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Implementation of TPACK in Islamic Religious Education Learning in Elementary School

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Abstract
The implementation of Technological Pedagogical Content Knowledge (TPACK) in Islamic Religious Education (PAI) learning at the elementary school level can be seen as an important strategy to synergistically integrate technology, pedagogical approaches, and content materials, so that the learning process becomes more interactive and meaningful for students. This study was designed to examine in depth how TPACK is implemented in this context, while identifying various factors that act as supporters and obstacles for teachers in operationalizing it. Methodologically, this study adopted a qualitative approach through a case study design carried out in one elementary school. The research subjects included the principal and four PAI teachers who were directly involved in the learning practice. Data collection was carried out through three main techniques, namely in-depth interviews to explore the perspectives and experiences of the subjects, direct observation of learning activities in the classroom, and documentation studies to strengthen the validity of field findings. The validity of the data was checked through triangulation techniques, while the analysis process followed the Creswell model. Research findings indicate that Islamic Religious Education teachers have optimized the Technological Knowledge dimension by integrating various digital media into their learning practices, such as Canva, YouTube, Google Classroom, and Quizizz, to increase student engagement and active participation. In the Pedagogical Knowledge aspect, teachers use diverse and interactive learning strategies utilizing technological support. Content Knowledge remains the main foundation through strengthening core Islamic Religious Education materials combined with digital media and holistic assessment. The implementation of TPACK received support from the school through the provision of facilities, teacher training, and Teacher Working Group (KKG) activities. Despite infrastructure limitations, the implementation of TPACK has made a positive contribution to the effectiveness of Islamic Religious Education learning.

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1. INTRODUCTION

Technological advances in the digital era have brought significant changes to the delivery of education. Several experts have argued that digital technology has developed into an effective medium to support the learning process over the past decade (Min, 2022) (Meers et al., 2023) (Meers et al., 2023). In the context of everyday life, students are now increasingly connected to gadgets, social media, and various digital platforms. This situation significantly shapes their learning patterns and the way they access information, differing

from previous generations (Manzoni et al., 2020) (DiLullo, 2020). This situation requires teachers to adapt learning methods to be more relevant to students' characteristics, contextualized to their lives, and able to encourage active engagement. In Islamic Religious Education learning, the use of technology is not merely placed as an aid, but can be part of a learning strategy to build interactive, inspiring learning experiences that are appropriate to the needs of students (Eden et al., 2024) (Kalyani, 2024) (Thelma et al., 2024)

However, Islamic Religious Education (PAI) teaching practices in schools are still largely conventional. Learning tends to emphasize memorization and textual understanding of material, while contextual and interactive learning experiences have not received adequate attention. This condition can lead to decreased student motivation, limited interaction during learning, and the emergence of the perception that religious subjects are monotonous. This issue becomes increasingly important at the elementary school level because students are at a developmental stage where they are beginning to understand real events and concrete objects, have a strong sense of curiosity, but their emotional and motivational states are still relatively volatile, and they tend to become bored quickly. In line with Indonesian Government Regulation Number 55 of 2007, education is directed at developing students' abilities to understand, appreciate, and practice religious teachings in a manner that balances developments in science, technology, and the arts. Therefore, Islamic Religious Education (PAI) learning needs to integrate religious content with technology so that the material presented can provide a more meaningful learning experience.

One approach that is relevant to these needs is TPACK. The TPACK framework positions three forms of knowledge as the main elements that teachers need to master in an integrated manner, namely:

1. **Content Knowledge (CK)** refers to the depth of the teacher's mastery of the substance of the subject matter and the values he wants to transmit to students.
2. **Pedagogical Knowledge (PK)** includes teacher competence in designing and implementing learning strategies and methods that can stimulate student activity, hone critical thinking skills, and facilitate a more comprehensive understanding of the material.
3. **Technological Knowledge (TK)** describes teachers' skills in integrating various digital devices, media, and technologies such as interactive learning videos, online evaluation platforms, and Canva-based visual presentations as supporting tools to strengthen students' understanding of learning content.

The integration of these three elements provides opportunities for teachers to design Islamic Religious Education (PAI) learning that is informative, engaging, interactive, and tailored to student characteristics. In implementing TPACK, teachers no longer function solely as information transmitters but also as facilitators who create conditions for active learning (Rahma, 2025; Thelma et al., 2024). The use of interactive digital media can contribute to increased student motivation, participation, and engagement (Monigir & Wakari, 2024). In addition, the implementation of TPACK can also support the formation of religious attitudes and increase students' appreciation for the values of the Qur'an (Anggraini et al., 2025).

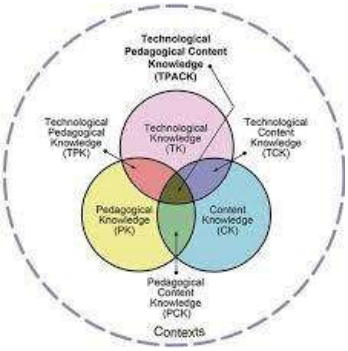
Several previous studies have demonstrated the benefits of implementing TPACK in Islamic Religious Education (PAI) learning. For example, research by Febrianto et al. (2026) demonstrated that integrated TPACK can improve student motivation, engagement, and understanding in Islamic Religious Education (PAI) learning in eighth graders at SMP Negeri 2 Tunjungan Blora. Meanwhile, research by Aroka (2024) demonstrated that the TPACK approach is effective in improving digital literacy and student understanding of Islamic Religious Education (PAI) material in eleventh graders at SMAN 9 Padang.

However, both studies were conducted at the secondary and higher education levels, so there is still room to examine the implementation of TPACK at the elementary school level. Differences in TPACK implementation between elementary and secondary schools are not only related to the age of the students, but also to how teachers design learning experiences, mediate learning, and simplify the relationship between technology, pedagogy, and content elements according to student development. At the elementary school level, teachers need to create safe, concrete, simple, and directed learning experiences. Students at this stage still require intensive guidance, easy-to-understand visual examples, and a clear activity structure. Therefore, the implementation of TPACK in elementary schools cannot simply be understood as the use of technology in learning, but must consider both the child's developmental stage and the objectives of basic Islamic religious learning. This situation opens up research opportunities to understand the strategies, obstacles, and practices used by teachers in implementing TPACK.

The urgency of this research relates to the need to understand how Islamic Religious Education (PAI) teachers at SD2 Darul Hikam, Bandung Regency, respond to the development of learning technology through the integration of technology, pedagogy, and content. The accuracy of integrating technology at the elementary level of education not only influences the attractiveness of learning but also relates to the effectiveness of material delivery, the achievement of pedagogical objectives, and the formation of students' basic religious understanding. Delays in adapting technology can cause the learning process to be less able to respond to the characteristics of today's students who require concrete, interactive, and contextual media. Therefore, this research is important to obtain an empirical picture of the practices, obstacles, and opportunities for implementing TPACK in Islamic Religious Education (PAI) learning in elementary schools.

a. TPACK Concept

TPACK is a conceptual framework that combines three main knowledge domains in learning: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK) (Hanik et al., 2022) (Oktaviana & Yudha, 2022). This concept was developed from the idea of Pedagogical Content Knowledge (PCK) and provides a foundation for teachers to deliver material effectively, creatively, and in line with technological developments. TPACK can be a basis for teachers in adapting learning designs to the characteristics of Generation Alpha and the digital environment (Salim, 2025) (Hendri et al., n.d.). Within this framework, technology is not positioned merely as a means of entertainment or social communication, but as a learning instrument that can help improve material understanding, critical thinking skills, and active student engagement.



Gambar 1. Technological Pedagogical Content Knowledge (TPACK) Framework (Mishra & Koehler, 2008)

The TPACK components consist of seven main elements as follows:

1. **Technological Knowledge (TK)** is a basic skill teachers need to possess in operating various hardware and software, such as laptops, projectors, and digital learning applications. TK also encompasses the ability to continuously adapt to the development and emergence of new technologies. Mastery of this aspect enables teachers to use technology appropriately to support and optimize the learning process.
2. **Content Knowledge (CK):** This knowledge relates to the teacher's in-depth understanding of the material or subject being taught. This knowledge encompasses theories, values, and specific objectives of the learning material. Mastery of the material alone is not sufficient; teachers also need to understand the characteristics of how students learn. With a strong foundation in CK, teachers can develop learning strategies that help students gain a deeper understanding.
3. **Pedagogical Knowledge (PK)** is an important competency that a teacher must possess. Based on Government Regulation of the Republic of Indonesia Number 19 of 2005, pedagogical competence relates to a teacher's ability to manage learning, which includes understanding students, planning learning, implementing learning, evaluating learning outcomes, and developing student potential. Pedagogical knowledge also encompasses a teacher's ability to provide motivation and choose appropriate learning methods, including managing the classroom to ensure a conducive learning atmosphere.
4. **Pedagogical Content Knowledge (PCK)** relates to a teacher's ability to determine the most appropriate way to deliver material to ensure optimal student understanding. PCK encompasses teaching techniques and classroom management tailored to the characteristics of the material or subject area. Through PCK, teachers can create meaningful learning experiences through active learning activities and content-appropriate pedagogical approaches.
5. **Technological Content Knowledge (TCK)** emphasizes the relationship between specific material and the technological devices or platforms used in the learning process. This aspect requires teachers to be able to determine the technology that best suits the characteristics of the material. Selecting the right technology allows for clearer, more engaging, and easier-to-understand conceptual delivery, thus enabling the learning process to proceed more optimally.
6. **Technological Pedagogical Knowledge (TPK):** This is a teacher's ability to effectively connect the use of technology with learning strategies or methods. TPK emphasizes the ability to select technology that is appropriate for the learning approach used, for example, in group work activities or online learning.
7. **Technological Pedagogical and Content Knowledge (TPACK)** is an integration of TK, CK, and PCK that enables teachers to develop effective, engaging learning that is tailored to students' needs. In Islamic Religious Education (PAI) learning, its implementation can be realized through the use of interactive quizzes, educational videos, and online discussions aimed at strengthening material understanding, increasing participation, and developing digital literacy. Thus, the TPACK framework encourages a shift in the role of teachers from merely delivering material to designing innovative, contextual learning experiences that are in line with the demands of the digital era (Surahman et al., 2025; Silvester et al., 2024).

In Islamic Religious Education (PAI) learning, TPACK can be implemented through interactive quizzes, instructional videos, online discussions, and digital modules. Utilizing these various strategies has the potential to increase student motivation, participation, and digital literacy. Thus, TPACK goes beyond the conceptual level but

can be used as a practical framework for ongoing application in learning in the digital era.

b. Islamic Education Learning in Elementary Schools

Islamic Religious Education (PAI) learning is directed at developing students' attitudes, behaviors, and character in accordance with Islamic teachings, encompassing aspects of faith, worship, morals, and social relationships (Ramadhani, 2024) (Cahyani et al., 2024). Thus, PAI is not only oriented toward mastering religious knowledge but also toward developing religious competencies that can be applied in everyday life.

Elementary school is a crucial stage in instilling good values and character building. At the same time, students are exposed to various influences from social media, social interactions, and media culture. Therefore, Islamic Religious Education (PAI) learning needs to be designed to encourage active participation, provide contextual experiences, and relate to students' lives (Fahrieyah, 2024) (Yanti, 2024). At SD2 Darul Hikam, teachers combine a competency-based approach with the reinforcement of religious values through habituation activities and the screening of educational videos containing moral and religious messages. This strategy is aimed at fostering critical awareness in students.

The use of innovative digital media, such as interactive videos, portable learning applications, online assessments, and gamification approaches, can serve as strategic intermediaries to create more interactive and participatory learning experiences. The use of these media has demonstrated effectiveness in supporting students' learning interests, participation, and critical thinking skills (Yusup & Mastoah, 2025) (Desrita, 2025) (Yusup & Mastoah, 2025).

However, Islamic Religious Education (PAI) learning still faces several challenges, including students' in-depth understanding, the use of conventional learning methods, and limited facilities and infrastructure. Several alternative solutions include improving teacher competency through training and developing a curriculum oriented toward media literacy.

c. Integration of TPACK in Islamic Education Learning

The implementation of TPACK allows teachers to begin learning by analyzing the material and competencies students need to achieve, then determining appropriate methods and selecting technology that supports these objectives. In practice, teachers can use digital modules, educational videos, interactive quizzes, and various online applications to strengthen understanding of the material presented. Next, the lesson plan is developed using the TPACK approach and followed by assessment and reflection activities as a basis for improving subsequent learning.

The TPACK approach can help students understand Islamic Religious Education concepts more deeply while developing evaluative, participatory, and digital literacy skills. Furthermore, the integration of technology, pedagogy, and content can strengthen students' appreciation of moral values and foster religious character, despite limited school facilities (Silviana Lianvani et al., 2023) (NURUL, 2023).

2. RESEARCH METHODS

This study uses a descriptive qualitative approach to describe the implementation of TPACK in Islamic Religious Education (PAI) learning at SD2 Darul Hikam, Bandung Regency. This approach was chosen because the study focuses on describing phenomena that occur in the field in a factual, systematic, and accurate manner without the intention of building new theories or testing hypotheses. The research subjects consisted of the principal and five Islamic Religious Education (PAI) teachers. Participants were selected using a

purposive sampling technique based on the teachers' experience in implementing TPACK. The principal was involved to obtain information regarding school policies and support for the provision of learning resources.

Data collection was conducted through in-depth interviews with Islamic Religious Education (PAI) teachers and school principals, observations of learning activities, and documentation of learning resources and media, including digital modules and various supporting media used during the learning process. Documentation was used to complement the interview and observation results to obtain a more comprehensive and contextual picture of TPACK-based Islamic Religious Education (PAI) learning practices.

The research was conducted over eight weeks. The research stages included preparation, developing interview instruments, collecting field data, conducting initial analysis, confirming findings, and refining the analysis. This timeframe provided the opportunity to obtain in-depth data, conduct repeated observations of the learning process, and compare the consistency of information from various sources.

Data analysis follows the Miles and Huberman (1994) model, which consists of three main stages, namely:

1. Data filtering and selection, namely selecting data from interviews, observations, and documentation that have the strongest relationship with the research focus.
2. Data presentation, namely organizing information systematically in the form of narratives, matrices, or thematic categorization so that the relationships between findings can be understood more easily.
3. Drawing conclusions and verification, namely finding patterns, themes, and meaning from the data that has been presented, then re-checking the validity of the findings through triangulation and member checks.

The coding process was carried out in stages so that the analysis process could be traced and replicated by other researchers. The first stage was open coding, which assigned initial codes to sections of data that contained important meaning, such as the use of digital media, pedagogical strategies, mastery of material, and technical barriers. The next stage was axial coding, which connected and grouped the initial codes into related categories, such as aspects of technology, pedagogy, and content. The final stage was selective coding, which determined the most dominant core categories in (Hidayati & Choiriyah, 2024), explaining the pattern of TPACK application in Islamic Religious Education learning.

Data reliability was strengthened through triangulation of sources and methods, as well as member checking with participants. These procedures were carried out to ensure that the researcher's interpretations remained consistent with the experiences and information provided by the participants. With this series of procedures, the research is expected to produce accurate, systematic, and accountable findings, while demonstrating a sufficient level of transferability.

3. RESULTS AND DISCUSSION

3.1. Research Results

Teachers utilize a variety of digital media to support Islamic Religious Education (PAI) learning activities. These include Canva, YouTube, CapCut, Google Classroom, PowerPoint, and Quizizz. These media are utilized to strengthen students' understanding of the material being studied. Technology-based learning is also considered capable of attracting students' attention and providing clearer visuals. This is reflected in the statement of one teacher: "Learning using technology attracts children's attention, helps them focus better, and increases their creativity and enthusiasm during the learning process" (Interview with a second-grade Islamic Religious Education teacher, 2025, lines 39-40).

This statement can be explained through the perspective of Mayer's multimedia learning theory, which states that the learning process can be more effective when information is delivered through a combination of verbal and visual elements because students can process information through two cognitive channels simultaneously [29]. In Islamic Religious Education (PAI) learning, the use of Canva, YouTube, CapCut, PowerPoint, and Quizizz not only functions as a learning complement. These media can also help explain abstract concepts, provide concrete examples, and reduce boredom during learning activities. A more diverse presentation of material allows students to maintain attention better. In addition, varied presentations can encourage higher cognitive engagement compared to conventional learning, which relies largely on lecture methods.

These findings also relate to Bruner's constructivist theory, which views learning as an active process where students construct their knowledge through exploration, discovery, and direct involvement in learning experiences (Bruner, 1961). The use of technology can expand students' opportunities to interact with material, explore information, and respond to various learning activities. This is crucial in Islamic Religious Education (PAI) because religious material cannot simply be understood through memorization but must also be internalized through meaningful learning experiences. Digital media allows students to take a more active role. They not only receive information from the teacher but can also observe, process, and demonstrate their understanding through various creative tasks, such as making videos or designing posters. Therefore, the increased attention and understanding of students in technology-based learning can be understood as a result of the characteristics of digital media, which provide diverse stimuli and support the information processing process.

3.2. Discussion

a. Application of Technological Pedagogical Content Knowledge (TPACK)

In the context of religious instruction, the use of digital technology should be examined more critically. Digitizing learning is not merely a means to facilitate understanding of the material but also has the potential to influence how students interpret religious practices if not managed with appropriate pedagogical and religious substance considerations. Technological Content Knowledge (TCK) is evident when teachers transform religious instruction materials, such as ablution, prayer, and etiquette, into demonstration videos, animations, and interactive quizzes. This transformation helps students see the practical stages more concretely. However, teachers still need to ensure that the visualizations used are accurate, orderly, and do not simplify religious practices into mere procedures. In other words, technology is not simply a medium for presenting information, but rather a tool whose use must remain guided by the authority and substance of Islamic teachings to prevent oversimplification (Rahmawati & Nurachadija, 2023).

In terms of Technological Pedagogical Knowledge (TPK), teachers' selection of digital media appears to take into account the characteristics of elementary school students, who tend to be responsive to visual and interactive stimuli. Learning videos and Quizizz, for example, can help increase attention and provide rapid feedback. However, their successful use still depends on the teacher's ability to direct activities so that learning doesn't stop at the fun or entertainment aspect. In religious instruction, teachers need to ensure that students don't simply watch videos or answer quizzes, but also understand the meaning, procedures, and spiritual values inherent in these practices.

Pedagogical Content Knowledge (PCK) is evident in the teacher's ability to determine which parts of the worship material need to be demonstrated, repeated, or emphasized through reflective activities. This approach is necessary to prevent learning from becoming a rote activity detached from meaning. Therefore, the success of TPACK-based worship learning is not solely determined by the sophistication of the technology

used, but by the teacher's ability to balance technology, learning strategies, and teaching substance. This balance is necessary to maintain the sacred value of worship and ensure it is understood correctly by students (Mishra & Koehler, 2006).

Pedagogical Strategy (PK)	Assistive Technology (TK)	Pedagogical Function in Islamic Education Learning
Demonstration of worship steps	YouTube, PowerPoint	Displaying the stages of worship practice visually so that students can more easily understand the correct and sequential procedures.
Visual-based material delivery	Canva, PowerPoint	Helps clarify abstract concepts in Islamic Religious Education through attractive, structured visual displays that are appropriate to the level of understanding of elementary school students.
Interactive Q&A	Quizizz, Google Classroom	Helps teachers quickly determine students' level of understanding while providing feedback that encourages active engagement.
Giving creative assignments	Canva, CapCut	Provide opportunities for students to demonstrate their understanding through creative digital products that are related to the context of the material.
Reinforcement of material through learning videos	YouTube, CapCut	Supports strengthening material retention through audio-visual presentation, which in turn makes it easier for students to remember and understand learning content.
Online assignments and collection of assignments	Google Classroom	Helps manage tasks more systematically, efficiently, and documented.

b. Institutional Support

The principal provides comprehensive support for the implementation of TPACK in the learning process. This support includes motivating teachers to actively participate in the Islamic Religious Education Teacher Working Group (KKG) forum, providing adequate infrastructure, and conducting internal training related to the use of digital media and technology integration in creative learning. This step aligns with the principal's statement: "We encourage teachers to use appropriate technology, not just as additional tools. Our strategy includes providing facilities such as projectors, laptops, and internet access, as well as teacher training and mentoring through internal workshops and KKG activities. The goal is to make learning more effective, engaging, and still based on character values." (principal interview).

Institutional support plays a crucial role in ensuring the optimal implementation of TPACK. Although schools still face limited facilities and training opportunities, the synergy between institutional support, teacher commitment, and the use of digital media can help increase student motivation, participation, and understanding of the material while reinforcing religious values.

The results of the study indicate that the implementation of TPACK in Islamic Religious Education (PAI) learning at SD2 Darul Hikam in Bandung Regency through the

use of digital media, such as Canva, YouTube, and Quizizz, reflects the application of Technological Knowledge (TK), which can help improve student focus. However, its implementation still faces obstacles in the form of limited infrastructure. These findings align with those of Rahmawati & Nurachadija (2023), who explain that TPACK can improve the effectiveness of religious learning by combining technological skills, pedagogy, and content mastery.

The application of Pedagogical Knowledge (PK) through inquiry and cooperative strategies enhanced by technology also aligns with (Anwar, 2025), who asserted that harmonizing technology and pedagogy in Islamic Religious Education (PAI) learning can create a learning environment that aligns with the characteristics of students in the digital age. This finding also demonstrates adaptive efforts in managing learning amidst existing limitations.

Meanwhile, Content Knowledge (CK) in Islamic Religious Education (PAI) learning can be optimally integrated through holistic assessment. Appropriate implementation of TPACK can increase student engagement while supporting teacher effectiveness in helping students understand religious values. Furthermore, TPACK can act as a catalyst in the development of HOTS (Hospital Values) in Islamic Religious Education (PAI) learning in elementary schools (Nurdin et al., 2025). This integration can ultimately strengthen motivation and foster a more comprehensive Islamic character in students (Auliya & Fahmi, 2026).

The findings of this study have implications for educational management policy, particularly regarding the need for ongoing TPACK training. Limitations stemming from the subjectivity of interviews and the use of a single sample suggest the need for further research using multi-site triangulation. Practically, the results support the development of Islamic Religious Education (PAI) learning innovations at the elementary education level through the use of technology, which requires institutional support, teacher competency enhancement, and the provision of adequate facilities. Theoretically, this study also enriches the body of TPACK studies by demonstrating the relevance of its application in the context of religious education. Furthermore, the findings provide opportunities for further research to design training strategies for Islamic Religious Education (PAI) teachers, particularly in digital literacy and more structured TPACK implementation, as recommended by Susrawati (2023).

4. CONCLUSION

The research results show that the application of Technological Pedagogical Content Knowledge (TPACK) in Islamic Religious Education (PAI) learning in elementary schools is a relevant strategy to respond to the demands of learning in the digital era. The integration of technology, pedagogy, and content not only increases student engagement but also strengthens their understanding of religious values. However, its implementation still faces challenges, particularly related to limited infrastructure. Therefore, systematic institutional policies are needed to strengthen learning technology facilities and infrastructure, while simultaneously increasing equitable network access in elementary schools.

From an educational management perspective, schools, along with policymakers, need to design a sustainable TPACK-based teacher professional development program. This program can be implemented through structured training, mentoring, and the optimization of Teacher Working Group (KKG) forums. In this process, the principal's leadership plays a strategic role, particularly in organizing the implementation of TPACK as part of learning planning and human resource management in schools.

Strategically, the results of this study indicate that basic education policy should not position technology merely as a complement to the learning process. Technology should be viewed as an essential component in managing Islamic Religious Education (PAI) learning. If this integration is designed in a planned manner, accompanied by strengthening teacher competencies and adequate institutional support, TPACK can make a sustainable contribution to improving the quality of learning, strengthening students' Islamic character, and achieving comprehensive basic education goals.

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