



Principal Strategies for Teacher Professional Development at TK IT Al Ittihad Pekanbaru

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ARTICLE INFO	ABSTRACT
Keywords: Collaborative Professional Learning; Early Childhood Education; Instructional Leadership; Principal Strategy; Teacher Professional Development.	Teacher professional development is essential for improving the quality of early childhood education and requires effective principal strategies to support continuous professional learning. However, evidence on such strategies in integrated Islamic early childhood education settings remains limited. This study aimed to analyse principal strategies for teacher professional development at TK IT Al Ittihad Pekanbaru, Indonesia. A descriptive qualitative single-case study was conducted involving four purposively selected participants, comprising the principal, vice principal, and two teachers. Data were collected through semi-structured interviews, non-participant observations, and document analysis, and analysed using Braun and Clarke's reflexive thematic analysis supported by ATLAS.ti 9. The findings revealed eight interconnected themes: strategic planning, teacher professional development initiatives, competency strengthening, professional learning culture, monitoring and evaluation, follow-up actions, supporting factors, and implementation barriers. The findings suggest that, within the context of TK IT Al Ittihad Pekanbaru, teacher professional development was perceived to be supported through interconnected practices involving instructional leadership, collaborative professional learning, continuous improvement, and the integration of Islamic values. These findings contribute to the educational leadership literature by providing contextual evidence on principal strategies for teacher professional development in integrated Islamic early childhood education settings.
Article History Received: July 25, 2026 Revised: August 03, 2026 Accepted: August 16, 2026	
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To cite this article : Afriliana, Hasanah, E., Zuhaery, M. (2026). Principal Strategies for Teacher Professional Development at TK IT Al Ittihad Pekanbaru. <i>Vokatek: Journal of Research and Community Service</i> , 4(2), 126-147. Doi. 10.61255/vokatek.v4i2.1674	

INTRODUCTION

Early childhood education (ECE) plays a fundamental role in developing high-quality human capital by fostering children's cognitive, social, emotional, linguistic, and character development during the early years (Ghosh, 2024; Kamiya & Nomura, 2023). Consequently, the quality of ECE services largely depends on teacher professional development, as teachers are the primary agents responsible for facilitating children's learning and development (Abarua et al., 2023; Umiyati et al., 2025). In recent years, rapid technological advances, the digitalisation of education, and the increasing demand for twenty-first-century competencies have intensified the need for continuous teacher professional development. UNESCO's *Reimagining Our Futures Together* emphasises that teacher professional development should move beyond improving individual competencies toward collaborative, reflective, and continuous learning that enables teachers to become agents of educational change (Kamali & Javahery, 2025; UNESCO, 2021). Similarly, West & Bautista (2022) argue that continuous professional development is a key factor in improving the quality of early childhood education, particularly in responding to curriculum reform, pedagogical innovation, and digital transformation.

School leadership has been widely recognised as a critical factor in supporting teacher professional development. Contemporary principals are expected to perform not only administrative responsibilities but also instructional leadership roles by fostering professional learning cultures, facilitating teacher collaboration, conducting instructional supervision, and creating school

environments that encourage continuous learning (Hallinger et al., 2020, 2025). Calderón (2023) found that instructional and distributed leadership positively contribute to teacher professional development, while Mthanti & Msiza (2023) emphasised that the effectiveness of continuous professional development programmes depends largely on principals' ability to plan, manage, and evaluate professional learning systematically.

Previous studies have generally examined principal strategies from three perspectives. First, research has focused on instructional leadership through academic supervision as a means of improving teachers' professional competencies (Gulo et al., 2026; Lorensius et al., 2022). Second, studies have explored professional learning communities as collaborative spaces for reflection, knowledge sharing, and improving instructional practice (Khasawneh et al., 2023; West & Bautista, 2022). Third, other studies have investigated continuous professional development programmes through training, mentoring, and school-based professional learning initiatives (Mthanti & Msiza, 2023; Mujiyat et al., 2026). Although these studies have generated valuable insights, they tend to examine each strategy independently and provide limited understanding of how principals integrate multiple strategies into a coherent and sustainable teacher professional development system. Furthermore, empirical evidence from integrated Islamic early childhood education institutions remains scarce, despite their distinctive educational characteristics.

In Indonesia, teacher professional development has become a national priority through the *Merdeka Belajar* policy, the implementation of the *Merdeka Curriculum*, and the strengthening of principals' roles as instructional leaders responsible for enhancing teachers' professional capacity (Kementerian Pendidikan Riset dan Teknologi, 2022). Nevertheless, early childhood education institutions continue to face challenges, including disparities in teachers' competencies, limited access to relevant professional development opportunities, underutilisation of educational technology, and the limited sustainability of continuous professional development programmes (Duraku et al., 2022; OECD, 2023). These challenges require principals to move beyond administrative functions by promoting collaborative professional learning, providing continuous mentoring, and establishing school environments that support lifelong professional learning (Harris & Jones, 2025). Studies conducted in Indonesia have also demonstrated that instructional leadership strengthens professional learning communities and supports the implementation of teacher professional development programmes (Larosa et al., 2025; Susiana et al., 2025).

This study was conducted at TK IT Al Ittihad Pekanbaru, an integrated Islamic early childhood education institution that has consistently implemented teacher professional development programmes integrating pedagogical competence with Islamic values. This context provides an opportunity to examine how principal strategies are implemented within an integrated Islamic educational setting. Accordingly, this study addresses the following research question: How does the principal plan, implement, monitor, evaluate, and follow up teacher professional development strategies in an integrated Islamic early childhood education institution? The study therefore aims to analyse principal strategies for teacher professional development at TK IT Al Ittihad Pekanbaru, including the factors that facilitate and hinder their implementation. By examining these strategies as an integrated process within a single institutional context, this study provides contextual evidence and context-specific insights into principal strategies for teacher professional development in an integrated Islamic early childhood education setting.

METHOD

This study employed a descriptive qualitative approach using a single-case study design to obtain an in-depth understanding of principal strategies for teacher professional development at TK IT Al Ittihad Pekanbaru, Indonesia (Villamin et al., 2025). The school was purposively selected as a positive case because it has consistently implemented various teacher professional development programmes, including instructional supervision, professional training, mentoring, and professional learning communities. The case was selected to provide contextual insights into the implementation of principal strategies within an integrated Islamic early childhood education institution rather than to generate findings that are statistically generalisable.

The participants consisted of four individuals: the principal (N1), the vice principal (N2), and two teachers (N3 and N4). At the time of the study, the school employed 11 teachers. Participants were selected through purposive sampling based on their direct involvement in planning, implementing, and evaluating teacher professional development programmes, as well as their willingness to participate in the study (Memon et al., 2024). The principal was recruited as the key informant because of responsibility for teacher professional development policies, while the vice principal was selected for coordinating programme implementation. The two teachers were selected because they were senior teachers who had actively participated in various professional development programmes and possessed relevant experience related to the research objectives. Participant selection followed the principle of information adequacy, ensuring that sufficient information was obtained to address the research objectives. The study was conducted from 2 February to 5 June 2026 after formal permission had been obtained from the school.

Data were collected through semi-structured interviews, non-participant observations, and document analysis. The interview protocol was developed based on the research objectives and covered five domains: planning, implementation, monitoring, evaluation, and the supporting and inhibiting factors of teacher professional development. All interviews were conducted in Indonesian, audio-recorded with participants' informed consent, and transcribed verbatim. A total of four interview sessions were conducted, with one interview session for each participant. Each interview lasted approximately 30–45 minutes. The interview quotations presented in this article were translated from Indonesian into English by the researchers. To preserve the original meaning, the translated quotations were carefully compared with the original transcripts to ensure semantic equivalence. Non-participant observations were conducted from 2 to 4 February 2026 through three observation sessions, with one observation conducted each day. Each observation session lasted from 07:30 to 11:00, following the school's regular instructional schedule, to observe teacher professional development activities, instructional supervision, and classroom teaching as the context for implementing the principal's strategies. Three institutional documents were also analysed: the Human Resource Development Programme, the Instructional Supervision Instrument, and the Teacher Performance Evaluation Programme. These documents were used to verify the interview and observational findings and to strengthen the evidence related to the planning, implementation, monitoring, and evaluation of teacher professional development strategies.

The trustworthiness of the findings was established through source triangulation, methodological triangulation, member checking, peer debriefing, and an audit trail (Ahmed, 2024). Source triangulation involved comparing information obtained from the principal, vice principal, and teachers, whereas methodological triangulation compared evidence generated from interviews, observations, and document analysis. Member checking was conducted after transcription by asking participants to review summaries of their interview responses to ensure the accuracy of the recorded information. All participants confirmed that the summaries accurately reflected their views and experiences. This process resulted only in minor clarifications to several interview statements and did not require any substantive revisions to the codes, themes, or overall interpretations. Peer debriefing involved discussions with fellow researchers regarding the coding process and theme development to refine data interpretation. These discussions resulted in minor refinements to the wording and organisation of several codes and themes to improve analytical clarity; however, the overall thematic structure and interpretation remained unchanged. An audit trail was maintained by documenting the entire research process, including data collection, coding, theme development, and analytical decisions, thereby ensuring the transparency and traceability of the study.

Data were analyzed using Braun & Clarke (2022) reflexive thematic analysis. The units of analysis consisted of meaning units identified from interview transcripts, observation notes, and documentary data. An inductive analytical approach was employed through six stages: (1) familiarising with the data through repeated reading; (2) generating initial codes; (3) grouping codes into preliminary themes based on shared meanings; (4) reviewing and refining the themes; (5) defining and naming the themes; and (6) producing the final report. All coding was conducted by the researcher, while theme development and refinement were discussed collaboratively with the research team to enhance the credibility of the interpretations. ATLAS.ti 9 was used to facilitate data

management, coding, and analytical documentation; however, the interpretation of the findings remained the responsibility of the researcher.

RESULTS AND DISCUSSION

The thematic analysis generated eight major themes that describe the principal's strategies for teacher professional development at TK IT Al Ittihad Pekanbaru, Indonesia. These themes were developed through an iterative process of coding, code categorisation, and theme development based on data obtained from semi-structured interviews, non-participant observations, and document analysis. The eight themes comprise strategic planning for teacher professional development, teacher professional development initiatives, strengthening teacher competencies, fostering a professional learning culture, monitoring and evaluation, follow-up actions for teacher professional development, supporting factors, and barriers to strategy implementation. To facilitate understanding of the findings, the conceptual relationships among these themes are illustrated in a thematic map, as presented in Figure 1.

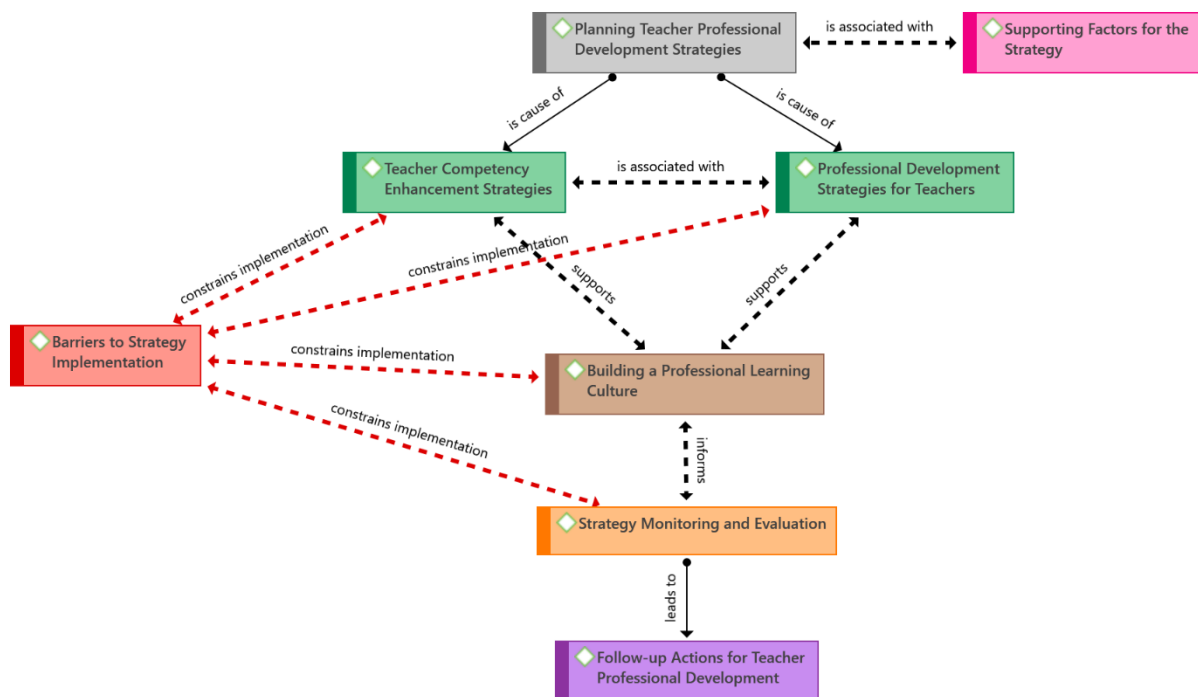


Figure 1. Thematic Map of Principal Strategies for Teacher Professional Development

Planning Teacher Professional Development Strategies

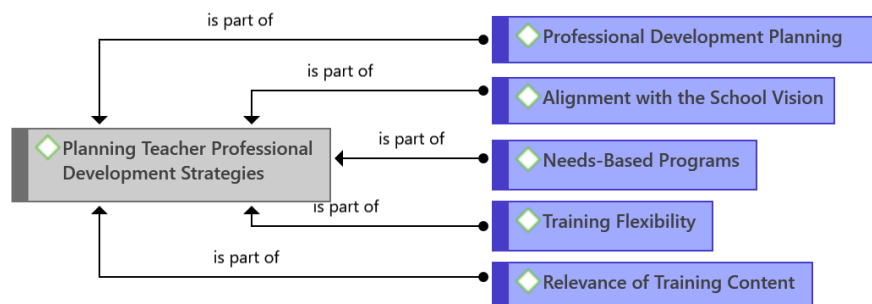


Figure 2. Thematic Map of Planning Teacher Professional Development Strategies

Figure 2 illustrates that the theme of planning teacher professional development strategies comprises five subthemes: professional development programme planning, alignment with the school vision, needs-based programmes, flexibility in training implementation, and the relevance of training content. These subthemes describe how the principal designs teacher professional development programmes through a planning process that considers both the school's strategic direction and teachers' professional needs.

The findings indicate that teacher professional development planning begins with the design of structured and continuous programmes. These programmes include professional training, seminars, workshops, in-house training, benchmarking visits (*study tiru*), and professional certification as initiatives to enhance teachers' competencies. As Participant N1 stated, *"As the principal, I strive to develop teacher professional development programs in a planned and sustainable manner."* (N1). This finding is supported by the Human Resource Development Programme document of TK IT Al Ittihad Pekanbaru, which demonstrates that the school has systematically planned a range of continuous professional development activities, as presented in Table 1.

Table 1. Human Resource Development Programs at TK IT Al Ittihad Pekanbaru

Program	Objective	Funding Source	Status
Tahsin and Tahfidz Program for YKPI Staff	To improve teachers' and staff members' Qur'anic competencies	YKPI/School Budget (RAPBS)	Implemented
Teacher Cluster Meetings	To promote the sharing of best practices and strengthen teacher collaboration	YKPI/School Budget (RAPBS)	Implemented
Quranic Camp	To strengthen teachers' Islamic values and competencies	YKPI/School Budget (RAPBS)	Implemented
Benchmarking Visits	To adopt best practices from other schools	YKPI/School Budget (RAPBS)	Implemented

Source: Adapted from the Human Resource Development Program Document of TK IT Al Ittihad Pekanbaru.

Programme planning was also aligned with the school's vision and informed by an assessment of teachers' professional needs. As one teacher (N3) stated, *"Another expectation I have is that teacher development programs should remain aligned with the school's vision"* (N3). This view was reinforced by the principal (N1), who explained, *"When discussing strategy, the first step we take is to identify the needs of each teacher"* (N1). These findings indicate that the planning process integrates the school's strategic direction with teachers' professional needs, enabling professional development programmes to be designed in ways that are responsive to the school's context.

The school also adopts a flexible approach to implementing professional development activities to minimise disruption to teaching and learning. Furthermore, the selection of training content is informed by the challenges teachers encounter in their daily classroom practice. As one teacher (N4) noted, *"The training content is relevant to the challenges we face in our daily classroom practice"* (N4). However, the vice principal (N2) acknowledged, *"On the other hand, the available training content is sometimes not fully aligned with the actual needs of teachers in our school"* (N2). These findings suggest that flexibility in programme implementation has become an important component of the school's professional development strategy. Nevertheless, further efforts are needed to ensure that training content more closely reflects teachers' professional needs. Overall, the theme of planning teacher professional development strategies demonstrates that the principal develops teacher professional development programmes through a planning process aligned with the school's vision,

informed by teachers' identified needs, supported by flexible implementation, and guided by the relevance of training content as the foundation for continuous teacher professional development.

Professional Development Strategies for Teachers

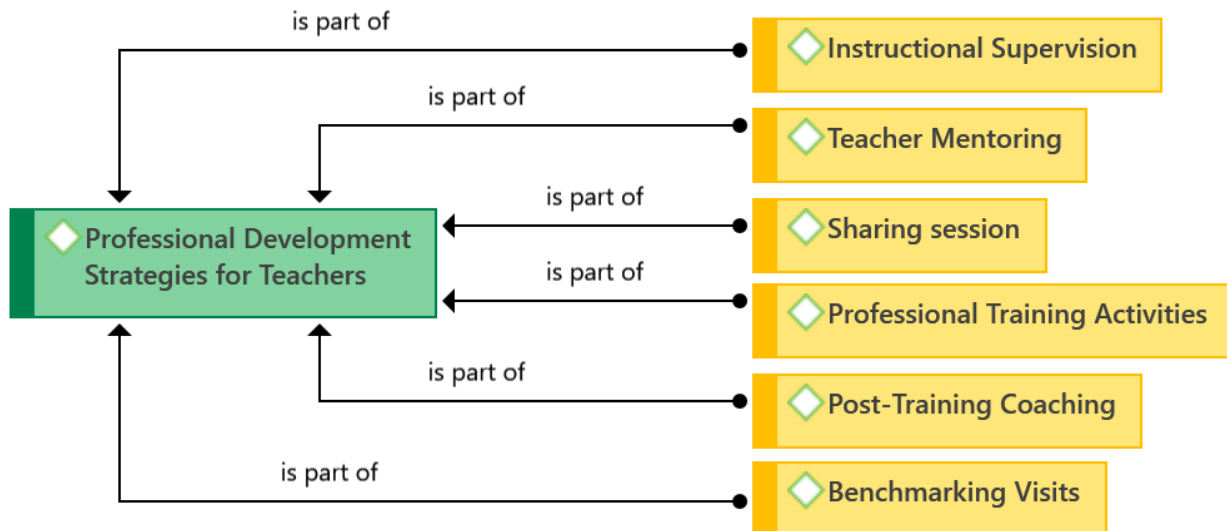


Figure 3. Thematic Map of Professional Development Strategies for Teachers

Figure 3 illustrates that the theme of professional development strategies for teachers comprises six subthemes: instructional supervision, teacher mentoring, sharing sessions, professional training activities, post-training coaching, and benchmarking visits (study tiru). These subthemes represent the various strategies implemented by the principal to support teachers' continuous professional development.

The findings indicated that professional development strategies for teachers began with the systematic implementation of instructional supervision. Instructional supervision was conducted not only to evaluate classroom teaching but also to identify each teacher's professional development needs, providing the basis for determining appropriate follow-up support. As the principal (N1) explained, "We also conduct academic supervision systematically, at least twice each semester" (N1). This finding was supported by the Instructional Supervision Instrument, which demonstrates that the supervision process covered lesson opening, subject matter mastery, instructional processes, the use of learning media, learning assessment, lesson closure, and the integration of Islamic values, as presented in Table 2.

Table 2. Academic Supervision Instrument

Supervision Component	Assessment Aspect
Lesson opening	Communicating learning objectives, conducting apperception, and preparing students for learning
Content mastery	Delivering instructional content systematically according to the lesson plan
Learning process	Classroom management, student participation, and classroom discussion
Use of instructional media	Appropriate use of teaching and learning media
Learning assessment	Evaluation of learning objectives and indicators
Lesson closure	Reviewing lesson content and providing follow-up activities
Integration of Islamic values	Integrating Qur'anic values, moral character, and exemplary behavior

Source: Adapted from the Academic Supervision Document of TK IT Al Ittihad Pekanbaru.

In addition to instructional supervision, professional development support is provided through teacher mentoring and sharing sessions. More experienced teachers mentor their colleagues in developing instructional competencies, while teachers who have participated in external training programmes are encouraged to share their knowledge, experiences, and good practices with other teachers. As the principal (N1) stated, *"Teachers who have attended training are then asked to share what they have learned with other teachers through sharing sessions"* (N1). These findings suggest that professional development support extends beyond formal training by promoting peer learning as an integral component of teachers' professional development.

The school also organised various professional training activities through training programmes, workshops, In-House Training (IHT), lesson study, coaching, mentoring, and benchmarking visits (study tiru) to broaden teachers' professional perspectives and strengthen instructional practice. As the principal (N1) explained, *"The school regularly organises training, workshops, In-House Training, lesson study, coaching, and mentoring"* (N1). Although these activities have been implemented, one teacher (N3) expressed the expectation that future professional development programmes should include a stronger practical orientation. As the teacher stated, *"I also hope that, in the future, there will be more practice-oriented training so that what we learn can be applied directly in the classroom"* (N3). This expectation indicates that, although various professional development activities have been implemented, their practical application in classroom instruction remains an important area for further strengthening.

The findings further reveal that professional development support does not end after teachers participate in training programmes. Instead, the school continues to provide post-training coaching based on the results of instructional supervision and professional training activities, enabling teachers to apply newly acquired knowledge and skills in their instructional practice. As the vice principal (N2) noted, *"The results of academic supervision do not stop at evaluation but are always followed up with mentoring"* (N2). Thus, programme evaluation is connected to follow-up support, with instructional supervision providing evidence for identifying areas that require further mentoring and improvement.

Overall, the theme of professional development strategies for teachers demonstrates that the principal has established a comprehensive support system comprising instructional supervision, teacher mentoring, sharing sessions, professional training activities, post-training coaching, and benchmarking visits. These complementary strategies collectively support teachers' continuous professional development.

Teacher Competency Enhancement Strategies

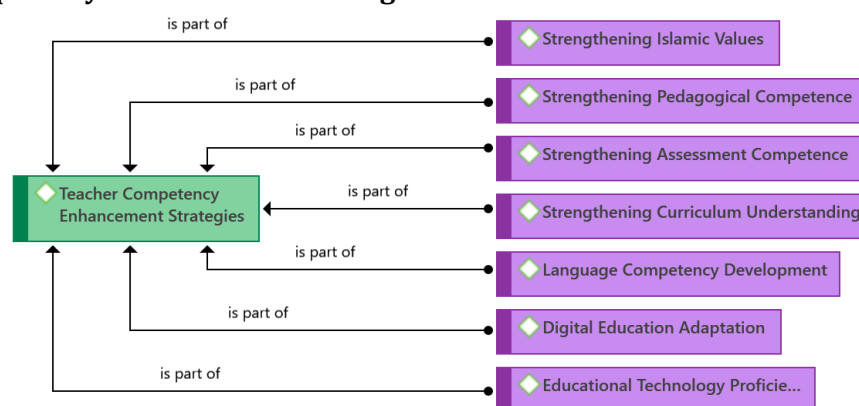


Figure 4. Thematic Map of Teacher Competency Enhancement Strategies

Figure 4 illustrates that the theme of teacher competency enhancement strategies comprises seven subthemes: strengthening Islamic values, enhancing pedagogical competence, strengthening learning assessment, strengthening curriculum understanding, developing language competence, adapting to digital education, and enhancing educational technology competence. These subthemes represent the various strategies implemented by the school to enhance teachers' competencies in response to instructional needs and the evolving educational landscape.

The findings indicated that teacher competency enhancement began with the development of teachers' character and spirituality as an integral part of the school's Islamic identity. Various programmes, including Islamic studies, *tahsin*, *tahfidz*, training in the An-Nur Qur'anic teaching method, Quranic Camp, and teachers' overnight spiritual retreats (*mabit*), were organised to strengthen teachers' religious competencies. As the principal (N1) explained:

"Since our school is based on Islamic values, we also provide programs to strengthen teachers' Qur'anic competencies, such as training in the An-Nur method, Qur'an teacher certification, *tahsin* and *tahfidz*, monthly Islamic study sessions, Quranic Camp, and *mabit* for teachers" (N1).

This finding was reinforced by a teacher (N3), who explained that the programme aimed at *"developing teachers with Islamic character and a love for the Qur'an"* (N3). These findings indicate that strengthening Islamic values was regarded as an inseparable component of teacher professional development at TK IT Al Ittihad.

In addition to strengthening Islamic values, the school facilitated the enhancement of teachers' pedagogical competence through a variety of professional development activities. The interview findings indicated that teachers perceived improvements in their teaching ability while also strengthening their understanding of learning assessment and curriculum understanding. As one teacher (N4) stated, *"The most significant change I have experienced is that my teaching ability has improved"* (N4). Another teacher (N3) explained, *"I also learned more effective assessment techniques so that classroom learning became better"* (N3). Teachers also reported gaining new knowledge that strengthened their understanding of curriculum development. As one teacher (N4) remarked, *"I also gained a great deal of new knowledge about curriculum developments"* (N4). These findings indicate that the professional development programmes supported teachers in strengthening their pedagogical competence while enhancing their understanding of learning assessment and curriculum development, thereby enabling them to implement more effective instructional practices.

The findings also indicated that the school supported the development of teachers' language competence as part of its professional development strategy. As the vice principal (N2) explained, *"We also develop teachers' English language competence"* (N2). This finding suggests that English language competence was recognised as an important component of teacher competency enhancement to support teachers in responding to contemporary educational demands.

The findings further indicated that competency enhancement also focused on preparing teachers to adapt to the demands of digital education. As the principal (N1) explained, the school organised *"digital learning training"* for teachers. (N1). This was reinforced by a teacher (N3), who stated that the programmes had prepared teachers to *"face developments in education in the digital era without abandoning Islamic values"* (N3). These findings indicate that adapting to digital education formed an important component of the school's teacher competency enhancement strategy.

In addition to adapting to digital education, the school strengthened teachers' competence in educational technology by providing opportunities to improve their digital literacy and practical skills in using educational technology. As one teacher (N3) remarked, *"I have become more accustomed to using various digital learning media, such as presentation applications, online learning platforms, and applications for learning assessment"* (N3). This finding was further supported by the principal (N1), who explained, *"We also continue to improve teachers' competence in digital literacy"* (N1). These findings suggest that teachers perceived these professional development programmes as helping them integrate educational technology more effectively into classroom instruction.

Overall, the findings indicate that teacher competency enhancement at TK IT Al Ittihad was implemented through an integrated approach combining the strengthening of Islamic values, pedagogical competence, learning assessment, curriculum understanding, language competence, adaptation to digital education, and educational technology competence. Together, these complementary strategies reflect the school's commitment to enhancing teachers' professional competencies in ways that respond to both the school's distinctive characteristics and the evolving demands of contemporary education.

Building a Professional Learning Culture

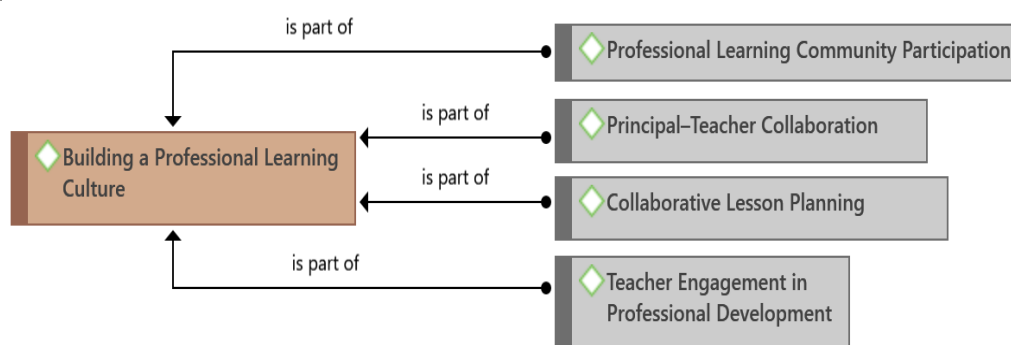


Figure 5. Thematic Map of Building a Professional Learning Culture

Figure 5 illustrates that the theme of building a professional learning culture comprises four subthemes: participation in professional learning communities, principal–teacher collaboration, collaborative lesson planning, and teachers' participation in professional development activities. These subthemes describe how the school builds a collaborative working environment that promotes continuous professional learning and teacher development.

The findings indicated that the Professional Learning Community (PLC) served as the primary platform for teachers to engage in discussions, share experiences, and disseminate good practices acquired through various professional development activities. Through these collaborative learning opportunities, the knowledge gained by individual teachers was not only applied in their own practice but also shared with colleagues, thereby extending professional learning across the school. As the principal (N1) explained, *"We also have a Professional Learning Community (PLC), which provides a forum for teachers to discuss and share best practices"* (N1). This finding suggests that the Professional Learning Community functioned as a collaborative learning environment that facilitated knowledge sharing and professional dialogue among teachers.

A professional learning culture was also built through close collaboration between the principal and teachers in implementing professional development programmes and in the joint preparation of instructional materials. The interview findings indicated that this collaboration extended to the collaborative preparation of instructional materials, which formed part of teachers' lesson planning practices. As the principal (N1) explained, *"We prepare instructional materials collaboratively"* (N1). This practice was also confirmed by the vice principal (N2), who stated, *"Teachers prepare instructional materials collaboratively"* (N2). These findings indicate that principal–teacher collaboration extended beyond programme implementation to support collaborative lesson planning through the joint preparation of instructional materials, thereby strengthening collaborative professional learning practices within the school.

In addition to collaborative lesson planning, the school encouraged teachers' active participation in professional development activities organised both within and outside the school. Teachers actively participated not only by attending professional development programmes but also by contributing to the planning, coordination, and implementation of these activities. As one teacher (N3) stated, *"Besides participating in school activities, I am also ready to serve as a committee member or facilitator in teacher professional development activities whenever needed"* (N3). Another teacher (N4) remarked, *"I am willing to be involved in the planning, coordination, and implementation of activities according to the school's needs"* (N4). These findings suggest that teachers assumed active roles in supporting professional development programmes, thereby strengthening shared responsibility and sustaining a collaborative learning culture within the school.

Overall, the theme of building a professional learning culture demonstrates that the principal fostered a collaborative learning environment through participation in the Professional Learning Community, principal–teacher collaboration, collaborative lesson planning, and teachers' active participation in professional development activities. Together, these complementary forms of collaboration reflect the school's commitment to sustaining a professional learning culture that supports teachers' continuous professional development.

Monitoring and Evaluation of Teacher Professional Development Strategies

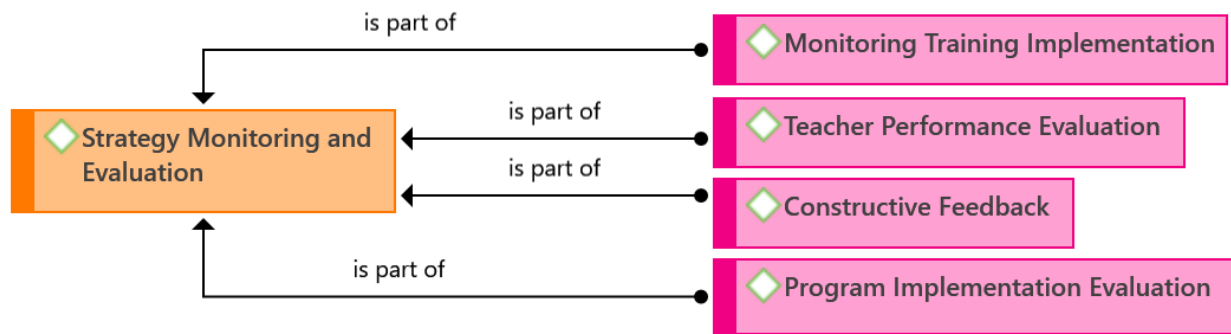


Figure 6. Thematic Map of Monitoring and Evaluation of Teacher Professional Development Strategies

Figure 6 illustrates that the theme of monitoring and evaluation of teacher professional development strategies comprises four subthemes: monitoring training implementation, teacher performance evaluation, constructive feedback, and programme implementation evaluation. These subthemes describe how the school monitors the implementation of teacher professional development strategies and utilises evaluation outcomes as the basis for continuous teacher support and programme improvement.

The findings indicated that the school monitored the implementation of training outcomes to examine how teachers applied the competencies acquired through professional development in their classroom practice. This monitoring process formed part of the school's ongoing professional support system and served as the basis for periodic teacher performance evaluations. As one teacher (N4) explained, *"We also monitor how the outcomes of the training are implemented by teachers in their daily teaching practices"* (N4). This finding was supported by the Teacher Performance Evaluation Programme document, which demonstrates that the school conducts regular teacher performance evaluations as part of its professional development system, as presented in Table 3.

Table 3. Teacher Performance Evaluation Program

Program	Objective	Target Participants	Implementation
Teacher Performance Evaluation	To evaluate teacher performance as the basis for professional coaching and development	All teachers	Conducted annually

Source: Adapted from the Teacher Performance Evaluation Program Document of TK IT Al Ittihad Pekanbaru.

The monitoring outcomes were subsequently used to provide teachers with feedback through instructional supervision, mentoring, and professional support tailored to their individual needs. As one teacher (N3) stated, *"The evaluations are constructive so that we can continue to improve"* (N3). This statement suggests that evaluation was not used solely to assess teacher performance but also functioned as a mechanism for reflection and professional support that promoted continuous professional development.

In addition to evaluating teacher performance, the interview findings also revealed the vice principal's perspective regarding appropriate criteria for evaluating teacher professional development programmes. According to the vice principal (N2), programme success should not be assessed solely by the number of training activities attended but should also consider how teachers apply the knowledge and skills acquired through professional development in classroom practice. As the vice principal (N2) explained, *"In my opinion, the success of teacher development programs should not be measured solely by the number of training programs attended"* (N2). This statement reflects the participant's perspective on appropriate programme evaluation criteria rather than direct evidence of the school's formal programme evaluation procedures. It suggests that successful professional development should also be viewed in terms of how effectively teachers translate the knowledge and skills gained from training into their instructional practice, thereby informing future programme improvement.

Overall, the theme of monitoring and evaluation of teacher professional development strategies demonstrates that the principal systematically monitored the implementation of training outcomes, evaluated teacher performance, provided constructive feedback, and assessed the implementation of teacher professional development strategies. These interconnected monitoring and evaluation practices served as the foundation for continuous teacher support and the ongoing improvement of teacher professional development.

Follow-up Actions for Teacher Professional Development

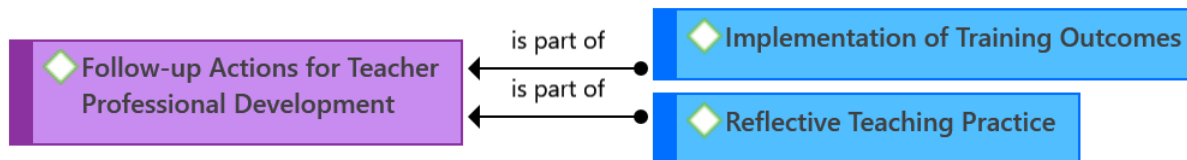


Figure 7. Thematic Map of Follow-up Actions for Teacher Professional Development

Figure 7 illustrates that the theme of follow-up actions for teacher professional development comprises two subthemes: the implementation of training outcomes and reflection on teaching practice. These subthemes describe how the school ensures that teacher professional development continues beyond formal training by encouraging teachers to apply newly acquired competencies and engage in reflective teaching as part of a continuous improvement process.

The findings indicated that teachers were encouraged to apply the knowledge and skills acquired through various professional development activities in their daily classroom practice. The implementation of training outcomes was regarded as an essential follow-up action that enabled teachers to adapt and apply newly acquired competencies to their own instructional contexts. As one teacher (N3) explained, *"After attending training, I always try to apply what I have learned in my classroom"* (N3). This finding suggests that teacher professional development was not viewed as an activity that ended with participation in training but as an ongoing process that continued through the application of professional learning in classroom practice.

Following the implementation of training outcomes, teachers engaged in reflection on their instructional practices to identify learning experiences, recognise their strengths, and determine areas requiring further improvement. As one teacher (N3) stated, *"These activities have encouraged me to reflect more frequently on my own teaching practices"* (N3). This reflective process subsequently became part of teachers' continuous self-evaluation of their instructional practice. As another teacher (N4) remarked, *"I try to evaluate what has worked well and which aspects still need improvement"* (N4). The findings indicate that teachers used reflective practice as a basis for improving classroom instruction while informing subsequent professional development activities within the school.

Overall, the theme of follow-up actions for teacher professional development demonstrates that the school sustained teacher professional development through the implementation of training outcomes and systematic reflection on teaching practice. These complementary follow-up actions reinforce the view that teacher professional development is a continuous process that is consistently integrated into everyday instructional practice.

Supporting Factors for Teacher Professional Development Strategies

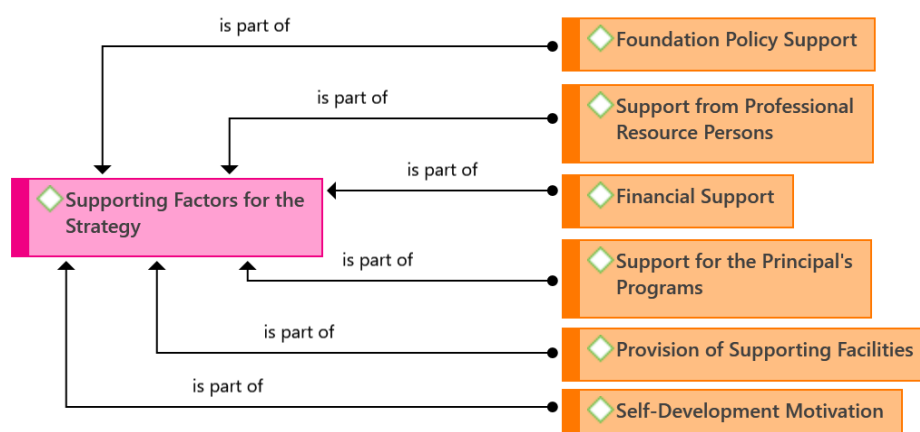


Figure 8. Thematic Map of Supporting Factors for Teacher Professional Development Strategies

Figure 8 illustrates that the theme of supporting factors for teacher professional development strategies comprises six subthemes: foundation policy support, support from professional resource persons, financial support, support for the principal's programmes, provision of supporting facilities, and teachers' self-development motivation. These subthemes represent the key factors that supported the implementation of teacher professional development strategies at TK IT Al Ittihad Pekanbaru.

The findings indicated that the successful implementation of teacher professional development strategies was strongly supported by the foundation's commitment through supportive policies, support from professional resource persons, and financial support for teacher development activities. As the principal (N1) explained, *"The foundation has been highly supportive. It provides policies that encourage the improvement of teachers' competencies"* (N1). Beyond policy support, the foundation also contributed to teacher professional development by *"inviting professional resource persons"* (N1). In addition, financial support was provided through *"funding for teacher development activities"* (N2). These findings indicate that foundation policy support, support from professional resource persons, and financial support formed a strong institutional foundation for sustaining teacher professional development programmes.

The findings further revealed that the implementation of teacher professional development strategies was strengthened by support for the principal's programmes. Teachers demonstrated their commitment to these programmes as part of their professional responsibilities. As one teacher (N3) stated, *"As teachers, we believe it is our responsibility to support the programmes designed by the principal"* (N3). Another teacher (N4) similarly explained, *"As teachers, we have a role in helping the principal so that professional development programmes can be implemented successfully"* (N4).

This support was further strengthened through the school's efforts to facilitate teachers' participation in professional development activities. As the vice principal (N2) explained, the school *"facilitates teachers in participating in training programmes, seminars, workshops, and webinars"* (N2). These findings suggest that support for the principal's programmes was reflected not only in teachers' commitment to participate but also in the school's efforts to facilitate the implementation of professional development activities.

The implementation of teacher professional development strategies was also supported by the provision of supporting facilities. Adequate facilities and infrastructure enabled teachers to participate in professional development activities more effectively. As the principal (N1) explained, *"The school provides the facilities and infrastructure needed to support teacher professional development activities"* (N1). These findings indicate that the provision of supporting facilities created a supportive environment for implementing teacher professional development programmes.

Teachers' self-development motivation also emerged as an important supporting factor. Teachers demonstrated a commitment to continuously developing their professional competencies despite various challenges. As one teacher (N3) remarked, *"Even so, I still try to participate in every activity that I can attend"* (N3). This commitment was further strengthened through the principal's

efforts to provide motivation, appreciation, and constructive feedback. As the principal (N1) explained, *"We also provide motivation, appreciation, and feedback to teachers for the progress they have achieved"* (N1). These findings indicate that teachers' intrinsic motivation, supported by recognition and encouragement from school leaders, strengthened their commitment to continuous professional learning.

Overall, the findings indicate that teacher professional development at TK IT Al Ittihad was supported by foundation policy support, support from professional resource persons, financial support, support for the principal's programmes, provision of supporting facilities, and teachers' self-development motivation. Together, these six supporting factors created favourable conditions for sustaining teacher professional development programmes within the school.

Barriers to Teacher Professional Development Strategies

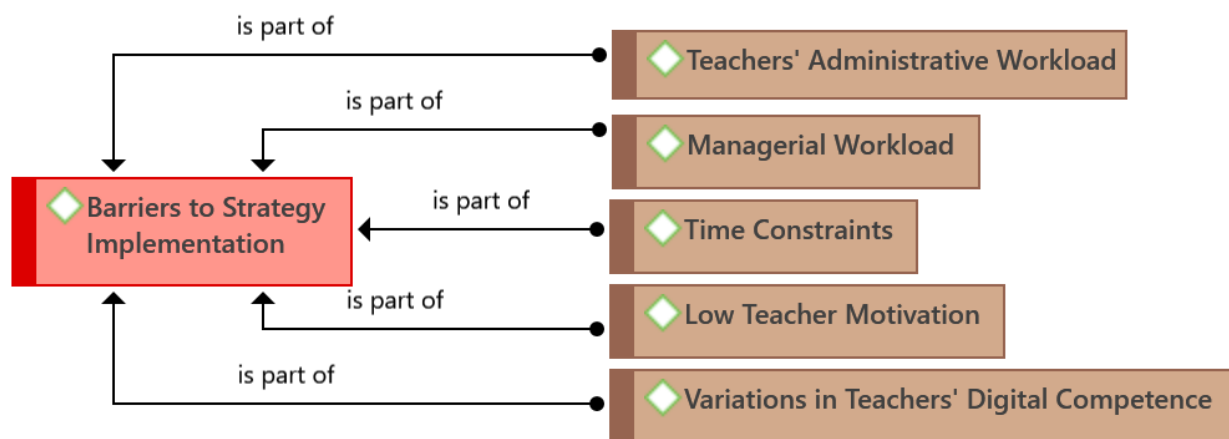


Figure 9. Thematic Map of Barriers to Teacher Professional Development Strategies

Figure 9 illustrates that the theme of barriers to teacher professional development strategies comprises five subthemes: teachers' administrative workload, principals' managerial responsibilities, time constraints, low teacher motivation, and variations in teachers' digital competence. These subthemes represent the major challenges encountered by the school in implementing teacher professional development strategies.

The findings indicated that teachers' administrative workload and the principal's managerial responsibilities constituted significant challenges in implementing teacher professional development programmes. Teachers were responsible not only for classroom instruction but also for a range of administrative duties, while the principal was required to balance managerial responsibilities, instructional supervision, school administration, and teacher professional support. As one teacher (N3) explained, *"As teachers, we are responsible not only for teaching but also for completing administrative tasks and preparing instructional materials"* (N3). This view was reinforced by the principal (N1), who stated, *"As the principal, I have to balance managerial responsibilities, academic supervision, school administration, and teacher development activities"* (N1). These findings suggest that the workload borne by both teachers and the principal limited the time available for participating in and managing professional development activities. As one teacher (N3) further noted, *"Sometimes, the time available to attend training or further develop our competencies is quite limited"* (N3).

In addition to time constraints, the findings revealed differences in teachers' motivation to participate in professional development activities. The principal explained that some teachers still perceived professional development as an administrative obligation rather than an opportunity for continuous professional growth. As the principal (N1) explained, *"Some teachers still regard training merely as an administrative requirement rather than as a need for professional growth"* (N1). The findings also revealed considerable variation in teachers' digital competence. Differences in technological proficiency influenced teachers' readiness to participate in professional development activities and to integrate technology into classroom instruction. As one teacher (N4) remarked,

"Teachers' technological competencies differ. Some are already comfortable using technology, while others still need time to adapt" (N4). This finding indicates that variations in digital competence represent an important challenge that should be considered when designing teacher professional development programmes to ensure that they are responsive to teachers' diverse needs and capabilities.

Overall, the theme of barriers to teacher professional development strategies demonstrates that the implementation of teacher professional development faced several challenges related to workload, time constraints, teacher motivation, and variations in digital competence. These findings suggest that the sustainability of teacher professional development strategies depends not only on the quality of the programmes designed but also on organisational conditions and teachers' individual characteristics that shape their implementation.

Discussion

Strategic Planning as the Foundation for Teacher Professional Development

The findings indicate that planning teacher professional development strategies was carried out through the development of continuous professional development programmes, alignment with the school's vision, identification of teachers' professional needs, flexibility in training implementation, and careful selection of training content. These findings suggest that strategic planning served as the foundation for aligning teachers' professional development needs with the school's educational goals, thereby supporting the systematic and purposeful implementation of professional development initiatives.

This finding is consistent with the work of Sancar et al. (2021) and Sims & Fletcher-Wood (2021), who argued that teacher professional development becomes more meaningful when it is embedded within a whole-school strategy supported by instructional leadership, sustained learning opportunities, and a collaborative professional culture. In the present study, initiatives such as workshops, in-house training, benchmarking visits (*study tiru*), and professional certification indicate that participants perceived teacher professional development as being integrated into the school's strategic planning rather than being implemented as isolated activities. Furthermore, the identification of teachers' professional needs prior to programme design aligns with the concept of data-informed professional development proposed by Glisson et al. (2026), which emphasises the importance of using evidence of teachers' actual needs to inform professional development planning.

Despite these positive findings, the study also revealed that the relevance of training content did not always fully correspond to the diverse professional needs of all teachers. This suggests that conducting a needs assessment alone is insufficient to ensure the relevance and responsiveness of teacher professional development planning. As argued by Recreo & Gonday (2026), effective strategic planning requires not only a sustainable professional development system but also close alignment between training content and teachers' professional learning needs. Accordingly, the present findings provide contextual evidence suggesting that evaluating the relevance of training content should be incorporated as an integral component of the planning process to ensure that teacher professional development programmes remain contextually relevant and responsive to teachers' evolving needs.

Sustainable Professional Support as a Mechanism for Teacher Competency Enhancement

The findings indicate that teacher professional support extended beyond instructional supervision to encompass mentoring, sharing sessions, professional training activities, benchmarking visits (*study tiru*), and post-training mentoring. These findings suggest that professional support was conceptualised as a sustainable process in which instructional supervision served to identify teachers' professional learning needs, while mentoring and post-training mentoring facilitated the transfer of newly acquired knowledge and competencies into classroom practice. This integrated approach suggests that continuous professional support contributed to teacher competency enhancement rather than relying solely on isolated professional development activities.

These findings are consistent with Warnock et al. (2022), who argued that instructional coaching promotes teacher reflection, collaboration, and the continuous improvement of instructional practice. Similarly, Geletu (2026) emphasised that sustained mentoring creates

opportunities for teachers to receive ongoing guidance, constructive feedback, and reflective support, thereby strengthening their professional competencies. In the present study, the integration of instructional supervision, mentoring, and post-training coaching illustrates that professional support extended beyond performance evaluation to provide continuous assistance throughout the implementation of newly acquired knowledge and skills. These findings suggest that sustainable professional support may help bridge the gap between professional learning and classroom practice.

The findings further indicate that teacher professional learning was fostered through a combination of professional training activities and collaborative learning among teachers, particularly through sharing sessions and benchmarking visits (*study tiru*). This finding supports Shanks (2023), who identified peer interaction as a fundamental component of professional learning because it enables teachers to exchange experiences, reflect on instructional practices, and disseminate effective teaching strategies. However, previous studies have reported that professional support often remains centred on instructional supervision or formal training without sustained follow-up mentoring (Marynowski et al., 2022). In contrast, the present study provides contextual evidence that participants perceived post-training coaching as an integral component of the school's professional development strategy, supporting the continued application of professional learning in instructional practice. Consequently, this study provides contextual evidence suggesting that integrating sustainable professional support into teacher professional development may strengthen the continuity between professional learning, instructional implementation, and teacher competency enhancement.

Holistic Teacher Competency Development to Address Contemporary Educational Challenges

The findings indicate that teacher competency enhancement was implemented through a holistic approach integrating the strengthening of Islamic values, pedagogical competence, classroom assessment, curriculum understanding, language proficiency, and adaptation to educational technologies. These findings suggest that teacher professional development extended beyond improving instructional skills to encompass character formation, responsiveness to curriculum reform, and readiness to address the challenges of digital transformation in education. Such an approach reflects participants' perceptions of the school's commitment to developing teachers' competencies comprehensively while balancing the demands of twenty-first-century education with the preservation of Islamic values.

These findings are consistent with Yarriswamy (2025), who argued that effective teacher professional development should integrate pedagogical competence, digital competence, reflective practice, and professional values to enable teachers to respond effectively to educational change. Likewise, Fatimah et al. (2025) emphasised that proficiency in educational technology constitutes an essential dimension of teachers' professional competence because it supports innovative, collaborative, and student-centred learning. In the present study, the emphasis on classroom assessment, curriculum understanding, and technology training suggests that participants perceived the school as adopting an adaptive approach to teacher competency enhancement in response to evolving educational demands. These findings suggest that holistic professional development may support teachers in developing the diverse competencies required to navigate increasingly complex educational environments.

Beyond strengthening pedagogical and digital competencies, the findings reveal that teacher professional development also prioritised character formation and spiritual development through programmes such as *tahsin* (Qur'anic recitation improvement), *tahfidz* (Qur'an memorisation), Islamic studies, Quranic Camp, and *mabit* (overnight spiritual retreat). The integration of these programmes suggests that, within the context of an Integrated Islamic School, teacher competency enhancement was perceived not merely as the development of technical teaching expertise but also as the cultivation of professional values, ethical dispositions, and spiritual character that underpin effective educational practice. This perspective differs from much of the existing literature, which has primarily conceptualised teacher professional development in terms of pedagogical and digital competencies (Srilestari, 2026). Consequently, the present study provides contextual evidence suggesting that, in Integrated Islamic Schools, professional competency enhancement may be closely associated with character and spiritual development, reflecting a professional development strategy that aligns with the institution's vision, organisational culture, and educational identity.

Collaborative Learning Culture as a Driver of Teacher Professional Development

The findings indicate that a collaborative professional learning culture was fostered through teachers' participation in the Professional Learning Community (PLC), collaboration between the principal and teachers, collaborative lesson planning, and teachers' active engagement in a range of professional development activities. These findings suggest that teacher professional development extended beyond formal training by creating collaborative learning opportunities that enabled teachers to exchange knowledge, reflect on instructional practices, and develop a shared commitment to improving the quality of teaching and learning. Such an environment suggests that collaborative learning functioned as a central mechanism for sustaining continuous professional growth within the school.

These findings are consistent with Johannesson (2022), who argued that professional learning communities are strengthened through a shared vision, teacher collaboration, instructional leadership, organisational support, and continuous learning opportunities. Similarly, García-Martínez et al. (2021) emphasised that collaborative cultures and relational trust are essential conditions for enhancing schools' capacity to achieve sustained instructional improvement. In the present study, the Professional Learning Community, collaborative lesson planning, and the principal's ongoing professional support suggest that collaborative learning was embedded within the school's organisational practices rather than functioning as an occasional professional development activity. These findings suggest that a collaborative learning culture may provide an organisational foundation for continuous teacher professional development.

However, previous research has suggested that the implementation of professional learning communities in many schools remains largely driven by school leaders, with teachers participating primarily in collaborative activities rather than actively contributing to decision-making (Ballangrud & Aas, 2022). In contrast, the present study provides contextual evidence that participants perceived teachers as being actively involved throughout the planning, implementation, and evaluation of professional development programmes alongside the principal. This participatory approach suggests that teachers were able to contribute to determining the direction of professional development in accordance with the school's needs. Consequently, the findings provide contextual evidence suggesting that a collaborative learning culture may be strengthened not only through teacher collaboration but also through collaborative leadership that empowers teachers to participate in professional decision-making. Within the context of this study, teacher professional development appeared to be embedded within the school's organisational culture rather than remaining a series of isolated professional learning activities.

Monitoring and Evaluation as Drivers of Continuous Teacher Professional Development

The findings indicate that the monitoring and evaluation of teacher professional development strategies were conducted through monitoring the implementation of training outcomes, evaluating teacher performance, providing constructive feedback, and reviewing the implementation of professional development programmes. These findings suggest that monitoring and evaluation functioned not merely as mechanisms of accountability but also as developmental processes that supported teachers in translating newly acquired knowledge and skills into classroom practice. Furthermore, the information generated through these processes was used to inform the continuous refinement of teacher professional development programmes.

These findings are consistent with Samundeeswari (2024), who argued that the evaluation of teacher professional development is most effective when it focuses on changes in instructional practice and their impact on teaching and learning rather than simply measuring teachers' participation in professional development activities. Similarly, Avgitidou et al. (2024) emphasised that monitoring, reflective practice, and constructive feedback constitute essential components of professional learning communities because they enable teachers to critically examine their instructional practices and continuously strengthen their professional competencies. In the present study, monitoring and evaluation extended beyond assessing programme implementation to supporting teacher learning through systematic feedback and reflective professional dialogue. These findings suggest the developmental role of monitoring and evaluation within sustainable teacher professional development.

However, Sims et al. (2025) reported that the evaluation of teacher professional development frequently remains limited to measuring programme implementation or participation rates, with evaluation findings often underutilised in informing subsequent professional learning initiatives. In contrast, the present study provides contextual evidence that participants perceived evidence generated through monitoring and evaluation as being systematically used to guide instructional supervision, provide constructive feedback, support teacher mentoring, and refine future professional development programmes. Consequently, these findings provide contextual evidence suggesting that monitoring and evaluation may function as mechanisms of organisational learning that connect evidence from programme implementation with continuous programme improvement and sustained teacher professional development. Rather than serving solely as accountability measures, monitoring and evaluation appeared to function as integral processes through which the school supported the continuous improvement of its professional development programmes and teachers' professional growth.

Reflection and Follow-up Actions as Mechanisms for Enhancing the Impact of Teacher Professional Development

The findings indicate that follow-up actions to teacher professional development were implemented through the application of training outcomes in classroom practice and systematic reflection on teaching experiences. These findings suggest that teacher professional development extended beyond participation in training activities by encouraging teachers to transfer newly acquired knowledge and skills into their instructional practice while engaging in reflective inquiry as part of a continuous improvement process. Consequently, follow-up actions appeared to function as a mechanism that connected teachers' professional learning experiences with the ongoing refinement of instructional practice, thereby supporting the continued application of professional learning in classroom practice.

These findings are consistent with Kennedy (2016), who argued that teacher professional development produces meaningful outcomes when teachers apply new learning, critically reflect on their instructional practice, and use evidence of student learning to inform continuous instructional improvement. Similarly, Sancar et al. (2021) emphasised that effective teacher professional development requires opportunities for teachers to implement newly acquired knowledge, receive constructive feedback, and engage in sustained reflective practice. In the present study, the implementation of training outcomes, accompanied by systematic reflection on teaching practice, suggests that participants perceived the school as establishing a continuous professional learning cycle that supported the ongoing improvement of instructional practice. These findings suggest that the perceived benefits of teacher professional development depend not only on participation in learning activities but also on structured opportunities to apply, evaluate, and refine professional practice.

Although reflection and follow-up actions are widely recognised as essential components of teacher professional development, their implementation remains challenging in many educational contexts. Bhandari (2025) noted that post-training follow-up is frequently insufficiently integrated into teacher professional development systems. In contrast, the present study provides contextual evidence suggesting that participants perceived reflective practice as being integrated into the evaluation of classroom practice and used to inform subsequent professional development planning. Consequently, this study provides contextual evidence suggesting that the integration of reflective practice and structured follow-up actions may create a sustainable mechanism linking teachers' professional learning experiences, continuous instructional improvement, and future professional development planning. This integrated process may contribute to the sustainability of teacher professional development within the school.

Organisational Support as an Enabler of Teacher Professional Development

The findings indicate that the implementation of teacher professional development strategies was supported not only by the quality of the programmes designed by the school but also by the organisational support that facilitated their sustainable implementation. Such support was reflected in the foundation's policies, the provision of financial resources, the involvement of professional resource persons, principal-initiated programmes, the availability of supporting facilities, and teachers' motivation to continuously enhance their professional competencies. These findings

suggest that teacher professional development may be understood as a shared responsibility in which organisational commitment and individual agency interact to sustain continuous professional learning.

These findings are consistent with Rizqi & Syafika (2024), who argued that organisational support, instructional leadership, and learning opportunities are fundamental elements in establishing effective professional learning communities. Similarly, Hakvoort et al. (2022) emphasised that the provision of adequate resources, a collaborative organisational culture, and a supportive learning environment constitute essential conditions for sustaining teacher professional development. In the present study, the foundation's contribution extended beyond policy and financial support to include the provision of professional resource persons and learning facilities that supported the consistent implementation of professional development programmes. These findings suggest the importance of organisational capacity in creating an environment conducive to continuous teacher learning.

An important finding of this study is that organisational support did not operate independently of teachers' individual motivation. The evidence indicates that organisational resources and professional learning opportunities were perceived to contribute to teacher development when teachers were motivated to engage actively in continuous learning and competency enhancement. Conversely, teachers' motivation required organisational structures and opportunities through which it could be translated into participation in training, mentoring, and collaborative professional learning activities. These findings suggest that organisational support and teacher motivation functioned as mutually reinforcing factors rather than as separate determinants of professional development. Consequently, this study provides contextual evidence suggesting that teacher professional development strategies may be better understood as the product of the dynamic interaction between institutional support and teachers' professional commitment, rather than as the outcome of either factor in isolation. This interpretation is consistent with the findings of Feng et al. (2024) and Tamang et al. (2024), who highlighted the complementary roles of organisational conditions and individual motivation in sustaining professional learning.

Challenges in Achieving Sustainable Teacher Professional Development

The findings indicate that the sustainability of teacher professional development may be influenced not only by the quality of professional development programmes but also by the organisation's capacity to address the challenges that emerge during their implementation. This study identified teachers' administrative workload, principals' managerial responsibilities, time constraints, suboptimal teacher motivation, and variations in teachers' digital competence as key factors influencing the implementation of teacher professional development strategies. These findings suggest that teacher professional development operates within a complex organisational context in which its sustainability is shaped by the interaction between organisational conditions and teachers' individual characteristics.

Time constraints and excessive workload have consistently been identified as significant barriers to teacher professional development. Srivastava & Gupta (2025), argued that heavy workloads reduce teachers' opportunities to participate actively in professional learning communities and other professional learning activities. Likewise, Guzman & Aguilar (2025) emphasised that effective teacher professional development requires sufficient time for teachers to engage in learning, collaboration, and reflective practice. In the present study, teachers' administrative responsibilities and the principal's managerial duties constrained the time available for participation in professional development activities. Furthermore, variations in teachers' digital competence created diverse professional learning needs, indicating that a uniform approach to professional development was insufficient to support teachers with differing levels of technological readiness. These findings suggest the importance of adopting differentiated professional development strategies that are responsive to teachers' diverse capabilities and learning needs.

The findings also reveal considerable variation in teachers' engagement with professional development activities. While some teachers demonstrated strong motivation to continuously improve their professional competencies, others continued to perceive professional development primarily as an administrative requirement rather than an opportunity for meaningful professional learning. This variation suggests that the availability of professional development programmes does

not automatically result in equal levels of teacher participation or engagement. Consequently, the findings suggest that sustaining teacher professional development may depend not only on organisational support but also on teachers' readiness and willingness to take advantage of available learning opportunities. This study therefore provides contextual evidence suggesting that sustaining teacher professional development may require a balanced approach that combines supportive organisational conditions with strategies to strengthen teacher motivation, manage workload effectively, and provide differentiated mentoring tailored to teachers' individual needs and levels of professional readiness. This interpretation is consistent with the findings of Lüsse et al. (2025) and Masoumi & Noroozi (2025), who emphasised that sustainable professional learning depends on the alignment of organisational support with teachers' individual capacities and motivations.

CONCLUSIONS

This study concludes that the principal's strategies for teacher professional development at TK IT Al Ittihad Pekanbaru were implemented through a coordinated and contextually integrated approach, encompassing needs-based professional development planning, professional support through instructional supervision, coaching and mentoring, the enhancement of pedagogical, digital, and Islamic competencies, the development of a collaborative learning culture, as well as monitoring, evaluation, and follow-up actions oriented towards improving instructional practice. The implementation of these strategies was supported by the foundation's policies, the principal's leadership, the availability of organisational resources, and teachers' motivation, although it continued to face challenges related to teachers' administrative workload, time constraints, principals' managerial responsibilities, and variations in teachers' motivation and digital competence. The findings provide contextual evidence suggesting that, within TK IT Al Ittihad Pekanbaru, teacher professional development was perceived as being supported not only by professional training opportunities but also by the integration of instructional leadership, a collaborative learning culture, continuous improvement processes, and the strengthening of Islamic values. Therefore, this study contributes contextual insights to the field of educational leadership by enhancing the understanding of how principals manage teacher professional development within the specific context of Integrated Islamic Early Childhood Education.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to the Principal, Vice Principal, and all teachers of TK IT Al Ittihad Pekanbaru for their valuable participation and cooperation throughout this study. The authors also acknowledge the academic support provided by the Master's Program in Educational Management, Universitas Ahmad Dahlan, as this research was conducted as part of the first author's master's thesis. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

AUTHOR CONTRIBUTION STATEMENT

AF conceived the study, designed the research, collected and analyzed the data, and drafted the manuscript. EH supervised the research, contributed to the research methodology, validated the findings, and critically reviewed and revised the manuscript. MZ contributed to the conceptual development of the study, validated the data interpretation, and critically reviewed and revised the manuscript. All authors read and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors used ChatGPT (OpenAI) solely to assist with language refinement, grammar checking, manuscript editing, and improving the clarity and readability of the academic writing. All AI-assisted outputs were critically reviewed, verified, and substantially revised by the authors. The authors take full responsibility for the originality, accuracy, interpretation, and integrity of the content presented in this manuscript.

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