

Digitalisation of Pesantren through Pegon Keyboard Virtual and Rumah Kitab in Preserving the Archipelago's Khazanah and Islamic Studies

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Article history: Received: November 23, 2024 | Revised: Februari 12, 2025 |

Available Online: April 14, 2025

Abstract

Integrating digital technology into Islamic boarding schools (*pesantren*) is increasingly essential to preserve and revitalise traditional Islamic education in response to modern pedagogical demands. This study employed a Research and Development (R&D) approach utilising the ADDIE model analysis, Design, Development, Implementation, and Evaluation, focusing on the initial development phase. The primary objective was to design a digital learning tool that supports using the Pegon script and the broader Islamic intellectual heritage of the archipelago. Data were collected through in-depth interviews with pesantren stakeholders, including *ustadz/ustadzah*, students (*santri*), and religious institutional representatives. Feasibility assessments were conducted through expert and practitioner validation using content, language, and visual presentation questionnaires. Qualitative data were analysed through reduction, presentation, and conclusion drawing, while quantitative data were processed using eligibility percentage calculations. The results indicated that the developed virtual Pegon keyboard and *rumah kitab* (digital book repository) prototypes were categorised as "very feasible" based on expert evaluation. Findings suggest that the successful implementation of digital tools in pesantren requires the pedagogical readiness of educators and students and institutional policy support regarding the use of electronic devices. The digitalisation of pesantren through these applications offers a viable solution to preserving and transmitting Islamic knowledge and local cultural values in both face-to-face and online learning environments. This research contributes to the growing field of digital Islamic education by offering a contextually grounded and culturally sensitive innovation in educational technology design.

Keywords: Digitalization of Pesantren; Pegon Virtual Keyboard; Rumah Kitab

Introduction

The Society 5.0 era marks a shift in social and educational paradigms towards the comprehensive integration of technology in daily life.¹ In this context, traditional Islamic educational institutions such as Pesantren face significant challenges and opportunities to make digital adaptations without losing their scientific identity. Pesantren, which has been the centre of moral, spiritual, and social development, needs to address the challenges of digital transformation to strengthen its relevance in modern society.² Based on data from the Ministry of Religious Affairs of the Republic of Indonesia in 2023, as cited by Inayah, more than 36,000 pesantren in Indonesia, most of them still rely on manual systems in administration and learning, with a low level of digital technology adoption, especially in rural areas and pesantren based on local traditions.³

Digitalising pesantren education is a technological effort transforming locality-based Islamic education values and culture. Wahid emphasised that the digitalisation of pesantren must pay attention to the spiritual and intellectual essence passed down through generations through the yellow book and pegon script.⁴ Meanwhile, Angga Teguh Prastyo sees digitalisation as an effective means of preserving pesantren culture and strengthening religious moderation. In this framework, the concepts of Islam Nusantara and Islam Keindonesiaan become epistemological foundations that allow synthesis between classical Islamic values and the dynamics of digital society.⁵ This collaboration between local wisdom and modern technology is the strength of pesantren in maintaining their existence and relevance.

Digital adoption in the context of pesantren does not necessarily run smoothly. Many pesantren, especially those affiliated with Rabithah Ma'ahid Islamiyah (RMI), face human resources, infrastructure, and digital literacy limitations. This impacts the

¹ Muhammad Amin, Deka Zainurrahman, and Budi Cahyono, "WEB-BASED DESIGN OF THE PUBLIC INFORMATION SYSTEM OF PONDOK PESANTREN HIDATUSSALAFIYAH KAMPAR KIRI TENGAH KABUPATEN KAMPAR," *IndraTech* 5, no. 1 (2024): 150-60.

² Adri Lundeto, "Digitalization of Pesantren: The Loss of Traditionalist Culture or a Progress?" *Journal of Education and Development* 9, no. 3 (2021): 452-57.

³ Nurul Inayah, Lely Ana Ferawati Ekaningsih, and M Alaika Nasrulloh, "Munzalan Mubaroka Ekopesantren Guide," *Insight Mediatama*, 2023.

⁴ Mohammad Akmal Haris, "The Urgency of Digitalization of Pesantren Education in the Era of Society 5.0 (Opportunities and Challenges at Al-Amin Islamic Boarding School in Indramayu)," *Islamic Management: Journal of Islamic Education Management* 6, no. 01 (2023): 49-64.

⁵ Angga Teguh Prastyo and Isna Nurul Inayati, "Implementation of Digital Literacy Culture to Strengthen Religious Moderation for Santri (Case Study in Mahad Uin Maulana Malik Ibrahim Malang)," *Incare, International Journal of Educational Resources* 2, no. 6 (2022): 665-83.

effectiveness of technology in supporting the learning of classical books and the preservation of pegon script as a cultural heritage and medium of knowledge transmission. Therefore, this research attempts to answer the central question: How is the readiness and strategy of RMI pesantren in Senori Sub-district in implementing digitalisation, especially in preserving the pegon script and learning the yellow classical book digitally?

Various previous studies have highlighted the issue of digitalisation in the context of pesantren. Mukhamat Saini noted that resistance to change is the main inhibiting factor in the digital transformation of pesantren.⁶ Maulina Rezka Hayyu Salsabila showed that the Pegon Virtual Keyboard application can make it easier for students to write pegon script, but the limited training is a challenge.⁷ Ahmad and Fatoni's research found that the digitisation of classical yellow books was successfully implemented in certain pesantren. However, it depended highly on the readiness of human resources and technological devices.⁸ Meanwhile, Aulia emphasised the importance of cloud-based information systems for the efficiency of pesantren administration. Of the five studies, none have explicitly examined digital technology's integration in preserving the pegon script and learning the yellow Islamic classic books in RMI pesantren in rural areas.

The novelty offered by this research includes: First, the focus on the integration of digitisation in the preservation of pegon script, which is a typical medium for the transmission of Islamic knowledge in Java, which has not been widely explored in contemporary studies. Second, the specific context of the research location - namely, the RMI pesantren in Senori District, Tuban - provides a new perspective on the challenges and strategies of digitalisation in a local community-based pesantren environment. This research captures the real conditions in the field and offers a systemic approach to strengthening digitalisation based on pesantren culture.

This study aims to analyse the readiness, strategies, and challenges of digitalisation of RMI pesantren in Senori Subdistrict, focusing on preserving pegon script and yellow

⁶ Mukhamat Saini, "Pesantren in the Digital Age: Between Tradition and Transformation," *Tasamuh: Journal of Islamic Studies* 16, no. 2 (2024): 342-56.

⁷ Maulina Rezka Hayyu Salsabila, "The Application of Pegon Arabic to Literacy Skills at Madrasah Diniyah Takmiliah Ula Islamiyah Bojongsana Village Suradadi District Tegal Regency" (UIN KH Abdurrahman Wahid Pekalongan, 2023).

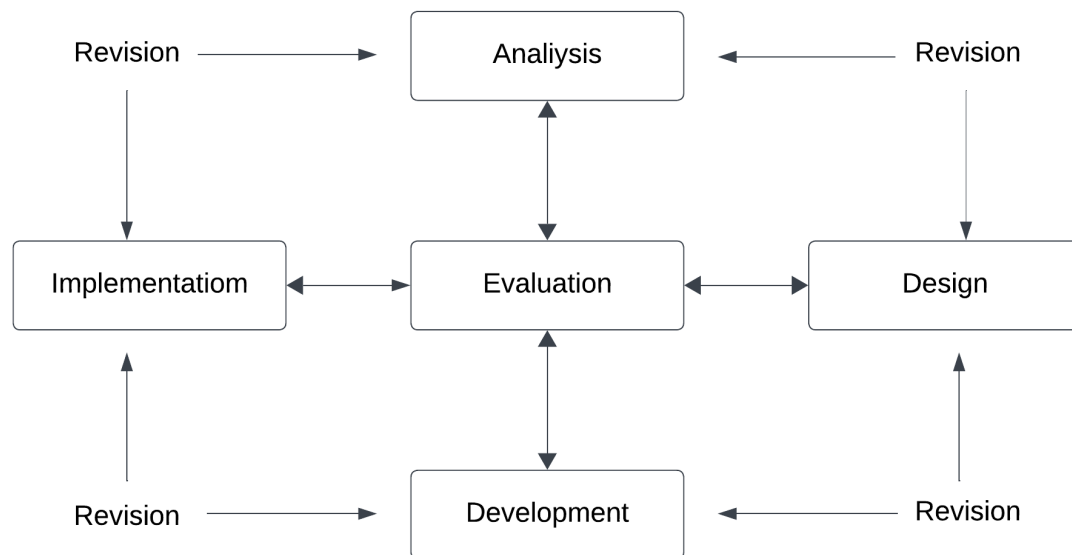
⁸ Aris Risdiana, Reza Bakhtiar Ramadhan, and Imam Nawawi, "Transformation of 'Kitab Kuning'-based Da'wah to Digital Platform," *Journal of Religious LECTURE* 18, no. 1 (2020): 1-28.

classical book learning. The theoretical contribution of this study is to enrich the discourse on the integration of Islamic education and locality-based technology. At the same time, the practical contribution is in the form of implementable recommendations for policymakers, pesantren managers, and developers of culture-based educational applications. This research is expected to reference pesantren digitalisation models that maintain the roots of the Nusantara Islamic tradition and intellectual identity.

Research Methods

This study used a Research and Development (R&D) approach based on the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), suitable for designing solutions based on the community's real needs. This research focuses on Level 1 Development, up to the product design stage without full implementation.

The main objective is to identify the need for digitalisation of pesantren learning, especially in preserving Pegon script and the Islamic treasures of the archipelago, and design application-based media as an initial solution. The following ADDIE flowchart illustrates the process that has been followed in this research:



The following is the Research Implementation Timeline

Month	Activities
Month 1	Initial observations and needs interviews (Analysis)
Month 2	Product design and prototype development
Month 3	Feasibility test by experts and practitioners (Development)
Month 4	Data analysis and product revision based on evaluation

For data collection and analysis techniques, the research used several steps; first, in-depth interviews with the RMI, pesantren caregivers, ustadz/ustadzah, and students; second, expert test questionnaires and practitioner test questionnaires to assess the feasibility of content, language, and visual applications. Third, qualitative data is analyzed through stages: reduction, presentation, and conclusion drawing. Fourth, quantitative data from the questionnaire were analyzed using the formula:

Quantitative data from the feasibility test questionnaire results are calculated using the following formula.

$$\text{Percentage of eligibility} = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100\%$$

After that, the average score is calculated using the formula

$$\text{Average score} = \frac{\text{Total score}}{\text{Number of assessors}} \times 100\%$$

The percentage obtained is then interpreted into the criteria as follows

Table 1: Interpretation of Feasibility

Percentage	Interpretation
81 - 100 %	Very Feasible
61 - 80 %	Worth
41 - 60 %	Decent Enough
21 - 40 %	Less Feasible
1 - 20 %	Very Less Feasible

Digital Transformation in the Pesantren Context: Integration of Innovation and Tradition

The development of digital technology within the framework of the Industrial Revolution 4.0 has accelerated the reform of the global education system, including Islamic education based on pesantren. Pesantren, which have been known for traditional education patterns such as *sorogan*, *bandongan*, and *wetonan*, are now transforming through the adoption of digital technology adapted to local wisdom and the spiritual needs of students.

This research shows that integrating the Pegon Keyboard Virtual and Rumah Kitab applications concretely represents this adaptation. This innovation aligns with the *sociotechnical system* theory that underlines the importance of integrating technology, people, and social structures in educational innovation (Bostrom & Heinen.⁹ adapted by Castañeda & Selwyn.¹⁰ In this case, technology is not just an instrument, but part of a living and dynamic ecosystem of educational culture in pesantren.

The Role of Pegon Virtual Keyboard in Nusantara Islamic Literacy

Pegon Keyboard Virtual allows the young generation of pesantren to access and write Pegon script more practically and interestingly. The cyclicity of this change in access is because the Pegon script is an essential medium in disseminating the scholarly treasures of Nusantara scholars. As stated by Muhammad Rizal, digital-based local literacy preservation can strengthen cultural identity and improve students' digital literacy.¹¹

This initiative also reinforces Melyana's view that technology adoption in traditional institutions will be more effective if tailored to the local cultural context.¹² Pegon Keyboard Virtual connects classical Islamic literacy heritage practices with contemporary digital literacy practices, creating a new space for contextualized and meaningful learning.

⁹ Robert P Bostrom and J Stephen Heinen, "MIS Problems and Failures: A Socio-Technical Perspective. Part I: The Causes," *MIS Quarterly*, 1977, 17–32.

¹⁰ Linda Castañeda and Neil Selwyn, "More than Tools? Making Sense of the Ongoing Digitizations of Higher Education," *International Journal of Educational Technology in Higher Education* (Springer, 2018).

¹¹ Muhammad Rizal, Muhammad Osama, and Saiful Bahri, "The Use of Technology towards Science Needs in Salafi Islamic Boarding Schools," *IJECA (International Journal of Education and Curriculum Application)* 7, no. 2 (2024): 200-212.

¹² Melyana R Pugu, Noneng Nurhayani, and Farida Asy'ari, "Implementation of Local Wisdom in Learning in Schools Around Rural Areas," *Journal of Education Science and Local Wisdom* 4, no. 2 (2024): 105-16.

Rumah Kitab and Ubiquitous Learning in Pesantren

The Rumah Kitab app offers open access to digital yellow books, translated books, and learning log features. This supports the principle of *ubiquitous learning* described by Park & Kim (2020), where the learning process is no longer bound by time and space.¹³ This *anytime-anywhere learning* feature is relevant to the needs of the digital generation of santri who are now familiar with mobile learning.¹⁴

Rumah Kitab also adopts a *blended learning* approach, combining classical and digital teaching methods, which increases motivation and retention.¹⁵ The use of technology to support learners' active engagement is also in line with *constructivism* theory, which emphasizes the importance of learners' active interaction with materials in constructing the meaning of learning.¹⁶

Determinants of Successful Digitalization of Pesantren

Three key factors determine the success of pesantren digitalization:

1. Contextualized Technology Design

The Pegon Keyboard and Rumah Kitab applications were designed to consider the user's digital literacy level and the pesantren context. Indra Surya Permana stated that *user-friendly design* and *cultural relevance* are the main determinants of the effectiveness of educational technology.¹⁷

2. Strategic Role of Ustadz/Ustadzah

¹³ Heriady Heriady, "Integration of Augmented Reality Technology in Moral Learning in Islamic Religious Education," *International Journal of Language and Ubiquitous Learning* 2, no. 4 (2024): 419-29.

¹⁴ Christina Juliane et al., "Digital Teaching Learning for Digital Natives; Challenges and Opportunities," *Scientific Journal of Information Systems Engineering and Management* 3, no. 2 (2017): 29-35.

¹⁵ Maryam Susanti and Marzuki Marzuki, "Cultivation of Citizenship Character Values through Marching Band Activities," *AGORA* 10, no. 1 (2021): 90-99.

¹⁶ Huang-Yao Hong, Pei-Yi Lin, and Yuan-Hsuan Lee, "Developing Effective Knowledge-Building Environments through Constructivist Teaching Beliefs and Technology-Integration Knowledge: A Survey of Middle-School Teachers in Northern Taiwan," *Learning and Individual Differences* 76 (2019): 101787.

¹⁷ Indra Surya Permana and Ade Sutriyono, "Design and Development of Concepts-Based Higher Education Digital Curriculum Books with Agile Scrum Method: Design and Development of Concepts-Based Higher Education Digital Curriculum Books with Agile Scrum Method," *MALCOM: Indonesian Journal of Machine Learning and Computer Science* 5, no. 1 (2025): 423-35.

The success of digitalization depends heavily on the digital competence of educators.¹⁸ Muhammad Rafiq emphasized the importance of continuous training to improve the digital pedagogical literacy of pesantren teachers.¹⁹

3. Sensitivity to Cultural Values

A digital approach that does not eliminate pesantren's spiritual values and traditions will be more accepted by the Islamic education community. Amirotu Diana affirmed this, showing that learners' emotional engagement increased when local values were integrated into the learning process.²⁰

This research makes a significant theoretical contribution to the discourse of technology integration in Islamic tradition-based education. In contrast to previous studies that more generally discuss the digitalization of modern schools, this article highlights the adaptation process in the pesantren education ecosystem that has a distinctive value system, social structure, and learning model. The findings also enrich the literature on *technology-mediated cultural preservation*, showing that technology can serve a dual function: as a pedagogical instrument and a preservation tool for local Islamic intellectual culture, including the Pegon script and the yellow classical book.

Conclusion

Digitalization of Islamic Boarding Schools through Pegon Keyboard Virtual in Preserving the Khazanah of the Archipelago and Islam contains the results of the pesantren digitalization process itself, how through pegon keyboard virtual and rumah kitab can be applied by the pesantren in digitizing the pesantren itself in the form of the pedagogic ability of ustadz-ustadzah in utilizing learning media in the form of pesantren digitalization through pegon keyboard virtual and the readiness of santri in receiving pesantren digitalization learning as a preservation of the archipelago and Islamic treasures. both ustadz-ustadzah and santri will not be able to apply this pesantren digitalization without the policy of the pesantren caregivers in utilizing electronics in the

¹⁸ Rayinda Dwi Prayogi, "21st Century Skills: Digital Competencies of Future Educators," *Education Management* 14, no. 2 (2020).

¹⁹ Muhammad Rafiq-uz-Zaman et al., "Educational Environment and Teacher Performance in the Context of Special Education Institutions in Pakistan: A Review Paper," *Social Science Review Archives* 3, no. 2 (2025): 17-35.

²⁰ Amirotu Diana and Mohammad Zakki Azani, "The Concept and Context of Islamic Education Learning in the Digital Era: Relevance and Integrative Studies," *Profetika: Journal of Islamic Studies* 25, no. 01 (2024): 33-44.

form of laptops, computers, android, gadgets and the like, Both ustadz-ustadzah and santri will not be able to implement this pesantren digitalization without the policy of the pesantren caregiver in utilizing electronics in the form of laptops, computers, androids, gadgets and the like.

Digitalization of pesantren can be used as a reference by pesantren in digitizing virtual keyboard pegon and rumah kitab. After applying pesantren digitalization, the virtual keyboard pegon and rumah kitab became one of the solutions for implementing pesantren digitalization through the virtual keyboard pegon and rumah kitab to preserve the Nusantara and Islamic repertoire. This is applied in one of the pesantren in learning the book of Tawheed 'aqidatul awwam, through face-to-face, online learning, and assignments when the ustadz-ustadzah cannot learn in class.

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