

Technology-Based Capacity Development Models for Islamic Religious Education Teachers: A Systematic Literature Review

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ABSTRACT

The rapid development of digital technology has transformed educational practices and increased the urgency of strengthening teachers' professional competencies in the digital era. This study aims to analyze technology-based capacity development models for Islamic Religious Education (IRE) teachers through a Systematic Literature Review (SLR) approach. The study adopted the PRISMA framework to identify, select, and analyze relevant literature published between 2015 and 2025. Data were collected from the Scopus database using keywords related to teacher professional development, technology integration, and digital learning. After the screening and eligibility process, 19 articles were selected and analyzed thematically. The findings reveal that effective technology-based capacity development models are dominated by TPACK, MOOCs, blended learning, mentoring, and Communities of Practice (CoP). These approaches contribute significantly to improving teachers' digital literacy, pedagogical competence, self-efficacy, and instructional creativity. However, the study also identifies several challenges, including limited infrastructure, low ICT competencies, technology anxiety, resistance to change, and inadequate institutional support. In the context of Islamic Religious Education, technology integration requires not only technical competence but also the incorporation of Islamic ethical values and digital spirituality. The study concludes that sustainable, collaborative, and context-based professional development supported by institutional policies and mentoring systems is essential for strengthening IRE teachers' competencies in the digital era. The findings provide theoretical and practical implications for designing future teacher development programs in Islamic education in Indonesia.

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Introduction

The rapid advancement of digital technology has significantly transformed the landscape of education, including Islamic Religious Education (IRE). The integration of technology into educational practices has shifted traditional teacher-centered learning toward more interactive, student-centered, and technology-enhanced pedagogical models. In Indonesia, this transformation has become increasingly urgent due to the demands of the Industrial Revolution 4.0, Society 5.0, and the widespread adoption of digital learning environments after the COVID-19 pandemic. Educational institutions are expected not only to adopt technology infrastructure but also to strengthen teachers' professional competencies in utilizing technology effectively within the learning process (Wang et al., 2023). Nevertheless, many Islamic Religious Education teachers still encounter difficulties in integrating technology into pedagogical practices, particularly in relation to digital literacy, instructional innovation, and technological pedagogical competencies (Hasyim et al., 2021; Iskandar & Riantoni, 2023).

The challenges faced by Islamic Religious Education teachers are multidimensional. Although the availability of digital devices and internet access in schools has improved, disparities in technological competencies among teachers remain significant. Data from the Indonesian Central Bureau of Statistics indicate that the proportion of schools with computer access has increased steadily; however, the utilization of technology for pedagogical purposes remains uneven across educational levels and regions (BPS, 2024). Moreover, teachers often experience barriers related to inadequate training, limited institutional support, lack of confidence in technology integration, and insufficient digital pedagogical knowledge (Prasojo et al., 2019). These conditions become more complex within Islamic Religious Education because teachers are required not only to master technological tools but also to preserve moral, spiritual, and character-oriented educational values embedded in Islamic teaching (Nabila et al., 2023). Consequently, the development of technology-based capacity-building models for Islamic Religious Education teachers has become a crucial issue in contemporary educational discourse.

Previous studies have emphasized the importance of teacher professional development in strengthening digital competencies and improving instructional quality. The concept of teacher capacity development refers to a continuous process of improving pedagogical, professional, social, and technological competencies through systematic training, mentoring, collaboration, and reflective practice (Putri & Imaniyati, 2017). In the context of technology integration, the Technological Pedagogical Content Knowledge (TPACK) framework has become one of the most influential theoretical models for understanding teachers' competencies in combining technology, pedagogy, and subject content effectively (Herring et al., 2016). Several studies have demonstrated that TPACK-based professional development programs positively influence teachers' confidence, beliefs, and instructional practices in technology integration (Drajati et al., 2023). In Islamic Religious Education, TPACK is considered highly relevant because teachers are expected to integrate Islamic values with innovative digital pedagogies to create meaningful and contextual learning experiences (Ajizah & Huda, 2020).

In addition to TPACK, the Diffusion of Innovation Theory proposed by Rogers et al. (2014) provides an important theoretical perspective for understanding how technological innovation is adopted within educational settings. The theory explains that the adoption of innovation is influenced by factors such as perceived usefulness, compatibility, institutional support, and social communication processes. Within Islamic educational institutions,

technology adoption often depends on teachers' readiness, school culture, leadership support, and access to professional learning communities (Mailin et al., 2022). Furthermore, humanistic learning theory emphasizes the importance of learner-centered approaches, self-development, and meaningful educational experiences in promoting teachers' professional growth (Utami, 2020). These theoretical perspectives collectively provide a conceptual foundation for analyzing technology-based capacity development models for Islamic Religious Education teachers.

Several recent studies have explored technology integration in Islamic education from different perspectives. Research by Norjannah et al. (2022) revealed that teachers' competencies in developing technology-based Islamic Religious Education significantly affect the effectiveness of learning implementation. Similarly, (Dewi, 2023) found that the ability of Islamic Religious Education teachers to use IT-based instructional media contributed positively to student engagement and motivation. Other studies highlighted the growing role of artificial intelligence, digital platforms, MOOCs, and online professional development programs in enhancing teachers' instructional capacities (Diantama, 2024; Jati, 2023). Despite these developments, existing studies remain fragmented and tend to focus on specific technologies, isolated training programs, or limited educational contexts. There is still a lack of comprehensive synthesis regarding the models, strategies, challenges, and effectiveness of technology-based capacity development for Islamic Religious Education teachers.

Therefore, this study aims to systematically review the existing literature on technology-based capacity development models for Islamic Religious Education teachers. The study seeks to identify dominant models, technological approaches, theoretical foundations, implementation strategies, challenges, and future directions discussed in previous research. Through a systematic literature review approach, this article is expected to provide a comprehensive understanding of how technology can be effectively integrated into the professional development of Islamic Religious Education teachers. In addition, the findings of this study are expected to contribute theoretically to the discourse on Islamic education and educational technology, while also offering practical recommendations for policymakers, educational institutions, and teacher development programs in strengthening teachers' digital and pedagogical competencies in the contemporary educational era.

Method

This study employed a Systematic Literature Review (SLR) approach by adopting the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to systematically identify, evaluate, and synthesize previous studies related to technology-based capacity development models for teachers in the digital era (Page et al., 2021). The SLR approach was selected because it enables a structured, transparent, and comprehensive review of relevant literature, allowing the study to map research trends, identify challenges, and explore best practices in technology integration within educational contexts (Snyder, 2019). To guide the review process, this study formulated research questions (RQ) using the Population, Intervention, Comparison, Outcome, and Context (PICOC) framework (Petticrew & Roberts, 2006). The PICOC framework was employed to systematically define the scope and focus of the study, particularly in identifying relevant literature concerning Islamic Religious Education (IRE) teachers, technology-based professional development models, technological integration, and teacher competency improvement in the Indonesian educational context. The research was guided by four main research questions: (1) How can technology-based teacher capacity development models

effectively improve the competencies of Islamic Religious Education teachers in Indonesia in the digital era?; (2) What technical and psychological challenges are faced by Islamic Religious Education teachers in integrating technology into the learning process?; (3) What technology-based training approaches are the most effective in improving the technological and pedagogical skills of Islamic Religious Education teachers?; and (4) What best practices of technology-based teacher capacity development models have been implemented and are relevant to the context of Islamic Religious Education in Indonesia?

The data used in this study consisted of secondary data obtained from scientific journal articles indexed in the Scopus database. The literature search process was conducted using keywords derived from the PICOC framework, including “teacher development,” “professional development,” “technology integration,” and “ICT in education” (Kitchenham & Charters, 2007). The inclusion criteria included articles published between 2015 and 2025, written in English or Indonesian, categorized as journal articles, related to Social Sciences and Computer Science, and conducted within the Indonesian educational context. The article selection process followed the PRISMA flow, beginning with 984 articles identified through the initial search. The articles were subsequently filtered based on publication year, document type, language, subject area, journal source, and contextual relevance, resulting in 19 articles selected for final analysis (Moher et al., 2009; Page et al., 2021).

The selected articles were analyzed thematically through data extraction procedures focusing on research objectives, methodologies, findings, challenges, and implications related to technology-based teacher capacity development (Braun & Clarke, 2006). The analysis process aimed to identify dominant models, effective training approaches, technological and psychological challenges, and best practices relevant to Islamic Religious Education teachers in Indonesia. Each article was evaluated according to its relevance to the research questions, ensuring consistency, transparency, and validity in the review process (Xiao & Watson, 2019). Conclusions were drawn systematically based on the synthesis and interpretation of the reviewed literature to provide theoretical and practical insights into strengthening teacher professional capacity in the digital era.

Results and Discussion

1. Results

a. General Description of the Articles

Based on the literature screening process using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, a total of 19 articles met the inclusion criteria and were further analyzed in this study. The selected articles were published between 2015 and 2025, indicating the growing development of research on technology-based teacher capacity development during the last decade. Most of the articles originated from reputable international journals, ensuring methodological quality and academic credibility. All selected sources were journal articles, providing consistency in the type and depth of scientific discussion.

The contexts explored in the selected studies varied across several educational sectors, including English as a Foreign Language (EFL/ELT), vocational education, early childhood education, maritime education, and higher education. This diversity reflects the broad implementation of technology-based teacher capacity development across educational disciplines and levels. Although the contexts differed, the studies remained relevant because they consistently focused on strategies, models, and challenges related to teacher

professional development in technology-integrated learning environments.

Although none of the analyzed studies specifically examined Islamic Religious Education (IRE) teachers, the findings remain highly relevant to the Indonesian Islamic education context. The reviewed studies discussed important issues such as technology-based training models, challenges of technology adoption, effective professional development approaches, and best practices in educational technology implementation. Therefore, these studies were used as analogical and comparative references for understanding the development of Islamic Religious Education teachers' capacities while considering the unique characteristics and values embedded within Islamic education.

b. Publication Trends

The analysis of publication trends indicates that research on technology-based teacher capacity development experienced fluctuating growth between 2015 and 2025.

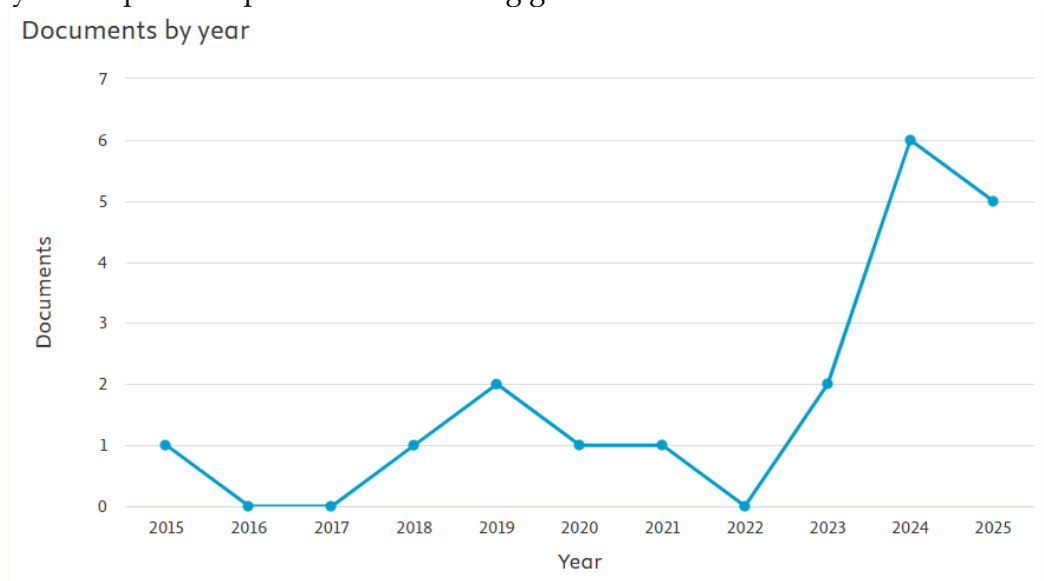


Figure 1. Publication Trends on Technology-Based Teacher Capacity Development (2015–2025)

The findings show that publication growth became significantly stronger after the COVID-19 pandemic, particularly between 2023 and 2025. This increase demonstrates growing academic concern regarding teachers' digital competencies and educational transformation in Indonesia.

c. Distribution of Research Areas

The distribution of publications based on subject areas reveals that Social Sciences dominated the studies with 47.4%, followed by Arts and Humanities with 21.1%, and Computer Science with 7.9%.

Table 1. Distribution of Research Areas

Research Area	Percentage
Social Sciences	47.4%
Arts and Humanities	21.1%
Computer Science	7.9%
Other Fields	23.6%

Documents by subject area

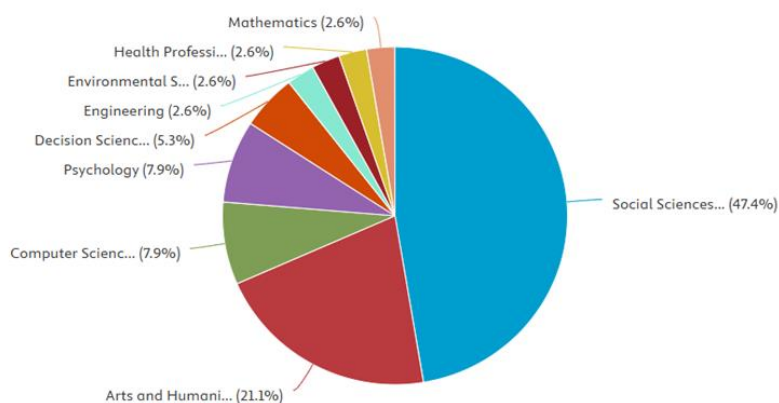


Figure 2. Distribution of Research Areas

The dominance of Social Sciences confirms that teacher capacity development is mainly examined from educational, social, and policy perspectives emphasizing pedagogy, professionalism, and educational transformation.

d. Distribution Based on Country

Indonesia dominated the publication distribution with 19 documents, indicating that technology-based teacher capacity development has become an urgent and highly relevant issue in the national educational context.

Table 2. Distribution of Publications by Country

Country	Number of Publications
Indonesia	19
Malaysia	2
Australia	1
South Korea	1
Taiwan	1
Türkiye	1
Vietnam	1

This phenomenon reflects Indonesia's intensive efforts to improve teacher digital competencies and strengthen educational transformation programs.

e. Data Extraction Findings

To facilitate systematic comparison and analysis, important data from each study were extracted and organized into thematic categories.

Table 3. Data Extraction

No	Authors, Year & Title	Research Focus	Methodology	Main Findings	Related RQ
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1	Sunardi et al. (2025), <i>Tension Between Theory and Practice in Literature Courses at University-Based Educational Institutions: Strategies and Approaches</i>	Tension between conceptual understanding and classroom implementation of literature	Multi-case study involving four literature teachers through interviews, observations, and document analysis	The tensions were influenced by curriculum, time constraints, assessment, and teachers' beliefs; strategies included professional development, collaboration, reflection, and technology integration	RQ1, RQ3, RQ4
2	Sugihartini et al. (2025), <i>Innovative Web-Based Microteaching Model: To Improve the Teaching Skills of Prospective Informatics Teachers in Vocational High Schools</i>	Development of prospective informatics teachers' teaching skills through Web-Based Microteaching (WBM)	Research and Development (R&D) using the ADDIE model	WBM improved teaching skills, lesson planning, and instructional practice; web platforms facilitated access to materials and feedback	RQ1, RQ3
3	Murwaningsih (2025), <i>The Impact of Teachers' Professional Development on the Internet Self-Efficacy and ICT Competencies</i>	The impact of professional development on internet self-efficacy and ICT competencies	Survey using PLS-SEM involving 150 vocational school teachers	Professional development enhanced internet self-efficacy and ICT competencies; self-efficacy mediated the relationship between professional development and ICT competence	RQ1, RQ3
4	Salim et al. (2025), <i>Humanistic Learning with Community-Based Learning Approach: Exploring Teacher Performance in Education Public Office Program</i>	The impact of humanistic and community-based learning on teacher performance	Pre-test and post-test non-control group involving 144 junior high school teachers	Motivation, professional engagement, and skills improved; however, technology integration remained insignificant	RQ3, RQ4
5	Anwar et al. (2025), <i>Integrating Technology into English Language Teaching at Indonesian High Schools: Teachers' Reflections</i>	High school English teachers' experiences in integrating technology	Mixed-methods involving online surveys with 20 teachers and semi-structured interviews with 10 teachers	Technology use increased, but barriers included technical issues, limited support, and restricted access; technology-based professional development was recommended	RQ2, RQ3
6	Simajuntak (2024), <i>Navigating the Seas of Knowledge: Cognitive Load Management for Maritime Cadets</i>	Cognitive load management strategies and professional development among maritime cadets	Qualitative study involving 72 cadets	Spaced repetition, case studies, and technology-based learning were effective; challenges included overload and limited time	RQ3, RQ4
7	Simajuntak et al. (2024), <i>Enhancing Global Maritime Education: A Qualitative</i>	Curriculum effectiveness and technology integration in	Field study with qualitative analysis	Integrative curricula successfully bridged theory and practice; technology integration preferences and	RQ1, RQ4

	<i>Exploration of Post-Internship Perspectives and Preparedness among Cadets</i>	maritime vocational training		geographical differences influenced adaptation	
8	Megawati et al. (2024), <i>Exploring Pre-Service Teachers' Beliefs and Experiences during Emergency Remote Teaching</i>	Pedagogical beliefs and technology integration during emergency remote teaching	Multiple case study involving 15 pre-service teachers through questionnaires, interviews, and observations	Alignment and misalignment between pedagogical beliefs and technology use were influenced by internal and external factors	RQ2, RQ3
9	Mardiana (2024), <i>Perceived Impact of Lecturers' Digital Literacy Skills in Higher Education Institutions</i>	The impact of lecturers' digital literacy on teaching and research	Mixed-methods using t-test, ANOVA, and TPACK framework	Digital literacy was essential for technology integration; TPACK-based professional development was recommended	RQ1, RQ3
10	To Khuyen et al. (2024), <i>Exploring Teachers' Epistemological Framing through Classroom Discourse in 6E-STEM Classes: From Perception to Practice</i>	Implementation of 6E-STEM and technology integration in teaching	Case study involving classroom observations, interviews, and NVivo analysis	Coaching-based professional development improved content, pedagogical, and technological competencies; implementation varied depending on students	RQ1, RQ3
11	Hasibuan et al. (2024), <i>Promoting Media Literacy among Early Childhood Education: A Case Study in Deli Serdang Regency, Indonesia</i>	Media literacy competencies among early childhood education teachers	Descriptive qualitative study using interviews and observations	Teachers were proficient in using digital technology but lacked conceptual understanding of media literacy; professional development remained limited	RQ1, RQ3, RQ4
12	Jati (2023), <i>MOOC as a Technology-Focused TPD for EFL Teachers in Indonesia</i>	Expectations and experiences of teachers participating in MOOC-based professional development	Mixed-methods using pre-post surveys and interviews involving 200 EFL teachers	Teachers showed high commitment; barriers included time management and internet connectivity; Communities of Practice needed improvement	RQ3
13	Drajati et al. (2023), <i>Exploring the Impact of TPACK-Based Teacher Professional Development (TPD) Program on EFL Teachers' TPACK Confidence and Beliefs</i>	Development of EFL teachers' TPACK competencies	Case study using teacher diaries and interviews	TPACK-based professional development improved teachers' confidence and beliefs regarding technology integration	RQ1, RQ3
14	Megawati et al. (2021), <i>Emergency Remote Teaching and Learning: Technology-Based</i>	Integration of digital applications in lesson planning	Practical implementation and observation	The use of Canva, Zoom, iSpring, and TikTok strengthened teachers' professional development,	RQ3

	<i>Instructional Plan Across Grade Levels</i>			especially in instructional planning	
15	Lie et al. (2020), <i>Secondary School Language Teachers' Online Learning Engagement During the COVID-19 Pandemic in Indonesia</i>	Teachers' engagement in online learning	Case study involving 18 teachers through surveys and interviews	Teachers improved their technological knowledge, but the quality of online learning still required improvement; TPACK was recommended	RQ2, RQ3
16	Prasojo et al. (2019), <i>An Explanatory Sequential Study on Indonesian Principals' Perceptions on ICT Integration Barriers</i>	Principals' perceptions of ICT integration barriers	Survey involving 250 principals and focus group discussions with 30 participants	Barriers included teachers' limited knowledge, funding issues, traditional teaching styles, inadequate professional development, and school culture	RQ2
17	Habibi et al. (2019), <i>Preparing Future EFL Teachers for Effective Technology Integration: What Do Teacher Educators Say?</i>	ICT competencies and support for prospective EFL teachers	Survey involving 138 respondents and interviews with seven teacher educators	Positive attitudes toward ICT were identified, but competencies remained moderate and classroom ICT integration was still ineffective	RQ2, RQ3
18	Owen et al. (2018), <i>Systematic Educational Change and Teacher Skill-Building in Developed and Developing Countries: The Importance of Teacher Peer Learning Groups</i>	ICT professional development and its impact on teaching practices	Surveys, interviews, and case studies involving teachers and principals	Coordinated professional development improved ICT integration in classrooms; peer learning and mentoring were essential	RQ1, RQ3, RQ4
19	Ansyari (2015), <i>Designing and Evaluating a Professional Development Programme for Basic Technology Integration in English as a Foreign Language (EFL) Classrooms</i>	Professional development for developing EFL lecturers' TPCK	Design-based research using interviews, logbooks, and TPACK/TAC surveys	TPACK-based professional development improved TPCK; active engagement, collaboration, and feedback were critical aspects	RQ1, RQ3

The synthesis identified four major patterns: (1) the dominance of TPACK and blended learning models, (2) technical and psychological barriers to technology adoption, (3) the effectiveness of contextual and sustainable training, and (4) the importance of mentoring and institutional support.

2. Discussion

a. Effective Technology-Based Teacher Capacity Development Models

The synthesis of 19 reviewed studies demonstrates that technology-based teacher capacity development models in Indonesia increasingly emphasize integrative,

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collaborative, and sustainable approaches. The Technological Pedagogical Content Knowledge (TPACK) framework emerged as the most dominant model for strengthening teachers' digital and pedagogical competencies.

Table 5. Dominant Technology-Based Capacity Development Models

Model	Characteristics	Benefits
TPACK	Integration of pedagogy, content, and technology	Improves digital pedagogical competence
MOOC	Flexible online training	Expands learning access
Blended Learning	Combination of online and face-to-face learning	Supports gradual adaptation
Community of Practice (CoP)	Collaborative peer learning	Encourages reflective learning
Mentoring	Continuous professional guidance	Strengthens self-efficacy

TPACK-based professional development significantly improved teachers' self-efficacy, instructional creativity, and confidence in integrating technology into learning processes. In the context of Islamic Religious Education, this framework enables teachers to combine Islamic values, pedagogical strategies, and digital media meaningfully.

b. Technical and Psychological Challenges in Technology Integration

The findings indicate that technology integration in education faces both technical and psychological barriers.

Table 4. Major Challenges in Technology Integration

Category	Challenges
Technical Challenges	Limited internet access, lack of infrastructure, low ICT skills
Psychological Challenges	Low self-efficacy, technology anxiety, resistance to change
Institutional Challenges	Lack of policy support and mentoring
Contextual Challenges	Limited digital training for Islamic education

For Islamic Religious Education teachers, these challenges become more complex because technology integration must remain aligned with spiritual values, ethics, and Islamic educational principles.

c. Effective Technology-Based Training Approaches

The analysis reveals that effective technology-based training approaches are characterized by interactivity, sustainability, collaboration, and contextual relevance.

Table 7. Characteristics of Effective Training Approaches

Approach	Key Characteristics	Impact
Hands-on Training	Direct practice using technology	Improves practical competence
Mentoring	Continuous feedback and guidance	Increases confidence
Peer Learning	Collaborative discussion and sharing	Strengthens professional community
Project-Based Training	Real instructional product development	Encourages creativity
Reflective Practice	Reflection and evaluation	Improves teaching quality

The findings support experiential learning theory, emphasizing that teachers learn more effectively through direct practice, reflection, and contextual experience.

d. Best Practices in Technology-Based Teacher Capacity Development

The synthesis of the reviewed studies indicates that best practices in technology-based teacher capacity development involve holistic integration between professional training, institutional support, mentoring, and digital culture development.

Table 8. Best Practices in Technology-Based Teacher Development

Best Practice	Description
TPACK Integration	Combining technology, pedagogy, and content
Professional Learning Community (PLC)	Collaborative teacher learning culture
Mentoring and Coaching	Sustainable professional assistance
Institutional Support	Leadership, infrastructure, and policy support
Ethical Digital Literacy	Integrating digital ethics and Islamic values

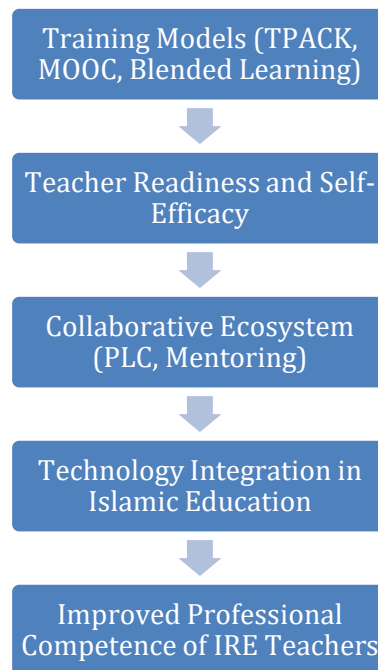


Figure 3. Conceptual Framework of Technology-Based Capacity Development

Within Islamic Religious Education, best practices should also incorporate Islamic ethical values and digital spirituality. Technology should be positioned as a means of strengthening Islamic learning, da'wah, and moral development rather than replacing spiritual interaction.

Conclusion

This study concludes that technology-based teacher capacity development models play a significant role in improving teachers' professional competencies in the digital era, including within the context of Islamic Religious Education (IRE) in Indonesia. Based on the findings of the Systematic Literature Review (SLR), effective capacity development models are characterized by integrative, collaborative, and sustainable approaches, particularly through the implementation of TPACK, MOOCs, blended learning, mentoring, and Communities of Practice (CoP). These models not only enhance teachers' technological competencies but also strengthen pedagogical skills, self-efficacy, and instructional creativity in integrating technology into classroom practices.

The study also reveals that the integration of technology in education is still constrained by various technical and psychological challenges. Technical barriers include limited internet access, inadequate digital infrastructure, and low levels of ICT literacy, while psychological barriers involve technology anxiety, low confidence, resistance to change, and increased workload. In the context of Islamic Religious Education, these challenges become more complex because teachers are required to maintain spiritual values, ethical principles, and the distinctive characteristics of Islamic learning while adopting digital technology.

Furthermore, the findings indicate that effective technology-based training approaches should be practical, contextual, interactive, and supported by continuous mentoring and collaborative learning environments. One-off training programs are considered insufficient

to create sustainable changes in teaching practices. Instead, long-term professional development supported by peer learning groups, Professional Learning Communities (PLC), and institutional support has a stronger impact on teacher transformation and technology integration.

Finally, the study highlights that the best practices in technology-based teacher capacity development are closely related to the integration of pedagogical frameworks, institutional policies, mentoring systems, and digital culture development. For Islamic Religious Education teachers, technology integration should not merely focus on technical mastery but also incorporate Islamic ethical values, digital spirituality, and responsible technology use. Therefore, future teacher development programs should emphasize holistic and value-oriented digital competency development to support innovative, meaningful, and contextually relevant Islamic education in the 21st century.

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