

DESIGN OF INFORMATION TECHNOLOGY-BASED DIGITAL PAI TEXTBOOKS IN MADRASAH

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Abstract: *The digital transformation in education has encouraged Islamic schools (madrasahs) to adopt information technology-based digital textbooks as an effort to improve the quality of Islamic Religious Education (PAI) learning. This article comprehensively discusses designing digital PAI open textbooks in madrasahs, focusing on information technology integration, benefits for improving collaborative learning, implementation challenges, model development, quality standards, best practices, and recent case studies. This research uses a literature review and case analysis approach, referring to the ADDIE and 4D development models, as well as the TPACK and TAM frameworks for technology integration. The results show that digital PAI textbooks are able to improve accessibility, interactivity, and student learning motivation, but face challenges in infrastructure, digital literacy, and validation of religious content. Case studies in various madrasahs emphasize the importance of teacher training, stakeholder collaboration, and quality assurance and digital ethics in developing digital PAI textbooks.*

Keywords: *Digital Textbooks, Islamic Religious Education, Information Technology, Madrasah, Interactive Learning*

Introduction

The development of information and communication technology in the era of globalization has brought fundamental changes in various aspects of human life, including in the field of education, especially Islamic Religious Education in the madrasa environment. The Quranic verses that explain the importance of literacy in this case technology and the tools facilitated by teachers for students, as stated in Q.S. Al-Alaq 1-5, emphasize reading in the sense of analyzing/researching studies and emphasize the use of the 'qalam' (pen) as a medium or tool, which can be understood as a symbol of a tool or technology for learning and documenting knowledge. This transformation encourages the need to adapt traditional learning methods into a more interactive and modern system through the integration of digital technology. Hidayat Edi Santoso, (2025) narrates that this integration process not only serves to improve the quality of learning and accessibility for students, but also requires managing challenges related to inequality of access and educator competence in utilizing technology effectively. (Anugerah, 2023; Nugraha et al., 2023).

Digital textbooks specifically designed based on information technology are expected to be interactive media that visualize abstract concepts in Islamic Religious Education, thereby

optimally increasing student motivation and understanding (Fadhilah & Mansur, 2025; Hafiz et al., 2024). Through the design of these digital textbooks, Islamic education is expected to utilize technological innovation to improve the quality and access of learning, although it still has to face the challenges of the digital divide and human resource readiness (Suwahyu, 2024; Wahyono & Rofi'i, 2023). This reflects the need for a comprehensive strategy to ensure that the use of information technology not only increases pedagogical effectiveness, but is also contextually relevant to religious values and the needs of a competent and adaptive future generation (Nugraha et al., 2023; Shalehah et al., 2025).

Specifically, the integration of technology into the Islamic Religious Education curriculum requires a strategy for developing learning methods that align with the vision of the Minister of Primary and Secondary Education (Kemdikdasmen) to strengthen religious education as an investment in civilization through data- and technology-based innovation, capable of combining technology with religious values without compromising the substance and depth of students' religious understanding (Fadhilah & Mansur, 2025). The use of technology in this context must be based on Islamic principles, such as justice, ethics, and information security, to ensure that digital transformation aligns with the noble goals of education. The concepts of justice and ethics in the use of technology are essential foundations to ensure that the use of digital media does not negatively impact students (Wahyono & Rofi'i, 2023).

Furthermore, an adaptive and contextual approach is needed to anticipate various moral risks and the spread of invalid religious information in the digital space, so that Islamic education can maintain its relevance and serve as an effective instrument for character formation (Shalehah et al., 2025; Suwahyu, 2024).

Literature Review

1. Digital Textbooks in the Context of Islamic Religious Education

Digital textbooks are teaching materials developed in electronic format, accessible through digital devices such as computers, tablets, or smartphones, and often equipped with interactive features such as video, audio, animation, and quizzes (Arin Prajawinanti, 2023; Sintia Purba, et al., 2025). In the context of Islamic Religious Education (PAI), digital textbooks function not only as sources of information but also as learning media that can facilitate active, collaborative, and contextual learning (M. Arif Khoiruddin, 2025; Sasi Hanila, Dwi Meila Nur Anggraini, et al., 2024).

Digital Islamic Religious Education (PAI) textbooks can improve student motivation, conceptual understanding, and learning outcomes, especially when designed with attention to instructional design principles and multimedia integration (Apriani, et al., 2025). Digital textbooks also enable personalized learning, access to materials anytime and anywhere, and collaboration between teachers and students through online platforms (Erisa Kurniati, 2025). Designing learning blogs and videos is also an integral part of educational digital literacy.

2. Integration of Information Technology in the Development of Digital Islamic Education Textbooks

The integration of ICT in the development of digital Islamic Education textbooks involves the use of various platforms and applications, such as Learning Management Systems (LMS), e-Modules, mobile applications, and Augmented Reality (AR) and Virtual Reality (VR)

technologies (Rizqi Hidayati, Hafidz, 2025). LMS platforms such as Moodle, Google Classroom, and Edmodo are widely used to distribute digital textbooks, manage assignments, and facilitate online discussions (Ika Qutsiati Utami, 2025).

AR/VR technology is beginning to be adopted to provide immersive learning experiences, such as simulations of the Hajj pilgrimage or three-dimensional visualizations of Islamic history (Saifol Basroni, et al., 2025). Mobile applications such as the Qur'anic Companion and Tajweed Tutor also support interactive and adaptive Quranic learning (Zamsiswaya, S., et al., 2024). The integration of ICT in digital Islamic Education textbooks must pay attention to pedagogical principles, access, and sensitivity to Islamic values (Azhari, M., 2024; Mintasih, D., Sukiman, & Purnama, S., 2024).

3. Model and Framework for Developing Digital Textbooks

Beberapa model pengembangan yang umum digunakan dalam perancangan buku ajar digital PAI antara lain :

- a) The 4D Model (Define, Design, Develop, Disseminate) is a model that emphasizes the stages of needs analysis, design, development and product distribution (Rachman, R. I., et.al., 2023; Safia, E., Hasani, D. N. S., Hulinggi, M., & Solong, N. P. 2024; Nirwana, R., et.al. 2025).
- b) The ADDIE (Analyze, Design, Develop, Implement, and Evaluate) model is systematic and flexible, encompassing needs analysis, design, development, implementation, and evaluation (Rachman, R.I., et. al., (2023).
- c) The R&D (Research and Development) model is used to produce innovative products and test their effectiveness through expert validation and field trials (Afini, D., et. al., 2025; Mintasih, D., et. al., 2024).

The TPACK (Technological Pedagogical Content Knowledge) and TAM (Technology Acceptance Model) frameworks are also used to ensure optimal integration of technology, pedagogy, and content (Nurul Ratnawati, et al., 2022).

4. Quality Standards and Validation of PAI Digital Textbook Conten

Validation of digital Islamic Education textbooks includes aspects of the accuracy of religious material, completeness and relevance of content, clarity of language, graphic design, ease of use, and suitability with the curriculum and Islamic values (Syakhrani, A. W. (2025). The assessment is carried out by material experts, media experts, and users (teachers/students) through validation instruments and limited cova tests (Nirwana, R., et.al., 2025).

Ethical, cultural, and religious sensitivity aspects are the main concerns, especially in the presentation of material related to Islamic Faith, Worship, and the History of Islamic Culture. Digital textbooks must meet internal and external quality standards, and comply with the regulations of the Ministry of Religious Affairs and the latest madrasah curriculum policies such as KMA 450 of 2024 (UIN Siber Syekh Nurjati Cirebon, 2025).

5. Evaluation of the Effectiveness of Digital Textbooks

Evaluation of the effectiveness of digital textbooks is conducted by measuring their validity, reliability, and impact on student learning outcomes (Alkan, A., 2024). Evaluation

instruments include pre- and post-tests, student response questionnaires, and observations of learning activities (Safia, E., et al., 2024). Studies show that valid and practical digital textbooks can significantly improve student learning outcomes, motivation, and engagement (Suparno, 2025; Fitria, E. M., 2025).

The aforementioned theories provide the arguments for this study. These concepts explain the Design of Digital Islamic Education Textbooks: Technology Integration in Madrasahs. A previous study by Sakdiyah, et al., 2025, designed innovative, flexible, and values-based learning strategies that align with technological advances while maintaining the basic principles of Islamic education. Technology integration can support in-depth learning without sacrificing the essence of Islamic teachings (Hidayat, 2025). Miftahul Jannah, et.al, (2025) provides the essence of digital PAI learning which is not only participatory in nature, but also forms spiritual awareness and ethical behavior and interest which implies that the planned and character-oriented use of technology can strengthen the internalization of religious values, so that the mastery of technology-based religious pedagogical competencies to realize quality PAI learning.

Method

This study employed a library research and case analysis approach, reviewing literature, journal articles, research reports, and policy documents related to the development of digital Islamic Education (PAI) textbooks in madrasahs over the past five years (Miftakhul Azizah et al., 2025). The analysis was conducted qualitatively, identifying key themes: the integration of Information and Computer Technology (ICT), benefits, challenges, development models, validation, evaluation, and best practices.

The case study method, taken from the implementation of digital textbooks in several madrasahs in Medan, analyzed best practices and real-world challenges (Moleong, 2019). The development models analyzed included 4D, ADDIE, and R&D, with validation by subject matter experts, media experts, and end-users (teachers/students).

Result and Discussion

1. Integration of Information Technology in the Development of Digital Islamic Religious Education Textbooks

The integration of ICT in the development of digital Islamic Religious Education textbooks in madrasahs has become a strategic necessity to address the challenges of the times and increase the relevance of learning (Afini, D., 2025). The use of digital platforms such as LMS (Moodle, Google Classroom, Edmodo), e-modules, mobile applications, and AR/VR technology has enriched students' learning experiences and expanded access to learning resources (Iza Masruri, M.S., & Andika, A., 2024).

A study at MTsN 1 Makassar showed that the digital transformation of madrasahs involved strengthening infrastructure, training teachers, and developing digital content relevant to student needs (Umar, S.H., et al., 2024). Teachers were encouraged to develop interactive digital teaching materials, such as e-books, learning videos, and online quizzes, and to utilize open-source applications such as Canva, Quizizz, and Powtoon (Kulsum, U., 2024).

(Zou, Y., et al., 2025) ICT integration also enables the implementation of innovative learning models such as flipped classroom, blended learning, and project-based learning, which encourage active student participation and collaboration (Meila Nur Anggraini, et al., 2024; Resti Fatma Ayuningsih et al.; 2025). AR/VR technology is used for worship simulations and visualizations of Islamic history, providing an immersive and contextual learning experience (Irma, 2025). However, ICT integration must be accompanied by strengthening the digital literacy of teachers and students, as well as guaranteeing data security and user privacy (Hasrian Rudi Setiawan, 2025). Islamic ethical values such as honesty, justice, and privacy protection need to be internalized in the development and use of digital Islamic Education textbooks (Azhari, M., et al., 2024).

2. Benefits of Digital Textbooks for Improving the Quality of Islamic Religious Education Learning

Digital Islamic Religious Education textbooks provide various significant benefits in improving the quality of learning in madrasas, including:

- 1) Accessibility and flexibility; students can access materials anytime and anywhere, both online and offline, thus supporting independent learning and differentiation.
- 2) Interactivity and personalization; multimedia features (video, audio, animation, quizzes) increase student engagement and understanding, and enable personalized learning to suit individual needs.
- 3) Collaboration and Communication; digital platforms facilitate discussions, group work, and real-time feedback between teachers and students (Ahmad, N., Ma, et al., 2025).
- 4) Improved motivation and learning outcomes; empirical studies show increased student motivation, interest, and learning outcomes after using digital Islamic Religious Education textbooks.
- 5) Efficiency and transparency; the evaluation and reporting process for learning outcomes becomes more efficient and transparent through digital systems.
- 6) Strengthening values and character; Digital textbooks can be designed to instill Islamic values, character, and digital ethics in a contextual and applicable manner.

3. Challenges of Implementing Digital Textbooks in Madrasas

While providing many benefits, implementing digital textbooks in madrasas faces a number of complex challenges, some of which include:

- a) Limited infrastructure; not all madrasas have stable internet access, adequate digital devices, or reliable electricity, especially in 3T (disadvantaged, frontier, and outermost) areas.
- b) Digital literacy of teachers and students; many teachers and students still have limitations in operating digital devices and optimally utilizing learning applications.
- c) Content validation and accuracy; digital Islamic Education textbooks must be rigorously validated to ensure the accuracy of religious material, pedagogical relevance, and cultural sensitivity.
- d) The digital divide; there are disparities in access and skills between urban and rural madrasas, as well as differences in students' economic backgrounds.
- e) Data ethics and security; issues of privacy, data security, and ethical use of technology are key concerns in the digital environment.

f) Institutional policies and support; The implementation of digital textbooks requires adequate policy, regulatory, and funding support from the government and the Ministry of Religion.

4. Models and Frameworks for Developing Digital Islamic Education Textbooks

The development of digital Islamic education textbooks in madrasas generally follows systematic development models such as 4D, ADDIE, and R&D (Wedi, A., et al., 2025). The following is a brief explanation of these models:

a. 4D Model (Define, Design, Develop, Disseminate)

- a) Define: analyzing needs, student characteristics, learning objectives, and mapping materials.
- b) Design: designing a digital textbook prototype, selecting media, and developing evaluation instruments.
- c) Develop: product development, expert validation, revision, and limited trials.
- d) Disseminate: product distribution to a wide user base, training, and outreach.

b. ADDIE Model (Analyze, Design, Develop, Implement, Evaluate)

- a) Analyze: analyzing learning needs and problems.
- b) Design: designing the structure and content of the digital textbook.
- c) Develop: producing and validating digital textbooks.
- d) Implementing; implementing in the classroom and providing user training.
- e) Evaluating; conducting effectiveness evaluations, revisions, and continuous improvement (Syakhrani, A. W. (2025).

c. Model R&D (Research and Development)

Used to produce innovative products and test their effectiveness through expert validation and field trials.

d. TPACK and TAM Frameworks

- a) TPACK, emphasizing the integration of technological knowledge, pedagogy, and content.
- b) TAM, to measure technology acceptance based on perceived ease of use and usefulness.

5. Quality Standards and Content Validation of Islamic Religious Education Digital Textbooks

Validation of Islamic Religious Education digital textbooks is conducted through assessments by subject matter experts, media experts, and end users (teachers/students) using a rubric-based validation instrument. The aspects assessed include:

- a) Accuracy and completeness of religious material
- b) Alignment with the curriculum and learning outcomes
- c) Clarity of language and graphic design
- d) Interactivity and ease of use
- e) Cultural sensitivity and Islamic values
- f) Security and privacy of user data

Quality assurance is carried out through internal (SPMI) and external (SPME) quality assurance systems, as well as the PPEPP (Planning, Implementation, Evaluation, Control, and Improvement) cycle (American Psychological Association, 2020).

6. Evaluation of the Effectiveness of Digital Textbooks

Evaluation of the effectiveness of digital Islamic Religious Education textbooks is carried out by measuring validity, reliability, and impact on student learning outcomes. Evaluation instruments include pre- and post-tests, student response questionnaires, and observations of learning activities. Empirical studies have shown significant improvements in learning outcome scores, motivation, and student engagement after using digital textbooks.

7. Case Studies and Best Practices for Developing Digital Islamic Religious Education Textbooks in Madrasas

a. MTsN 1 Medan in the Digital Transformation of Madrasas

MTsN 1 Makassar is a pilot project for a digital madrasa by developing integrated digital services, teacher training, and open-source digital teaching materials (Umat et al., 2025). Teachers are required to create digital teaching materials, students are encouraged to have digital devices, and collaboration with parents is strengthened. The main challenges are device costs, electricity, and internet stability.

b. MTsS Aisyiyah in Developing Digital Teaching Materials Based on Student Needs

The development of digital teaching materials at MTs MTs Aisyiyah emphasizes meeting student learning needs, ease of access, and flexibility in learning. Teachers develop e-books, multimedia presentations, and Kahoot-based educational games for Islamic Religious Education (Rizka Harfiani, 2024). Evaluations show increased student motivation and understanding.

c. MAN 2 Model Medan Implements LMS and Teacher Training

MAN 2 Model Medan implements an LMS for Islamic Religious Education (PAI) learning, supported by regular teacher training and the provision of digital devices. Research results show increased interactivity, accessibility, and student learning independence, although challenges remain regarding access and digital literacy.

d. Medan State Elementary School in Character-Based Digital Learning Design

Medan State Elementary School implements character-based digital learning through the development of e-modules, tablet utilization, and LMS integration. Evaluations show an increase in students' religious, discipline, and responsibility character values.

e. Development of Integrated Digital Science Textbooks

A study at SMPIT Al-Ulum developed digital Islamic Religious Education textbooks based on science integration to improve students' creative thinking skills (Safia, E., et al. 2025). Expert validation demonstrated a very high level of feasibility, and effectiveness testing demonstrated significant improvements in student learning outcomes and creativity.

8. Technology and Platforms for Digital Textbooks

Various technologies and platforms are used in the development of digital Islamic Religious Education textbooks at madrasas, as shown in the following table:

Platform/ Teknologi	Key Feature	Advantages	Disadvantages
Moodle	LMS open-source, forum, quiz, progress tracking	Full-featured, flipped classroom	Requires technical configuration, interface is less intuitive
Google Classroom	Distribution of materials, assignments, real-time collaboration	Easy to use, Google Workspace integration	Limited features, internet dependence
Edmodo	Learning community, badges, discussions	Social media-like interface	Incomplete class management features
Quipper School	Competency curriculum, reporting	Structured materials, progress reporting	Paid access, less interactive
Zoom/Teams	Video conferencing, breakout rooms	Synchronous learning, session recordings	Requires a fast connection, less supportive of independent learning
Quizizz	Interactive leaderboards, quizzes	Educational games, instant feedback	Quiz-focused, less suitable for in-depth assignments
Canva	E-book design, infographics	Attractive, easy-to-use templates	Limited features for high interactivity
AR/VR	Worship simulations, Islamic history	Immersive experience, 3D visualizations	Expensive devices, limited

The use of this platform must be tailored to the needs, infrastructure, and characteristics of students in madrasas.

9. Instructional Design and UX/UI for Digital Islamic Religious Education Textbooks

The instructional design of digital Islamic Religious Education textbooks must consider the following principles:

- a) Analysis of student needs and characteristics
- b) Determination of clear learning objectives
- c) Development of valid, relevant, and contextual content
- d) Integration of multimedia (text, images, video, audio, animation)
- e) Interactivity (quizzes, discussions, simulations)
- f) User-friendly, responsive, and inclusive interface design (UX/UI)
- g) Continuous evaluation and feedback

Instructional design models such as Banathy, TPACK, and SAMR can be adapted to ensure optimal integration of technology, pedagogy, and content (Nurul Ratnawati, et.al., 2022; Herlia Alfiana, 2021).

10. Education and Curriculum Policies Regarding the Integration of Digital Textbooks in Madrasas

The latest policies of the Ministry of Religious Affairs, through KMA 450 of 2024 and KMA 183 of 2019, emphasize the importance of integrating digital textbooks into the madrasa curriculum at all levels (RA, MI, MTs, MA, MAK) (Afini, D., Rahayu, A., & Mutaqin, M.Z., 2025). Madrasas are encouraged to develop adaptive, innovative, and digital-based curricula, taking into account local visions, missions, and needs.

The Digital Madrasah Program and Madrasah Education Quality Reform (MEQR) are essential foundations for strengthening madrasah capacity in utilizing technology, improving teacher competency, and optimizing digital-based madrasah management.

11. Ethical, Cultural and Religious Sensitivity Aspects in PAI Digital Content

The development of PAI digital textbooks must pay attention to ethical, cultural and religious sensitivity aspects, including:

- a) Honesty and fairness in presenting material
- b) Protection of student data privacy and security
- c) Respect for cultural diversity and schools of thought
- d) Strengthening Islamic values in digital behavior
- e) Prevention of the spread of inappropriate or extreme content

The principles of Islamic ethics and Maqasid al-Shariah can be used as a framework for building responsible and moral digital competencies.

12. Teacher Training and Capacity Development

Teacher training is key to the successful implementation of digital Islamic Religious Education textbooks in madrasas (UIN Siber Syekh Nurjati Cirebon, 2025). The training program should include:

- a) Digital literacy and the use of learning platforms
- b) Digital content design and development
- c) Integration of Islamic values in digital media
- d) Digital ethics and security
- e) Evaluation and reflection on digital learning practices

Collaboration between madrasas, the Ministry of Religious Affairs, and the education community is crucial to support the ongoing development of teacher capacity.

13. Stakeholder Involvement

The active involvement of stakeholders (students, teachers, parents, the Ministry of Religious Affairs, and the madrasa community) is crucial in the development and implementation of digital Islamic Religious Education textbooks. Parental participation in providing devices and support for home learning, as well as collaboration with the digital community and industry, can strengthen the digital learning ecosystem in madrasas.

14. Business Model, Financing, and Sustainability

Developing digital Islamic Education textbooks requires a sustainable business and financing model, including:

- a) Funding from the School Operational Assistance Program (BOS), madrasah funds, and government support

- b) Collaboration with application developers and open-source platforms
- c) Community-based digital content development
- d) Implementation of a freemium or open-access model for digital textbooks

The sustainability of digital innovation in madrasahs depends on institutional commitment, policy support, and the active participation of all stakeholders.

15. Recommendations for International Journal Publication: Article Structure, APA Style, and Peer-Review Checklist

To ensure that an article on the design of a digital Islamic Education textbook is suitable for publication in an international journal, the following must be considered:

- a) Systematic article structure: Abstract, Introduction, Literature Review, Methodology, Discussion, Conclusion, and Bibliography
- b) APA citation style: Citations in every sentence, up-to-date and relevant bibliography, and consistent reference writing
- c) Peer-review checklist: Originality, relevance, clear methodology, theoretical and practical contributions, data validity, and publication ethics.

Conclusion

Designing digital textbooks for information technology-based Islamic Religious Education (PAI) learning in madrasahs is a strategic step in improving the quality of religious education in the digital era. The integration of ICT in the development of digital PAI textbooks offers significant benefits in the form of accessibility, interactivity, personalization, and improved student learning outcomes. However, implementation faces challenges related to infrastructure, digital literacy, content validation, and digital ethics. Systematic development models such as 4D, ADDIE, and R&D, as well as the TPACK and TAM frameworks, can be used to ensure optimal integration of technology, pedagogy, and content. Validation and evaluation of digital textbooks must involve subject matter experts, media experts, and end users, and must adhere to quality standards, religious sensitivity, and Islamic ethical values. Case studies in various madrasahs demonstrate that the successful implementation of digital PAI textbooks is heavily influenced by teacher training, policy support, stakeholder engagement, and ongoing quality assurance. Key recommendations include strengthening infrastructure, developing teacher capacity, cross-sector collaboration, and developing sustainable business and financing models. With a comprehensive, collaborative, and values-based approach, digital Islamic Education textbooks can become the main instrument in forming a generation of madrasahs who are intelligent, religious, and adaptive to the changing times.

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