), 1–11. <https://doi.org/10.61987/ijpp.v1i1.631>
- Yaqin, L. N., Prasajo, L. D., Haji-Othman, N. A., Yusof, N., & Habibi, A. (2023). Addressing the digital divide in indonesian higher education: Insights, implications, and potential solutions. In *Lecture Notes in Educational Technology: Vol. Part F2266* (pp. 291–307). [https://doi.org/10.1007/978-981-99-7645-4\\_13](https://doi.org/10.1007/978-981-99-7645-4_13)
- Zamroni, Fatmasari, R., Rasyidi, & Windiyani, T. (2025). Artificial intelligence as a tool to improve the quality of job-ready graduate skills in higher education. *2025 IEEE International Conference on Industry 4.0, Artificial Intelligence, and Communications Technology (IAICT)*, 129–136. <https://doi.org/10.1109/IAICT65714.2025.11101572>