

Implementation of the In-House Training Program in Enhancing the Digital Competence of Islamic Religious Education Teachers in Madrasahs of Pahae Jae Subdistrict

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ABSTRACT

Digital technology has changed what is expected of Islamic Religious Education (PAI) teachers, but in madrasahs outside urban centres the equipment, connectivity, and training available often lag behind that expectation. This study examines how an in-house training (IHT) programme enhanced the digital competence of PAI teachers in three madrasahs in Pahae Jae Subdistrict, North Sumatra, Indonesia, and pursues three objectives: to describe how the programme was implemented, to identify the competencies it developed, and to assess its contribution to digital-based PAI learning. The study used a classroom action research design informed by participatory action research, carried out in two cycles of planning, action, observation, and reflection, with 15 of the 25 PAI teachers in the subdistrict as participants. Data were collected through participant observation, structured interviews, documentation, and a pre-cycle questionnaire, and analysed through data reduction, presentation, and conclusion drawing, with triangulation across the sources. The main findings are as follows. Competence at baseline was uneven: 66.7% of teachers could operate laptops, projectors, and the internet, but only 33.3% could use a learning management system and 20.0% could produce interactive learning media. Group mastery then rose from 40% at baseline to 73% at the end of Cycle I and 100% at the end of Cycle II, and four competencies developed in sequence: digital literacy, the use of technology-based instructional media, the production of digital content, and the use of technology for assessment. Repeated, practice-centred cycles of training, rather than a single workshop, therefore offer a workable route to digital competence for PAI teachers in madrasahs.

1. INTRODUCTION

The expansion of digital technology has reshaped what is expected of teachers. Across education systems, teachers are now asked not only to deliver content but to design, facilitate, and assess learning with digital tools. Indonesian legislation defines teacher competence as a combination of pedagogical, personal, social, and professional capacities that are to be developed throughout a career (Law of the Republic of Indonesia No. 14 of 2005 on Teachers and Lecturers, Article 8), and recent Indonesian scholarship describes the corresponding shift from the teacher as knowledge transmitter to the teacher as facilitator in the digital era (Aspandi & Muttaqin, 2025), and the expectation of continuous professional development is echoed in the wider literature on teacher professionalism (Asmare, 2025; Putri, Kusaeri, & Rusdiyah, 2025). Islamic Religious Education (PAI) is a subject in which this expectation is both urgent and difficult. PAI material is normative and abstract, and teachers must make it contextual and applicable if learners are to engage with it seriously. Digital media offer a way to present such material through video, animation, and interactive content, and recent work on the development of PAI teaching materials argues that the subject must be reoriented towards interdisciplinary and applied approaches if it is to meet students'

needs (Muhammad Arifin, Sumiah Nasution, Sanudin Ranam, Siti Fuadah, & Muhammad Aunurrochim, 2026). The challenge is not confined to the delivery of content. A curriculum that aims at the formation of character as well as knowledge is increasingly delivered by digital means, which offer opportunities for personalised and scalable learning but depend for their effect on equitable access, robust infrastructure, and teacher training (Saekan Muchith, 2023). Yet the availability of technology does not by itself produce competent users. Two obstacles recur in the literature: the wider introduction of digital tools raises privacy and responsible-use questions that teachers must face in the classroom, and practice-based technology learning is constrained by the cost of equipment and the time it demands (Cahyanto, 2023; Santyadiputra & Hadi, 2023). The difficulty is greater in madrasahs outside urban centres, where teachers reported that the network was often unstable and that hands-on training rarely reached the subdistrict, and where teachers must keep pace both with curriculum expectations and with the digital environment in which learners now live (Ihza, Jumadi, & Satrio, 2024; Universitas Wijaya Kusuma Surabaya, Indonesia et al., 2025).

Against this background, school-based forms of professional development have attracted attention. In-house training (IHT) is defined as a programme organised by an institution to raise the competence and professionalism of its own personnel within that institution. In practice, in-house training is a form of school-based professional development in which the institution identifies its own needs and delivers the training itself, an arrangement that has been documented in schools in remote and underserved areas (Siska & Ishartiwi, 2025). Because its material is derived from an analysis of the teachers' own needs, in-house training is comparatively efficient in time and cost, adaptable to local conditions, and immediately transferable to classroom practice. It also connects national policy with local reality: governments promote the digital transformation of education, but whether that transformation occurs depends on what teachers can actually do on Monday morning. The present study is set in three madrasahs in Pahae Jae Subdistrict, Tapanuli Utara Regency, North Sumatra: MIN 1 Tapanuli Utara, MTs Swasta Al-Ikhlash Aek Botik, and MAS Al-Ikhlash Tarutung Dua. These madrasahs serve communities in which Muslims are a minority, and they carry responsibility for both academic instruction and the formation of religious character, a dual mandate that recent work on Islamic educational institutions in Indonesia frames in terms of institutional identity and religious moderation (Fauzi, Zainiyati, Lubab, Qadarin, & Mustofa, 2026). An initial observation and the pre-cycle questionnaire indicated that most PAI teachers in these madrasahs still relied on conventional media and manual assessment: only 20.0% could produce interactive learning media, 26.7% could use digital assessment platforms, and 33.3% could use and manage a learning management system. Few had received practical training in the use of digital tools for instruction, and the teachers reported that such training rarely reached the subdistrict and that the network was often unstable.

Several recent studies bear directly on the problem. Wipa et al. reported that an in-house training programme improved teachers' ability to use Google Classroom for online instruction (Wipa et al., 2026). Liu et al. likewise reported, in a systematic scoping review of information and communication technology in education, that technology improves instructional practice while infrastructure deficiencies and the digital divide impede its implementation (Liu, Luo, Pang, & Kan, 2025). Habibul Fattah et al. examined digital literacy and teacher readiness in Indonesian Islamic education and argued that readiness depends on technological competence, digital pedagogical skill, and the ability to embed Islamic values in digital instruction (Habibul Fattah, Hakim, & Hilmy, 2026). Arif et al. reviewed a decade of studies on the competencies of PAI teachers and concluded that technological and digital competencies must be added to the four established teacher competencies (Arif, Aziz, & Ma'arif, 2025), while Hunaidah and Hepi argued that digital competence has become a precondition for effective PAI instruction (Hunaidah & Hepi Ikmal, 2023). Together, these studies establish that digital competence matters for PAI teaching and that structured

training can change it. What they do not show is how such a programme unfolds when it is implemented as a sustained and reflective cycle, with PAI teachers acting as participants rather than recipients, in a subdistrict where this form of training has not previously been documented. The present study addresses that gap. The study therefore asked three questions: (1) how was the in-house training programme implemented in improving the digital competence of PAI teachers in the madrasahs of Pahae Jae Subdistrict; (2) what forms of competence were developed through the programme in relation to the use of digital media in PAI instruction; and (3) how did implementation of the programme relate to changes in the quality of digital-based PAI learning? To answer these questions the study employed a classroom action research design informed by participatory action research, in which teachers were treated not as passive subjects but as co-participants in identifying the problem, planning the action, observing its effects, and reflecting on the results. The design is described in detail in the Methods section. The study contributes an empirically documented account of how school-based training unfolds in madrasahs serving minority Muslim populations, and it offers practical indications for madrasah leaders and for the design of continuing teacher development in comparable settings.

2. METHODS

The study employed a classroom action research design informed by participatory action research, following the spiral model of Kemmis and McTaggart (Torang Siregar, 2025), which comprises planning, acting, observing, and reflecting. Two cycles were conducted, with the findings and reflections from each cycle informing the subsequent cycle. The researcher acted as a facilitator and co-participant, involving teachers in identifying needs, preparing materials, participating in practical training, and evaluating the results. This participatory approach was intended to improve teachers' digital competence through collaborative learning and reflective practice, consistent with the principles of consultation and cooperation in Islamic education. The study was conducted at three madrasahs in Pahae Jae Subdistrict, North Tapanuli Regency, North Sumatra: MIN 1 Tapanuli Utara, MTs Swasta Al-Ikhlas Aek Botik, and MAS Al-Ikhlas Tarutung Dua. Of the 25 Islamic Religious Education (PAI) teachers in the subdistrict, 15 teachers from these institutions participated in the programme. The study took place from August 2025 to March 2026 and involved teachers of Al-Qur'an Hadith, Akidah Akhlak, Fikih, Islamic Cultural History (SKI), and Arabic. Data were collected through participant observation, structured interviews, documentation, and a pre-cycle questionnaire. Observations assessed programme implementation and teachers' digital competence using a four-point rating scale, from poor to very good, covering 12 indicators related to training implementation and the use of digital technology in teaching and learning. The data were analysed descriptively and qualitatively through data reduction, data presentation, and conclusion drawing, with verification conducted throughout the analysis process (Alejandro & Zhao, 2024; Bowen, 2009; Chand, 2025). Quantitative results were calculated from questionnaire and observation records by determining the percentage of teachers who achieved the good or very good categories for each indicator. Improvements between the baseline and subsequent cycles were calculated as percentage increases relative to the baseline scores. Data credibility was strengthened through triangulation of observations, interviews, and documentation, while trustworthiness was addressed through credibility, transferability, dependability, and confirmability (Enworo, 2023). These procedures provided a basis for evaluating changes in teachers' digital competence and the implementation of the training programme.

The assessment of digital competence drew on three records gathered at each stage: participant observation of the training sessions, a practical test in which teachers produced digital material for their own subject, and the participants' evaluation forms. Each indicator was rated on the four-point scale from poor to very good, and the quantitative results were obtained by calculating,

for each indicator, the percentage of the 15 participating teachers rated in the good or very good category. The same reporting rules were applied to the pre-cycle record and to the records of the four subsequent meetings, so that Tables 1 to 4 can be read against one another; the sequence of the research steps is set out in Figure 1. [Author query: please supply (i) evidence of instrument validity, such as expert review of the 12 indicators and of the rating rubric; (ii) any reliability statistic for the observation scale and the questionnaire; (iii) the labels of the two intermediate categories of the rating scale and the cut-off used to define the good category; and (iv) confirmation that the same 12 indicators were used at every measurement point, since the Methods state 12 indicators while Tables 1 and 3 present seven and eight rows respectively.]

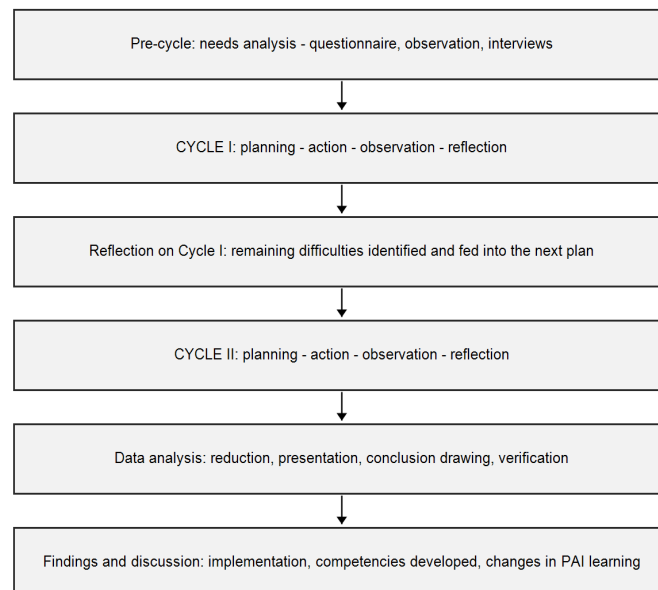


Figure 1. Flowchart of the research steps

3. RESULTS AND DISCUSSION

RESULTS

The findings are reported in three parts corresponding to the three research questions: how the programme was implemented, which competencies it developed, and what changed in digital-based PAI learning. All percentages refer to the 15 participating teachers. Three different measures are used in this section and should not be read as interchangeable. Table 2 reports composite competence scores, which aggregate a teacher's ratings across indicators into a single score and are therefore expressed as an increase between the baseline and the end of Cycle I. Table 3 reports indicator mastery, that is, the percentage of the 15 teachers rated good or very good on a single indicator at a given meeting. Table 4 reports group mastery at each measurement point, defined as the mastery percentage recorded on the indicator that concluded that meeting, the last row for that stage in Table 3, together with the pre-cycle baseline of 40%. Read in this way the three sets of figures agree: the 40% baseline is followed by 53% and 73% in Cycle I and 87% and 100% in Cycle II, exactly as Table 3 records for the concluding indicator of each meeting, while the increases of 40% to 46% in Table 2 describe individual composite scores and not group mastery.

Baseline digital competence

Before the first cycle, a pre-cycle questionnaire was administered to establish the starting position of the participants. Table 1 shows that competence was uneven across indicators. Two thirds of the teachers (66.7%) could operate laptops, projectors, and the internet, and 60.0% could use the

internet as a source of instructional material. Competence fell sharply on the more demanding tasks: only 33.3% could use and manage a learning management system, 26.7% could use digital assessment platforms, 20.0% could produce interactive learning media, and 60.0% could organise a digital classroom.

Table 1. Initial digital competence of PAI teachers in Pahae Jae Subdistrict (N = 15)

Indicator of digital competence	Able, n (%)	Not yet able, n (%)
Operating laptops, projectors, and the internet	10 (66.7)	5 (33.3)
Using the internet and digital sources in PAI instruction	9 (60.0)	6 (40.0)
Using and managing a learning management system	5 (33.3)	10 (66.7)
Producing interactive learning media	3 (20.0)	12 (80.0)
Using digital assessment platforms	4 (26.7)	11 (73.3)
Managing a digital classroom	9 (60.0)	6 (40.0)
Using Google Forms or similar tools for assessment	5 (33.3)	10 (66.7)

Source: Primary data from the pre-cycle questionnaire.

Interviews conducted at the same time indicate that the low figures reflected an absence of sustained, hands-on training rather than a lack of willingness. One senior PAI teacher explained:

"So far we have taught PAI using books, writing on the blackboard, or occasional dictation. We know this is the digital age, but honestly we do not know where to start. Using a projector or Canva seems very complicated, and in our area the network is often unstable." (translated from Indonesian)

Another teacher pointed to the mismatch between the training that was available and the support that was needed:

"We often attend general seminars about the curriculum, but training that guides us step by step, from holding a laptop to building a digital lesson, almost never reaches our subdistrict. We need to be accompanied slowly until we can do it." (translated from Indonesian)

This pattern shaped the design of the intervention. The programme was delivered in two cycles, each moving through planning, action, observation, and reflection, and each cycle took as its starting point the difficulties identified in the previous one.

Cycle I

Planning for the first cycle began with a needs analysis. Observation showed that most teachers could use computers and smartphones at a basic level but did not yet use digital media for interactive instruction. A training schedule, syllabus, and module were therefore prepared, covering foundational digital literacy, presentation applications, instructional video, and online sources of learning material. The headmasters, resource persons, and the organising committee were involved in setting the schedule and the content, and the required facilities, including laptops, projectors, and internet access, were made available for every session. The programme covered six modules: understanding digital learning technology; using and managing a learning management system through Google Classroom; using Canva and PowerPoint to build instructional media; managing a digital classroom; producing digital learning material; and using Google Form, Quizizz, and Wordwall for assessment. Delivery was practice centred, so that teachers worked through each task with a resource person available rather than receiving instruction alone. During the first cycle, 80% of the teachers took part actively in the practical sessions and the remainder required additional support. Table 2 reports the change in composite digital competence scores between the baseline and the end of Cycle I for the five subjects taught by the participants. Scores rose in every case. The increase ranged from 40% to 46%, with a mean increase of 43.5%. The largest increase was recorded

among the Al-Qur'an Hadis teachers at MAS Al-Ikhlas Tarutung Dua (46%), and the smallest increases (40%) were recorded by the Fikih teachers in two of the three madrasahs.

Table 2. Digital competence scores before and after Cycle I, by subject

School	Subject	Baseline score	Cycle I score	Increase (%)
MIN 1 Tapanuli Utara	Al-Qur'an Hadis	50	71	42
MIN 1 Tapanuli Utara	Akidah Akhlak	48	69	44
MIN 1 Tapanuli Utara	Fikih	52	73	40
MIN 1 Tapanuli Utara	SKI	49	71	45
MIN 1 Tapanuli Utara	Bahasa Arab	50	72	44
MTs Swasta Al-Ikhlas Aek Botik	Al-Qur'an Hadis	49	71	45
MTs Swasta Al-Ikhlas Aek Botik	Akidah Akhlak	51	73	43
MTs Swasta Al-Ikhlas Aek Botik	Fikih	50	70	40
MTs Swasta Al-Ikhlas Aek Botik	SKI	48	69	44
MTs Swasta Al-Ikhlas Aek Botik	Bahasa Arab	50	72	44
MAS Al-Ikhlas Tarutung Dua	Al-Qur'an Hadis	48	70	46
MAS Al-Ikhlas Tarutung Dua	Akidah Akhlak	50	72	44
MAS Al-Ikhlas Tarutung Dua	Fikih	51	73	43
MAS Al-Ikhlas Tarutung Dua	SKI	49	71	45
MAS Al-Ikhlas Tarutung Dua	Bahasa Arab	50	72	44

Source: Primary data from observation records and the cycle I assessment. Increase = $(\text{cycle I score} - \text{baseline score}) / \text{baseline score} \times 100$.

Evaluation was carried out through participant evaluation forms, practical tests, and documentation of the sessions. Teachers reported that the material was useful and easy to follow, and the practical test showed that they could build presentations and use interactive media with decreasing support. Group mastery at the indicator level is shown in Table 3.

Cycle II

Planning for the second cycle began with an analysis of the Cycle I results. Most teachers had by then acquired foundational digital literacy and were able to use technology in instruction, so the focus shifted to producing more complex digital content, using technology consistently, and applying digital applications to assessment. The schedule, syllabus, module, and practice guide were revised for the five subjects, and the target was set that every teacher would produce at least two quality digital products during the cycle. Delivery again combined demonstration, guided practice, and discussion. Teachers produced digital products for their own subjects, worked through the technical difficulties they encountered with the resource person, and used discussion sessions to compare materials and adapt them to their students. Observation during the cycle showed that teachers were producing more varied content independently and were using presentation and assessment applications with growing confidence. Group mastery rose to 87% at the first meeting of the second cycle and reached 100% at the second. Table 3 sets out the indicator level results across both cycles,

and Table 4 summarises the progression over the five measurement points. From a starting position in which group mastery stood at 40%, mastery increased at every meeting without exception.

Table 3. Group mastery of digital competence indicators across intervention meetings

Stage	Indicator	Teachers reaching mastery, n/N	Mastery (%)
Cycle I, meeting 1	Understanding digital learning technology	9/15	60
Cycle I, meeting 1	Using Canva and PowerPoint for instructional media	8/15	53
Cycle I, meeting 2	Using Google Classroom	10/15	67
Cycle I, meeting 2	Producing digital learning media	11/15	73
Cycle II, meeting 1	Producing interactive media with Canva and PowerPoint	12/15	80
Cycle II, meeting 1	Developing digital media independently	13/15	87
Cycle II, meeting 2	Producing digital assessment with Google Form	14/15	93
Cycle II, meeting 2	Managing digital learning	15/15	100

Source: Primary data from observation records and cycle assessments.

Table 4. Group mastery of digital competence by measurement point

Measurement point	Group mastery (%)
Before the programme	40
Cycle I, meeting 1	53
Cycle I, meeting 2	73
Cycle II, meeting 1	87
Cycle II, meeting 2	100

Source: Primary data from cycle assessments.

Competencies developed through the programme

Four forms of competence emerged consistently from the observation and interview records. The first was digital literacy, meaning the ability to locate, evaluate, and use digital sources of learning material. A teacher at MIN 1 Tapanuli Utara described the change:

"Through the in-house training we as teachers gained an understanding of how to use technology as a source of learning. We were taught how to find teaching material on the internet, how to use instructional video, and how to build a presentation that is more attractive so that students understand the material more easily." (translated from Indonesian)

The second was the use of technology-based instructional media. Teachers moved from exclusive reliance on lecture and printed material to presentation software, instructional video, and other visual media. The headmaster of MTs Swasta Al-Ikhlas Aek Botik observed that:

"Through this training the teachers have begun to understand the importance of technology-based instructional media. They no longer use only the lecture method; they have started to use digital presentations, instructional video, and other visual media that make the learning process more attractive for students." (translated from Indonesian)

The third was the ability to produce digital learning content. Teachers were trained to build digital versions of their teaching material, and a teacher at MTs Swasta Al-Ikhlas Aek Botik reported that:

"In this training we were shown how to produce teaching material in digital form, such as presentations and other instructional media. This helps us a great deal because the material we give to students becomes clearer and more interesting." (translated from Indonesian)

The fourth was the use of technology for assessment. Teachers learned to build evaluation instruments in digital form and to use them for classroom assessment. The headmaster of MAS Al-Ikhlas Tarutung Dua explained that:

"Through the in-house training the teachers have begun to understand how to use technology in evaluating learning. Teachers can now build evaluation instruments using digital applications so that assessment can be carried out more easily and efficiently." (translated from Indonesian)

Changes in the quality of digital-based PAI learning

The third research question concerned the contribution of the programme to the quality of digital-based PAI learning. Three changes were reported consistently across the three madrasahs. First, teachers began to use a wider range of media in a single lesson. As one teacher put it:

"After taking part in the IHT, we teachers understand better how to use technology in teaching, such as building teaching material in PowerPoint, using instructional video, and using learning applications. This has made PAI learning more interesting, and students also appear more active in following the lesson." (translated from Indonesian)

Second, teachers reported becoming more deliberate in planning technology-supported lessons rather than defaulting to lecture. Another participant contrasted the position before and after the programme:

"The IHT has helped us to raise the quality of our teaching. Before the training our use of technology was limited, but after the IHT we began to use digital media such as instructional video, presentations, and technology-based teaching material, so that lessons have become more varied." (translated from Indonesian)

Third, teachers described students as more attentive and more willing to participate when digital media were used, and they reported using digital assessment to check understanding more quickly. These changes were reported by teachers and recorded by the observer; the study did not measure student learning outcomes directly, and the observations should be read in that light.

DISCUSSION

The three research questions can now be considered together, because the implementation of the programme, the competencies it developed, and the changes reported in the classroom are closely connected. On the first question, the implementation followed the structure that the literature associates with effective in-house training. The material was derived from an identified need rather than imposed from outside, the delivery was internal to the madrasah, and the content was adjusted between cycles. Two features of the implementation appear to account for most of the movement observed. The first was the emphasis on guided practice: teachers produced artifacts during the sessions rather than watching demonstrations, which is consistent with the view that professional competence is developed through doing and reflection rather than through exposure alone (Siska & Ishartiwi, 2025). The second was the cyclical structure itself. Because each cycle ended with a structured reflection, the difficulties of one round became the plan of the next, which is precisely the function of the action research spiral (Torang Siregar, 2025). The pattern of the gains supports this reading. The largest absolute improvements occurred early, when teachers moved from 40% group mastery at baseline to 73% by the end of the first cycle, a gain of 33 percentage points in two meetings. The second cycle added a further 27 percentage points but did so from a much higher starting position, and it was the second cycle that produced mastery on the more demanding indicators, such as independent production of digital media (87%) and digital assessment (93%). In other words, the first cycle removed the operational barrier and the second cycle converted

operational skill into pedagogical use. This two-stage pattern - operational literacy first, the capacity to build and manage technology-supported learning environments afterwards - is visible in the indicator record itself rather than inferred from the totals, and it implies that the two stages should be assessed separately.

On the second question, the four competencies identified, namely digital literacy, use of technology-based media, production of digital content, and use of technology for assessment, overlap with, but do not coincide with, the four digital competencies identified for PAI teachers by Hunaidah and Hepi (2023), namely information, communication, content creation, and security: the assessment indicator at the centre of the present study has no counterpart in that scheme, and security does not appear as a separate indicator in the observation record used here. Two observations are worth making. First, the competencies were not acquired simultaneously. Literacy and media use preceded content production, and assessment came last, which suggests that a training programme that presents all four at once would be unlikely to produce the same result. Second, the competencies are specific to the work of the PAI teacher. Teachers were not trained to use technology in the abstract; they were trained to produce material for Al-Qur'an Hadis, Akidah Akhlak, Fikih, the History of Islamic Culture, and Arabic. This is significant because subject-specific training addresses exactly what generic ICT workshops leave implicit: a review of a decade of research on PAI teachers' competencies found that empirical work on how digital competence is actually cultivated among PAI teachers remains scarce (Arif et al., 2025), and it is the point at which subject specific training differs most clearly from generic ICT workshops. On the third question, teachers consistently reported that lessons had become more varied and that students had become more willing to participate. These reports are consistent with earlier findings. Wipa et al. found that an in-house training programme improved teachers' ability to use Google Classroom (Wipa et al., 2026), and Liu likewise reported, in a systematic scoping review, that infrastructure deficiencies and the digital divide impede the implementation of technology in education, constraints visible in the baseline record of these madrasahs (Liu et al., 2025). Arif reviewed a decade of studies on PAI teachers' competencies and concluded that technological and digital competencies must be added to the four established teacher competencies, a finding that parallels the movement observed here from operational skill to changed instructional practice (Arif et al., 2025). The baseline position - teachers able to operate equipment but not yet able to build digital media or assess digitally - corresponds to the readiness problem described by Habibul Fattah in their analysis of digital literacy and teacher readiness in Indonesian Islamic education (Habibul Fattah et al., 2026), and to the argument of Hunaidah and Hepi that digital competence has become a precondition for effective PAI instruction (Hunaidah & Hepi Ikmal, 2023). The present study extends this body of work in two respects. It documents the process rather than the outcome alone, by reporting the intermediate stages between baseline and final mastery, and it does so in madrasahs serving minority Muslim populations, a setting in which prior studies of in-house training have been rare.

Two features of the programme account for most of the movement observed, and both can be identified in the record rather than inferred from the totals. The first is that the material was derived from a needs analysis conducted with the teachers themselves, so that the design addressed the specific weaknesses the pre-cycle data revealed instead of following a generic training catalogue. The second is that every practical task was completed on the participants' own subject material: teachers produced digital content for Al-Qur'an Hadis, Akidah Akhlak, Fikih, the History of Islamic Culture, or Arabic, so that competence demonstrated at the end of a session was competence usable in the following week's lesson, which also explains the short interval between training and reported change. What the record does not show is which of the two features did the work, because they were introduced together and were not varied between the two cycles; the design therefore supports a claim about the package of needs-based, practice-centred training, and not about either element separately.

The findings also differ from those of earlier studies in two respects. First, Wipa et al. (2026) and Liu et al. (2025) reported improvement at the level of a single capability - the use of Google Classroom, or the application of information and communication technology - whereas the present study reports the sequence in which four competencies appeared: literacy and media use first, content production afterwards, and digital assessment last. That ordering matters for programme design, since a programme presenting all four dimensions simultaneously might produce a different pattern. Second, the baseline examined here matches the readiness problem described by Habibul Fattah et al. (2026) and Hunaidah and Hepi (2023): teachers able to operate equipment but not yet able to build digital media or to assess digitally. The comparison should nonetheless be read cautiously, because the earlier studies used different participants, settings, and instruments, and, as far as the literature consulted for this study shows, none of them reported intermediate measurement points; a difference in pattern may therefore reflect differences in measurement as much as differences in training. Within that limit, the present study adds a documented progression from baseline to full group mastery in madrasahs serving minority Muslim populations, a context in which in-house training has rarely been reported.

The theoretical implication is that school based training operates through reflection rather than through content. The material delivered in the two cycles was not unusual; what was unusual was that the same teachers returned to it, reported on it, and had the next round designed in response to what they reported. This supports the view that teacher development is best understood as an iterative process in which practitioners are participants in the design of their own learning rather than recipients of it. The practical implication follows directly: madrasah leaders who wish to raise digital competence should fund repeated short cycles of practice and review rather than a single workshop, should sequence foundational operational skills before content production and digital assessment, and should ensure that basic facilities such as laptops, projectors, and stable connectivity are in place before training begins, since the availability of these facilities was a precondition for the practice sessions in both cycles. Three limitations should be noted. The study was conducted in three madrasahs in a single subdistrict with 15 participants and no comparison group, so the findings describe what was observed in this setting and cannot be generalised to other contexts or attributed to the programme alone. The measures of competence were derived from observation and assessment records using a four point rubric, and no inter-rater or internal consistency statistics were reported. Finally, the study did not collect data on student learning outcomes; the observed changes in classroom practice and the teachers' reports of student engagement should therefore be read as indications of changed practice rather than as evidence of improved student achievement.

4. CONCLUSION

This study set out to describe the implementation of an in-house training programme, to identify the competencies it developed, and to examine its contribution to digital-based PAI learning in the madrasahs of Pahae Jae Subdistrict. Three conclusions follow. First, the programme was implemented as intended: two cycles of planning, action, observation, and reflection, with practice-centred delivery and material derived from an identified need, and group mastery improved at every measurement point from baseline to the end of the second cycle. The progressive character of these gains indicates that the improvement was associated with the structure of the training - repeated practice and reflection - rather than with a single exposure to new material. Second, the four competencies were acquired in a definite order: digital literacy and the use of technology-based media first, the production of digital content after them, and the use of technology for assessment last. School-based training for PAI teachers should therefore sequence foundational operational skills before content production and digital assessment. Third, teachers reported that digital-based PAI learning had become more varied and that students had become more willing to participate, and

observation recorded a corresponding shift away from exclusive reliance on lecture and printed material. Because the study measured neither student learning outcomes nor a comparison group, these are reported as changes in observed practice rather than as evidence of improved student achievement. On this basis, the madrasahs are advised to continue the programme in repeated cycles rather than as isolated events and to secure the required facilities before each cycle begins, and further research with a broader sample and with student outcome data is needed to establish whether the changes observed in practice are reflected in student learning.

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