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Integration of IoT Devices in PAI Learning: Strategic Impact on Curriculum Management, Evaluation, and Resources

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ABSTRACT

This research discusses the ongoing challenges in Islamic Religious Education (PAI) learning at STAI Haji Agus Salim, specifically the mismatch between lecturers' teaching styles, limited facilities, and student characteristics. This research emphasizes the role of the Internet of Things (IoT) as a strategic tool for improving the quality of education and learning management. Using a qualitative design through phenomenological analysis involving interviews, observations, and document review, the research findings indicate that IoT can support adaptive learning, real-time assessment, and managerial effectiveness. This integration aligns with Vygotsky's constructivist scaffolding theory and the TPACK framework in supporting teachers' digital literacy. However, there are still challenges related to technological competence, protection of student data, and resistance to organizational culture change. This research concludes that IoT has the potential to drive the creation of an adaptive, inclusive, and sustainable smart campus ecosystem, and that a phased implementation in a curriculum tracking system with TPACK-based training can be considered.

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1. INTRODUCTION

Islamic Religious Education (PAI) in religious universities plays a strategic role in shaping students' character, spirituality, and academic integrity. Research shows that a spirituality-based Islamic education framework can strengthen students' religious identity (Chanifah et al., 2021), while student well-being in Islamic higher education is closely related to spiritual and moral support from the institution (Zuhdi & Syarief, 2023). In the Indonesian context, Islamic Religious Education (PAI) in higher education has also proven to be a means of developing faith, character, and attitudes of tolerance (Rahmat & Wildan, 2022). However, the effectiveness of Islamic Religious Education (PAI) learning at STAI Haji Agus Salim still faces quite complex obstacles. Various issues have emerged, ranging from disparities in teaching quality among lecturers and the weak utilization of technology to a lack of alignment between teaching methods and the diversity of student characteristics. This condition

impacts inconsistent learning experiences and low quality of academic services and hinders the achievement of adaptive and inclusive educational goals.

One of the main issues lies in the disparity in teaching styles among lecturers. Some lecturers teach in a structured and curriculum-based manner, while others rely solely on personal experience without systematic planning. This creates a significant gap in the quality of teaching and leads to a lack of uniformity in students' competency achievement. The absence of standard institutional norms and weak academic oversight mechanisms worsens the situation, which leads to this phenomenon often being justified under the guise of "academic freedom." As a result, the learning process is not always orientated towards learning outcomes but rather simply becomes a formal routine. Additionally, the diversity of student characteristics complicates the issue. Students have diverse learning styles, backgrounds, and cognitive capacities. However, the teaching methods used by lecturers are still predominantly traditional and uniform, thus failing to accommodate the diverse needs of students. Students with low cognitive abilities struggle to understand abstract concepts, while students with innovative potential feel unchallenged, and their creativity is stifled. Failure to implement this adaptive learning strategy reduces the effectiveness of Islamic religious education in shaping students' intellectual and spiritual capacity. In fact, according to research (Wahyudi & Sunarsi, 2021), religious institutions need context-based guided discovery to facilitate students' cognitive heterogeneity.

Problems also arise at the level of educational management. Many administrative staff and educational personnel still have limited technological proficiency, resulting in inefficient academic services. This has resulted in inconsistent lecture scheduling, infrequent curriculum updates, and learning evaluations that are primarily administrative. This condition highlights the need for technology-based management transformation that can support the quality of academic services (Baijun, 2024; Kabakus et al., 2023).

To understand this issue, relevant theoretical foundations are needed. Vygotsky's (1978) constructivist theory emphasizes that effective learning requires scaffolding appropriate for students' Zone of Proximal Development (ZPD) (Aprianti et al., 2025; Coffman et al., 2023; Puntambekar, 2022). In the context of STAI Haji Agus Salim, the absence of teaching standards leads to lecturers failing to provide a consistent knowledge framework, resulting in students not receiving optimal learning support. Differentiated instruction theory emphasizes the importance of learning strategies that adapt to students' cognitive diversity and learning styles (Eikeland & Ohna, 2022). Without a differentiated approach, some students will fall behind while others will not have room to develop their potential (Langelaan et al., 2024). Furthermore, the Technological Pedagogical Content Knowledge (TPACK) framework by Mishra and Koehler (2006) emphasizes that the success of modern education is highly dependent on the integration of content knowledge, pedagogy, and technology (Mishra & Koehler, 2006). However, the actual conditions at STAI Haji Agus Salim show a gap in technological competence among lecturers and educational staff. This makes learning innovation difficult to achieve, and the integration of learning technology has not yet been able to support an adaptive curriculum. Thus, Vygotsky, Tomlinson, and TPACK provide a clear theoretical framework for explaining the complexity of the issues that arise.

In this context, the integration of the Internet of Things (IoT) becomes one potential solution. IoT not only serves as supporting infrastructure but also as an intelligent system capable of transforming learning, curriculum management, evaluation, and academic services (Fatima, 2025). Through sensors and analytics platforms, IoT can map lecturers' teaching patterns, detect students' learning gaps, and provide automated support for academic staff (Yahya, 2024). Thus, IoT has the potential to address three existing core issues: (1) disparities in faculty teaching methodologies, (2) the need for an adaptive curriculum for heterogeneous students, and (3) weak educational management due to technological limitations.

However, a literature review indicates that research on IoT integration in education has focused more on the general education context or broader aspects of educational management. Research on the

use of IoT in Islamic religious education is still limited, especially in the context of Islamic religious universities. There hasn't been much research that delves deeply into how IoT can bridge the teaching gap, build adaptive curricula, and respond to students' cognitive diversity in religious educational settings. This gap indicates a significant research gap.

This research aims to fill that gap by examining how the integration of IoT can reconstruct the Islamic Religious Education (PAI) learning ecosystem at STAI Haji Agus Salim. Specifically, this research aims to address the issue of how to integrate IoT devices to align with the disparities in lecturers' teaching methodologies and establish adaptive curriculum standards at STAI Haji Agus Salim. Referring to Vygotsky's constructivism framework, differentiated instruction theory, and the TPACK framework, this research not only offers practical contributions to improving the quality of learning and educational management but also provides a theoretical contribution to the literature on technology-based Islamic education.

2. METHODS

This research employs a qualitative approach with a case study method to explore the integration of Internet of Things (IoT) devices in Islamic Religious Education (PAI) learning and its impact on curriculum management, evaluation, and resources at STAI Haji Agus Salim. The use of the case study method aims to understand the issues in depth (Assyakurrohim et al., 2023).

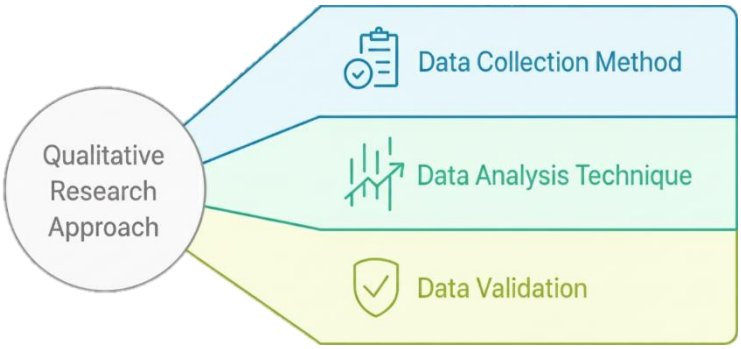

Figure 1. Research Design

2.1. Participants

The research subjects were selected using purposive sampling to ensure representation of diverse experiences and roles. Participants included 6 PAI lecturers, 15 students, and 3 educational staff/administrators directly involved in the learning process and academic management. This number is considered sufficient to obtain rich and diverse data. This number of participants is considered sufficient in phenomenological qualitative research because the main focus is not on statistical generalization but on the depth of exploring the participants' experiences. According to general recommendations for phenomenological research, a number of participants between 5 and 25 can already yield rich data (Huyler & McGill, 2019; Morse, 2000). With the composition of lecturers, students, and staff, this research is expected to achieve data saturation, which is the condition when no new themes emerge from the interviews and observations. This methodology ensures that the data obtained is sufficient to represent the phenomenon of IoT integration in PAI learning at STAI Haji Agus Salim.

2.2. Data Collection Techniques

Data was collected through three main techniques: first, in-depth interviews with lecturers, students, and staff to explore their experiences, perceptions, and challenges regarding IoT integration; second, direct observation of teaching practices and the use of technological devices in academic

activities; and third, document analysis, including relevant curricula, evaluation reports, and academic records.

2.3. Data Analysis

The analysis was conducted inductively using a phenomenological approach. This study uses Colaizzi's seven-step analysis Colaizzi (Colaizzi, 1978):

a. Read the entire interview transcript repeatedly.
b. Extract significant statements.
c. Formulate the meaning of those statements.
d. Group the meanings into main themes.
e. Develop a comprehensive description of the phenomenon.
f. Integrate the description into a more comprehensive conceptual framework.
g. Validate the results with participants (member checking).

Next, the analysis process used manual coding techniques by marking significant statements in the transcripts and then grouping them into conceptual categories (e.g., technological challenges, teaching disparities, or organisational resistance). Main themes emerge from this category, providing a comprehensive explanation of the phenomenon.

2.4. Theoretical Framework

The analysis of the research results is supported by a theoretical framework that includes:

a. Constructivism theory (Vygotsky) on scaffolding and ZPD.
b. Differentiated instruction theory (Tomlinson) related to students' cognitive diversity.
c. The TPACK framework (Mishra & Koehler), which connects content, pedagogy, and technology aspects.
d. Educational management concepts to explain the impact of IoT on academic governance (Tongkachok et al., 2021).

This research design provided a deep understanding of the effectiveness of IoT integration in Islamic Religious Education (PAI) learning, along with strategic recommendations to improve the quality of educational management at STAI Haji Agus Salim.Teori konstruktivisme (Vygotsky) tentang scaffolding dan ZPD.

3. FINDINGS AND DISCUSSION

3.1. Findings

The phenomenological analysis used in this study allows researchers to explore the subjective experiences of educational actors at STAI Haji Agus Salim. The research subjects were selected using purposive sampling techniques to ensure representation of experiences from various roles, including 6 Islamic Religious Education (PAI) lecturers, 15 students, and 3 educational staff/administrators. This number of participants is considered sufficient to obtain rich, diverse data that aligns with the goals of phenomenological research, which focuses on the depth of meaning rather than the breadth of data. Data was analyzed using Colaizzi's seven-step approach, resulting in a mapping of personal and collective experiences summed up into three main finding categories: (1) disparities in lecturers' teaching styles, (2) students' need for interactive learning, and (3) limitations in academic management along with proposed IoT integration.

3.1.1. Disparities in Lecturers' Teaching Styles

The first finding refers to the lack of uniformity in the teaching approaches of PAI lecturers. Of the six lecturers interviewed, most structured their lessons based on the Semester Learning Plan (RPS) and curriculum materials, while others tended to use traditional methods based on personal experience. A lecturer stated:

"I have created a syllabus according to campus standards, but students seem less interested if I only explain theory. Meanwhile, my colleagues tell more stories based on their life experiences, even without a clear plan." (Lecturer 3)

This gap in teaching styles creates inconsistency in students' learning experiences. Students accustomed to systematic learning feel confused when attending classes based solely on narration, while students who prefer practical stories get bored with classes that are too theoretical. Additionally, the limited physical facilities worsen the situation. Some lecturers complained about the blurry projector quality and unstable internet network, which often hindered presentations of digital media-based materials. This finding shows that without consistent teaching standards, achieving the effectiveness of Islamic Religious Education (PAI) learning becomes difficult.

3.1.2. Students' Need for Interactive Learning

Out of the 15 students interviewed, almost all emphasized the importance of more interactive, relevant, and responsive learning. They stated that the conventional method of long lectures made it difficult for them to maintain focus while studying. A student described their experience as follows:

"If the lecturer only explains from the book, I get bored quickly. I prefer when there are discussions or simulations, especially if we can utilize technology in real time." (Student 7)

This student's expectation aligns with the principles of constructivism, where knowledge is built through active experience and interaction, not just passive information reception. They also believe that integrating the Internet of Things (IoT) can create a more personalized learning experience, for example, through systems capable of providing quick feedback, automatically detecting attendance, and adjusting material to individual needs. This need reflects students' desire to move away from a homogeneous learning pattern towards a more adaptive and contextual model. Their hope aligns with the principles of constructivism, where knowledge should be built through interaction and experience, not just passive reception.

3.1.3. Limitations in Academic Management and Proposed IoT Integration

The results of interviews with 3 educational staff/administrators indicate that limitations in technology utilization are one of the biggest obstacles in educational management. Staff complained about difficulties in managing academic data, compiling curriculum evaluations, and monitoring the effectiveness of learning. An administrator explained:

"We still use manual methods for monitoring attendance and evaluation. Data is often scattered, and it's difficult to make quick decisions. If there were a technology-based system, the process might be easier and more transparent." (Administrator 2)

Interestingly, one of the staff members even proposed implementing IoT integration in campus management. According to him, this technology can be used to manage class schedules, monitor classroom space utilization, and provide real-time evaluation data. This indicates an awareness on the part of management that utilizing IoT is not only beneficial for lecturers and students but can also improve overall academic governance.

3.1.4. Synthesis of Findings

Overall, the results of this study confirm that there are three main issues affecting the effectiveness of Islamic Religious Education (PAI) learning at STAI Haji Agus Salim:

a. Disparities in lecturers' teaching methodologies, leading to uneven student achievement.
b. Students' need for interactive and adaptive learning that has not been met.
c. Limitations in academic management due to low staff technological literacy, impacting slow decision-making and weak curriculum evaluation.

3.2. Discussion

3.2.1. Integration of IoT in Islamic Religious Education Learning Based on Phenomenological Analysis

The complexity of the subjective experiences of educational actors at STAI Haji Agus Salim has been identified through phenomenological analysis in this study. This finding aligns with the research by Badriyah et al. (2025), which indicates that Islamic universities still face the same problems, namely low quality of education due to traditional teaching practices, inadequate lecturer competence, and insufficient facilities and infrastructure, which hinder effective academic processes (Badriyah et al., 2025).

Additionally, similar findings are supported by other research indicating that Islamic education continues to face significant challenges, including limited learning resources, still-classic learning methods, and human resource quality that is not yet optimal in mastering the use of IoT and interactive digital media (Ridha et al., 2025; Rohmiati, 2025; Siregar et al., 2025; Zainuddin et al., 2024). In the era of Society 5.0, villages and Islamic schools have great opportunities through the integration of IoT and interactive digital media to improve the quality of religious learning (Almardiah & Muis, 2025; Suhendi, 2024). Other technologies such as IoT, e-learning, and AI-based media also have the potential to increase learning motivation, student engagement, and teaching effectiveness (Permana & Hasanah, 2024).

Other research confirms that technological knowledge, 21st-century skills, and policy support are determining factors for teacher professionalism. Teachers still face challenges in terms of adaptation, accessibility, and the need for continuous training (Masitoh & Purbowati, 2024). More specifically, the adoption of IoT in Islamic learning is still very low. One study found that IoT can improve the effectiveness and efficiency of the learning process, but its implementation is limited by teachers' low knowledge, inadequate infrastructure, and reluctance to abandon traditional teaching styles (Ariyanti et al., 2024).

3.2.2. Constructivism and Technology Response

These field findings align with the idea of scaffolding, which, according to Vygotsky (1978), is a principle of constructivism in technology use—particularly the concept of scaffolding through relevance and the gradual withdrawal of support (fading support) by the teacher as students begin to internalize knowledge—reflected in students' demands for an adaptive learning environment that can be offered through IoT (including real-time collaborative platforms) (Vygotsky, 1978). Ţălu's (2025) article emphasizes that integrating IoT into higher education can design personalized learning spaces based on smart classrooms and adaptive platforms, which directly enhances student engagement and supports the principles of technology-based constructivism (Ţălu, 2025).

Educational literature also emphasizes the idea that scaffolding should be adaptive and contextual, adjusting support to students' Zone of Proximal Development (ZPD), thereby facilitating their engagement towards higher understanding (Wood et al., 1976). A number of empirical studies show that digital media as a scaffolding tool is proven effective. For example, in online Problem-Based Learning (PBL) models, technologies such as Learning Circles and Group Chat Boxes have been shown to support innovative pedagogy, enhance student engagement, and foster collaborative learning through technology (Zhong & Lyu, 2022). The integration of IoT within the higher education framework has proven capable of creating personalized learning conditions: smart classrooms, adaptive platforms, and real-time systems have been shown to support technology-based constructivism (Ţălu, 2025). However, the study is still theoretical, although it is consistent with newly developed adaptive learning and personalization models (Eappen et al., 2025). On a larger scale, review studies show that IoT can be used to enhance higher-order thinking skills, teamwork, and socialization through direct interaction with the real world. However, cognitive load and system complexity are major obstacles, especially for students with limited technical backgrounds (Shah & Iqbal, 2024).

3.2.3. Educational Management and IoT Transformation

Management's perspective reveals institutional barriers in the form of inefficiencies in resource management and learning processes. This challenge can be overcome through the integration of IoT, which utilizes data for decision-making, such as automated energy monitoring systems and learning analytics. The study by Pajar Machmud et al. (2025) shows that IoT has the potential to reduce educational operational costs by up to 35% while simultaneously improving the quality of real-time measurement-based evaluation (Machmud et al., 2025).

The integration of IoT as a basis for data-driven decision-making—for example, through automated energy monitoring and learning analytics—is considered a strategic option for addressing issues found in the field of education management. The study by Mylonas et al. (2019) shows that using IoT sensors installed in school buildings can provide practical insights into facility management (Mylonas et al., 2019).

A literature review on IoT as a learning analytics approach also indicates that integrating this technology can enable responsive and dynamic data-driven decision-making (Zhu et al., 2019). Media IoT enables monitoring of both the learning environment and user behavior, allowing evaluation and management processes to be tailored to real needs (Meylani, 2024).

Additionally, Putri et al. (2025) highlight that IoT, when combined with artificial intelligence (AI) on a smart campus, can not only save energy but also improve security by up to 30 per cent and speed up operational responses by up to 40 per cent (Putri et al., 2025). This system allows managers to maximize the use of air conditioning energy, which is the most energy-intensive component in higher education. The GENIIOT project in Brazil also demonstrated that IoT can be used to optimize the use of cooling energy, thereby improving operational efficiency and reducing energy costs by up to 40% (Kandil et al., 2025; Yasuoka et al., 2023).

Pedagogically, the use of IoT-based learning analytics enables more personalized learning. Sensors and smart devices provide real-time information about participation and engagement levels, as well as students' physical condition during the learning process. This has two strategic impacts for lecturers: (1) making education management more efficient and cost-effective based on the principles of adaptive learning and technology-based constructivism, and (2) improving the quality of learning through data-driven evaluation that supports adaptive decision-making and real-time interventions.

From the problems mentioned above, the implementation of IoT at STAI Haji Agus Salim requires a comprehensive approach. First, a TPACK framework-based training programmed is needed for lecturers and managers to ensure the harmonious integration of technological, pedagogical, and content knowledge. Second, the ethical aspects of student data protection must be strengthened through GDPR principles, including transparency, data minimization, and explicit consent (Löchner et al., 2025). Third, infrastructure readiness is a key requirement, whether through strengthening internet networks, providing IoT devices, or continuous technical support (Kandil et al., 2025). Fourth, a participatory change management strategy is needed, such as building a sense of urgency, forming a supporting coalition, and demonstrating short-term successes as proof of the tangible benefits of IoT (Díaz-Garcia et al., 2023; Ezzeddine et al., 2023). By combining these four elements, STAI Haji Agus Salim has the opportunity to develop an IoT integration model that is not only operational but also ethical, inclusive, and sustainable for the entire academic community.

3.2.4. Theoretical Convergence and Practical Implications

The intersection of phenomenological analysis, constructivism, and educational management confirms that the introduction of IoT in Islamic Religious Education (PAI) learning not only touches upon technical aspects but also impacts the epistemological and practical dimensions of education. From a phenomenological perspective, the subjective experiences of students and lecturers must be considered as the basis for learning barriers, such as monotonous teaching methods or inadequate facilities (Badriyah et al., 2025).

Meanwhile, Vygotsky's constructivist theory (1978) stresses the importance of scaffolding and social interaction, which can now be enhanced by collaborative and content-adaptive IoT technology

(Vygotsky, 1978). From an educational management perspective, the TPACK framework (Mishra & Koehler, 2006) highlights the importance of educators' and administrators' ability to connect technology, pedagogy, and content to create a new paradigm, where the IoT serves as a system enabler—connecting personalized learning, managerial efficiency, and data-driven evaluation.

Pilot projects, such as an IoT-based curriculum tracking system, can conduct strategic trials in stages to make PAI education more responsive to the demands of the digital era. At the managerial level, IoT can be used to reorganize the campus workflow towards a smart campus ecosystem—including automated energy monitoring systems, sensor-based attendance, and learning analytics dashboards—that supports data-driven decision-making.

Additionally, inclusivity is an important factor because students have diverse learning styles and special needs. IoT offers assistive technology solutions for students with disabilities and multimodal content that can support different learning preferences, although the cost of implementation remains a barrier (Ţălu, 2025). One realistic approach is through a phased method, such as a pilot project for an IoT-based curriculum tracking system with training for management staff on using IoT for education. In this way, PAI education can be directed to become more responsive, collaborative, and in line with the demands of the digital era, while still maintaining ethical and sustainability standards (Subagyo et al., 2018).

IoT should be implemented in phases through pilot projects with clear goals and indicators (e.g., an IoT-based curriculum tracking system, a pilot smart classroom in one faculty, or an energy monitoring system in one building). This pilot project can be used to test infrastructure readiness, evaluate cost/energy impact, train personnel, create privacy policies, and generate short-term wins that can reduce organizational resistance.

The literature review shows that the potential of IoT in building smart and adaptive learning environments is very promising. However, its successful implementation still requires infrastructure readiness, personnel competence (TPACK), and data control (Ferreira et al., 2024).

The findings of this research suggest a strong correlation between students' subjective experiences, pedagogical needs, and the institution's managerial capacity to respond to IoT integration. Critical evaluation indicates that the main barriers are not only technical constraints but also the willingness of human resources and the existing pedagogical framework. To explain these findings, an analysis matrix was created that combines the theoretical framework, interview results, IoT-based solutions, and implementation challenges.

Table 1. Analysis of IoT Integration at STAI Haji Agus Salim

Discussion Aspects	Theoretical Framework	Interview Findings	IoT Solutions	Challenges
Subjective Learning Experience	Phenomenological Analysis	Lecturer: The teaching style is not very suitable, and facilities are limited (blurred projector). Students: Methods are monotonous, and material is not very relevant.	Adaptive learning platform (AI/IoT-assisted LMS), attendance sensors for real-time interaction, and student feedback dashboard	Resistance to change in traditional methods

Knowledge Development	Constructivist Theory (Vygotsky, 1978)	Students desire interactive and contextual learning.	IoT-based educational games, real-time collaborative forums, and VR/AR simulations based on sensor data	Limitations of creativity in digital content design
Resource Management	Educational Management (TPACK)	Management personnel: -Limited resources -Difficulty in comprehensive evaluation -Staff lacks technological literacy	Automatic energy monitoring system, facility dashboard (real-time), presence/occupancy sensor, predictive maintenance	Technological Pedagogical Content Knowledge (TPACK) gap
Learning Evaluation	Educational Management	Difficulty in monitoring the effectiveness of the curriculum	Real-time assessment tools, automated feedback, and predictive analytics for academic impact and attention	Student privacy data protection
Learning Inclusivity	Constructivist + Phenomenological	Student characteristics are diverse (learning styles, interests)	Assistive technology (captioning, screen readers), multimodal content (video/audio/text)	High implementation cost
Implementation Strategy	TPACK + Educational Management	The need for training for management staff	Pilot project: IoT-based curriculum tracking system; TPACK training module ("IoT for Education"); GDPR-style privacy policy implementation	Infrastructure investment needs

Table 1 is designed to present aspects of IoT implementation relevant to the three main research problems: faculty teaching disparities, student adaptive learning needs, and limitations in academic management. As can be verified from the table above, the implementation of the Internet of Things (IoT) in the context of higher education, particularly at STAI Haji Agus Salim, serves not only as a mechanism for technical assistance but also as a driver of change in educational management. At the learning level, IoT enables the creation of a more personalized, interactive, and adaptive learning environment tailored to students' needs. At the management level, this technology helps improve

resource management efficiency, strengthen curriculum evaluation, and ensure inclusivity in the learning process. However, a number of challenges must also be anticipated, including the digital skills gap, resistance to change from traditional approaches, and student data privacy issues. Therefore, the integration of IoT needs to be planned with a phased implementation strategy, which includes education for educational staff, the development of relevant infrastructure, and an adaptive and sustainable policy framework.

To better visualize the significant changes from the implementation of IoT, Table 2 summarizes the "Before vs. After" conditions related to the three main research issues at STAI Haji Agus Salim.

Table 2. Before vs After IoT Integration

Main Problem	Before IoT Integration	After IoT Integration	Impact/Benefits
Disparities in faculty teaching	Teaching methods are not uniform or monotonous	Smart classrooms, adaptive platforms, and interactive simulation	Learning effectiveness increases, and scaffolding is appropriate for the student's ZPD
Adaptive learning needs of students	The teaching methods are characterized by passive learning and minimal interaction	Learning analytics, real-time collaborative forums, AR/VR	Motivation, engagement, and understanding increase
Limitations of academic management	Data manual, slow evaluation, staff lacks technological literacy	Real-time dashboards, energy monitoring, predictive maintenance	Management efficiency, quick decisions, transparency

From Table 2, it can be seen that the integration of IoT brings significant transformation in learning, facility management, and academic management. This impact not only improves the quality of education but also creates operational efficiency and supports inclusivity, transforming the paradigm of PAI education at STAI Haji Agus Salim to be more adaptive, personalized, and data-driven.

4. CONCLUSION

This research confirms that the implementation of the Internet of Things (IoT) in Islamic Religious Education learning at STAI Haji Agus Salim brings significant changes to the teaching and learning process and academic management. This technology enables more adaptive, interactive, and personalized learning, while also improving resource management efficiency, evaluation transparency, and decision-making accuracy. On the other hand, this study identifies several significant challenges, including limitations in staff technological competence, student data protection, suboptimal digital infrastructure, and resistance to organizational culture change.

To overcome these obstacles and maximize the benefits of IoT, a holistic and phased approach is needed. Strategic steps include enhancing faculty and staff capacity through TPACK framework-based training, implementing pilot projects such as curriculum tracking platforms or smart classrooms, strengthening digital infrastructure, and developing transparent and ethical privacy policies. IoT integration should be viewed as more than just a technical innovation; it serves as a facilitator for a smart campus ecosystem that supports personalized learning, efficient management, and the sustainability of Islamic education. Further research could expand the study by comparing Islamic universities in Indonesia, utilizing learning analytics data, and exploring the integration of IoT with other technologies such as AI and augmented reality in order to build an adaptive, inclusive, and sustainable digital education ecosystem.

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