EDUMASPUL:
Jurnal Pendidikan
P-ISSN 2548-8201 | E-ISSN 2580-0469

Vol. 10 No. 2 (2026), 849-857
DOI: https://doi.org/10.33487/edumaspul.v10i2.425

Teachers' Barriers in Utilising Artificial Intelligence in Learning: A Phenomenological Study at an Islamic Primary School

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Received	Revised	Accepted	Published
26/07/2026	17/08/2026	22/08/2026	**02/09/2026**

Abstract: *Artificial intelligence (AI) is increasingly entering Indonesian teaching practice, yet recent national evidence suggests that teachers' technical knowledge and classroom integration remain uneven despite generally positive attitudes. This study examined barriers experienced by teachers in utilising AI in learning at SD IT Darul Fikri, North Bengkulu, and explored how those barriers were experienced and interpreted. A qualitative study with a descriptive phenomenological orientation was conducted. Sixteen classroom and subject teachers served as the primary participants, while an ICT technician, an administrative staff member, the principal, and two foundation managers provided contextual information for triangulation. Data were collected through lesson observation, semi-structured interviews, and documentation. Interview data were organised into significant statements, meaning units, sub-themes, and a synthesis of essential meanings; contextual data were used to corroborate conditions surrounding teachers' experiences. The analysis identified three interrelated barrier categories: competence barriers, infrastructure barriers, and technical-institutional support barriers. Teachers described difficulty formulating precise prompts, basic feature mastery, the need to verify AI outputs, uneven readiness, unstable network coverage, insufficient or unevenly distributed devices, incidental ICT assistance, uncertainty in selecting suitable tools, and a gap between institutional policy and routine classroom use. Across the teacher accounts, four essential meanings were identified: barriers were treated as learning challenges rather than reasons to stop; AI was understood as a support tool rather than a substitute for pedagogical judgement; self-directed learning developed in response to limited mentoring; and verification of AI output was understood as professional responsibility. The findings suggest that where basic AI-supporting infrastructure has been introduced, practical integration may still be constrained by capacity, distribution, competence, and institutionalised support.*

Keywords: *Teacher barriers; artificial intelligence; primary school learning; phenomenology; AI literacy*

Abstrak: Kecerdasan buatan (AI) semakin banyak diterapkan dalam praktik pengajaran di Indonesia, namun bukti nasional terkini menunjukkan bahwa pengetahuan teknis guru dan integrasi di kelas masih belum merata meskipun secara umum sikapnya positif. Studi ini meneliti hambatan yang dialami guru dalam memanfaatkan AI dalam pembelajaran di SD IT Darul Fikri, Bengkulu Utara, dan mengeksplorasi bagaimana hambatan tersebut dialami dan diinterpretasikan. Studi kualitatif dengan orientasi fenomenologi deskriptif dilakukan. Enam belas guru kelas dan mata pelajaran berperan sebagai partisipan utama, sementara seorang teknisi TIK, seorang staf administrasi, kepala sekolah, dan dua manajer yayasan memberikan informasi kontekstual untuk triangulasi. Data dikumpulkan melalui observasi pembelajaran, wawancara semi-terstruktur, dan dokumentasi. Data wawancara diorganisasikan menjadi pernyataan penting, unit makna, sub-tema, dan sintesis makna esensial; data kontekstual digunakan untuk menguatkan kondisi seputar pengalaman guru. Analisis mengidentifikasi tiga kategori hambatan yang saling terkait: hambatan kompetensi, hambatan infrastruktur, dan hambatan dukungan teknis-kelembagaan. Para guru menggambarkan kesulitan dalam merumuskan petunjuk yang tepat, penguasaan fitur dasar, kebutuhan untuk memverifikasi keluaran AI, kesiapan yang tidak merata, cakupan jaringan yang tidak stabil, perangkat yang tidak mencukupi atau tidak terdistribusi secara merata, bantuan TIK insidental, ketidakpastian dalam memilih alat yang sesuai, dan kesenjangan antara kebijakan institusional dan penggunaan rutin di kelas. Di seluruh uraian guru, empat makna penting diidentifikasi: hambatan diperlakukan sebagai tantangan pembelajaran daripada alasan untuk berhenti; AI dipahami sebagai alat pendukung daripada pengganti penilaian pedagogis; pembelajaran mandiri dikembangkan sebagai respons terhadap bimbingan yang terbatas; dan verifikasi keluaran AI dipahami sebagai tanggung jawab profesional. Temuan menunjukkan bahwa di mana infrastruktur pendukung AI dasar telah diperkenalkan, integrasi praktis mungkin masih dibatasi oleh kapasitas, distribusi, kompetensi, dan dukungan institusional.

Kata kunci: Hambatan guru; kecerdasan buatan; pembelajaran sekolah dasar; fenomenologi; literasi AI

CITATION:	Firmansyah, H., Asmara, A., & Hidayat, T. (2026). Teachers' Barriers in Utilising Artificial Intelligence in Learning: A Phenomenological Study at an Islamic Primary School. *Edumaspul: Jurnal Pendidikan*, *10*(2), 849–857. https://doi.org/10.33487/edumaspul.v10i2.425
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Introduction

The use of artificial intelligence in Indonesian schools is expanding, but teacher readiness remains uneven. A national survey of 675 Indonesian EFL teachers found positive attitudes toward AI alongside limited technical knowledge and fragmented classroom practices, with AI used more often for lesson preparation than for transformative pedagogy (Rohmah et al., 2026). Evidence from elementary teachers likewise shows that AI literacy and facilitating conditions are closely associated with acceptance and intended use (Batubara et al., 2025). These findings place teacher competence and institutional conditions at the centre of educational AI integration.

The obstacles are not only technical. Systematic reviews show that infrastructure, digital competence, pedagogical readiness, trust, perceived usefulness, ethical concerns, and institutional support interact in shaping teacher adoption of AI (Chiu et al., 2023; Celik et al., 2022). The educational value of AI therefore depends not simply on access to a tool, but on whether teachers can connect it to learning goals, evaluate its outputs, and work within supportive organisational conditions.

In Indonesia, evidence from elementary and regional contexts points to uneven rather than uniform readiness. Studies report variation in AI literacy, facilitating conditions, access to training, and infrastructure, particularly when implementation extends beyond basic experimentation (Batubara et al., 2025; Wulandari et al., 2025; Zainuddin et al., 2025). These findings suggest that the challenge is not adequately captured by a simple urban-rural dichotomy; local capacity, institutional support, and the distribution of resources within schools also shape what teachers are able to do with AI.

Qualitative work at early-childhood and primary-school levels also shows that positive perceptions can coexist with limited digital literacy and insufficient practical training. Using a phenomenological orientation, Fadila et al. (2025) found that teachers viewed AI as useful for preparing materials and supporting instructional work while still reporting limited literacy, inadequate training, and concerns about its classroom implications. Wulandari et al. (2025) similarly documented uneven readiness among elementary teachers. Together, these studies indicate that understanding adoption requires attention not only to whether teachers use AI, but also to how they experience the demands, uncertainty, and professional responsibility associated with that use.

Preliminary observation at SD IT Darul Fikri North Bengkulu in November 2025 found that the use of AI in learning was not yet running optimally. Teachers' use of digital technology remained largely confined to basic learning media such as PowerPoint presentations and internet-sourced material, while AI applications for personalising learning, analysing student attainment, or providing automatic feedback were not being applied in a structured way. This local picture is consistent with reports that meaningful AI integration requires not only access, but also teacher competence, practical training, and institutional support (Sukariasih et al., 2025; Celik et al., 2022).

What remains insufficiently examined is the lived experience of teachers in a foundation-run school in a rural district where basic AI-supporting infrastructure and an institutional technology programme are already present, but capacity and access are not necessarily sufficient or evenly distributed. This is the gap the present study addresses. SD IT Darul Fikri is an accredited-A Islamic integrated primary school with laptops, projectors, an interactive flat panel, a computer laboratory, and WiFi, and its foundation promotes technology use through the International Futuristic School (IFS) programme. The setting is analytically valuable because it allows barriers to be examined beyond the simple presence or absence of technology. Two questions guide the research: what barriers do teachers experience in utilising AI in learning, and how do teachers experience and make sense of those barriers in pedagogical, professional, and emotional terms?

Method

Research design

This study used a qualitative design with a descriptive phenomenological orientation to examine teachers' lived experiences of barriers in utilising AI in learning. Phenomenology focuses on how a phenomenon is experienced and interpreted from the perspective of those who live through it (Moustakas, 1994; Creswell & Poth, 2018). Accordingly, the phenomenological analysis centred on the sixteen teachers who directly experienced AI-related barriers in their instructional work, while non-teacher informants were used to clarify and triangulate the institutional and technical conditions surrounding those experiences.

Setting and participants

The research was conducted at SD IT Darul Fikri, under the Darul Fikri Education and Da'wah Foundation, in Arga Makmur, North Bengkulu Regency. The site was selected purposively because it represents a foundation-run school in a district undergoing transition toward AI-supported learning; basic digital infrastructure is already

available, although its capacity and distribution are not always sufficient; the foundation has an existing technology policy through the IFS programme, allowing the relationship between policy and classroom practice to be examined; and most teachers had already begun trying AI applications, making it possible to recruit participants with direct experience of the phenomenon.

Field data were collected from 21 to 29 July 2026, following a pre-field stage of instrument preparation and permissions in May-June 2026. Twenty-one informants were recruited purposively. Sixteen classroom and subject teachers constituted the primary phenomenological participants, while the ICT technician, administrative staff member, principal, and two foundation managers served as contextual informants for triangulation, as shown in Table 1.

Table 1. Composition and analytic role of informants

Informant group	n	Role
Classroom and subject teachers	16	Primary data
ICT technician	1	Contextual data
Administrative staff	1	Contextual data
School principal	1	Contextual data
Foundation managers	2	Contextual data
Total	**21**	

Teacher participants were selected because they had tried AI as a learning medium or instructional aid and had encountered obstacles in using digital technology. Contextual informants were selected because they held responsibility for technical support, administration, school leadership, or foundation policy and therefore could clarify the conditions surrounding teachers' experiences.

Data collection

Three techniques were used. Observation of AI-supported lessons employed a guide covering ten aspects: availability of digital devices, network stability, teachers' use of AI or AI-supported applications, alignment with learning objectives, teacher-student interaction, student response, visible technical difficulties, teacher coping strategies, availability of ICT support, and classroom atmosphere. Semi-structured interviews lasting approximately twenty to thirty minutes were conducted with the sixteen teacher participants and five contextual informants between 24 and 27 July 2026. The interviews focused on concrete experiences of using AI, the barriers encountered, responses to those barriers, perceived institutional support, and the meanings participants attached to their experiences. Documentation included school technology policy, ICT facilities data, photographs of AI-supported lessons, and teacher-training reports.

Data analysis and trustworthiness

Analysis was organised in a phenomenologically oriented sequence consistent with Moustakas (1994) and Creswell and Poth (2018). Teacher interviews were transcribed and examined for statements directly related to experiences of AI use, barriers, responses, and professional meanings. Relevant statements were condensed into meaning units and initial codes, after which related units were clustered into sub-themes and broader descriptive categories. The teacher accounts were then synthesised into descriptions of what was experienced and the conditions shaping those experiences, from which four essential meanings were formulated. Data from the ICT technician, administrative staff member, principal, foundation managers, classroom observations, and documentation were used to contextualise and triangulate the teacher accounts rather than to determine the phenomenological essence. The analytic trail was kept data-led: for example, accounts of difficulty translating learning objectives into precise AI instructions were coded as prompt-formulation difficulty and clustered within competence barriers, while accounts of available but unstable WiFi were coded as network stability and coverage and clustered within infrastructure barriers. Ertmer's distinction between first- and second-order barriers was applied after the data-driven clustering as an interpretive lens rather than as a predetermined coding template. Credibility was supported through source triangulation, technique triangulation, member checking of interview material and preliminary interpretations, retention of supporting reference materials, and thick description so that readers can judge transferability to comparable settings.

Results and Discussion

Initial picture of AI use

Across the sixteen teacher accounts, the prevailing stance toward AI was positive but pragmatic. Teachers repeatedly described AI as "very helpful" and as something that "makes things much easier", while also acknowledging limits in their own skill and the need to verify outputs. Teachers reported encountering and trying AI at different times between 2019 and 2025, with most uptake occurring in 2024-2025. The spread in starting points indicates that adoption at this school developed gradually and unevenly rather than through a single, simultaneous institutional transition. The applications and digital platforms reported by teachers are summarised in Table 2.

Table 2. Digital and AI-supported applications reported by teachers

Application or platform	Reported purpose
ChatGPT	Preparing teaching material, lesson plans, questions and assessment, and finding teaching ideas
Canva	Designing visual learning media and presentation material
Gemini	Finding references and alternative explanations of concepts
DALL-E, Leonardo	Generating supporting images and illustrations
Quizizz, Wordwall	Composing quizzes and educational games for reinforcement
CapCut	Editing simple instructional video

Teachers reported using a mix of clearly generative AI tools, such as ChatGPT, Gemini, DALL-E, and Leonardo, and multipurpose digital platforms that may include AI-assisted functions, such as Canva, Quizizz, Wordwall, and CapCut. Because the study record did not consistently identify the specific AI feature activated within each multipurpose platform, these tools are reported as digital or AI-supported applications rather than classified uniformly as AI systems. Across the accounts, use was concentrated on preparing teaching material, drafting lesson plans and modules, designing visual media, and generating ideas for quizzes or learning activities. AI had therefore entered teachers' preparation workflow more consistently than it had become embedded in classroom delivery, a distinction that later helps explain the gap between institutional encouragement and routine pedagogical integration.

Categories of barriers

Inductive clustering of teacher meaning units produced three interrelated barrier categories and ten sub-themes, presented in Table 3. The categories were derived from recurrent experiences described by teacher participants and were then checked against contextual interviews, observation, and documentation.

Table 3. Barrier categories derived from teachers' accounts

Category	Sub-theme
Competence	Difficulty formulating precise prompts
	Mastery of features still at a basic level
	Limited output accuracy requiring verification
	Training insufficiently applicable; uneven readiness between teachers
Infrastructure	Network stability and coverage
	Sufficiency and even distribution of devices
	Logistical constraints prompting use of personal devices
Technical and institutional support	ICT staff support only incidental
	Confusion in selecting appropriate AI applications
	Gap between policy and classroom implementation

After these categories had been derived from the teacher accounts, Ertmer's (1999) distinction between first-order and second-order barriers was used as an interpretive lens. First-order barriers refer to external conditions such as devices, network access, time, and technical support, whereas second-order barriers concern confidence, beliefs, knowledge, and pedagogical readiness. In this study, the distinction is useful not as a template for generating themes, but for explaining why the barriers identified by teachers require different forms of response.

Infrastructure barriers

Limited numbers of projectors, network instability when accessed simultaneously, uneven WiFi coverage, and the distance between device storage and classrooms are all first-order barriers. What deserves emphasis is a shift in their nature. In much earlier work, infrastructure barriers meant the absence of devices and networks. Here devices and networks are present, but insufficient in quantity, unstable in quality, and uneven in distribution. The shift demands a different policy response: not initial procurement but capacity increase, continuous maintenance, and governance of device use. The finding on storage distance illustrates the point sharply — a device that is difficult to reach in practice ends up functioning like a device that is not there at all.

These barriers also carry a pedagogical consequence that is easily overlooked. Because devices do not reach every student, AI use in class proceeds on a one-device-for-many-students pattern, so AI remains an aid to presenting material and cannot yet be used for individual personalisation of learning, which is the potential most often described in the literature (Desrizal et al., 2025; Supriyadi & Nasution, 2024). Limited infrastructure thus restricts not merely technical convenience but the kind of AI use available to teachers at all.

Competence barriers and AI literacy

Difficulty formulating precise prompts and basic mastery of features are second-order barriers rooted in digital literacy and teacher confidence, consistent with Prasetyo et al. (2025) on low teacher digital literacy as the principal obstacle to operating AI-based platforms. The difficulty with prompts can be specified further through the AI literacy framework. Long and Magerko (2020) place the ability to communicate effectively with AI systems among the core competencies of AI literacy, and Ng et al. (2021) elaborate four dimensions: knowing and understanding AI, using and applying AI, evaluating and creating with AI, and attending to AI ethics. Prompt construction falls within using and applying, while teachers' habit of verifying AI output falls within evaluating and ethics.

A notable pattern within this case is that evaluative caution appeared more developed than application fluency. Teachers reported difficulty constructing precise prompts and using advanced features, yet they also described the need to check AI-generated content before using it with students. In AI-literacy terms, the ability to use and apply AI remained uneven, while elements of evaluation and ethical judgement were already visible (Long & Magerko, 2020; Ng et al., 2021). This pattern should be read as a contextual finding rather than as a general sequence through which AI competence necessarily develops.

General digital familiarity did not automatically translate into confident AI integration. Some teachers who were comfortable using laptops still reported difficulty choosing AI tools, formulating instructions, or connecting AI features to specific learning purposes. TPACK helps interpret this gap because effective technology integration depends on the intersection of technological, pedagogical, and content knowledge rather than technological skill alone (Mishra & Koehler, 2006). The difficulty of translating a learning objective into a precise prompt or appropriate AI-supported activity therefore points to a technological-pedagogical challenge, not merely an operational one. UNESCO's (2024) AI Competency Framework for Teachers similarly distinguishes AI pedagogy from basic knowledge of AI tools.

Readiness was also uneven between teachers. Some remained at the level of basic functions while others experimented more broadly, and the principal acknowledged differences in confidence and familiarity. This variation indicates that professional development should be differentiated according to existing competence and instructional need rather than delivered as a single uniform introduction to AI.

Technical and institutional support barriers

The IFS programme demonstrates institutional commitment to promoting technology and AI use through training, mentoring, and facilities. The teacher accounts nevertheless revealed a gap between policy-level support and classroom-level experience. Some teachers described the activities they had attended as closer to socialisation than sustained hands-on practice, while technical assistance remained incidental rather than routinely available. In Ertmer's (1999) terms, institutional support can reduce external barriers, but only when it is accessible at the point where teachers need to translate policy into practice.

The professional-development finding is consistent with Desimone's (2009) emphasis on content focus, active learning, coherence, duration, and collective participation. Short webinars or socialisation sessions with limited practice offer less opportunity for teachers to rehearse prompt construction, evaluate outputs, and adapt AI use to specific lessons. Celik et al. (2022) similarly identify continuous professional development and organisational support as conditions for meaningful teacher engagement with AI.

Taken together, the evidence suggests that institutional commitment had reached the level of programme initiation but had not yet become routine classroom practice for all teachers. The IFS programme existed and facilities were available, yet applied training and technical mentoring were experienced unevenly. The observation of a lesson without AI use is therefore better interpreted as evidence that integration was not yet routinised across everyday teaching, rather than as evidence of teacher rejection.

At the governance level, the findings also point to a need for clearer guidance on tool selection and responsible use. Holmes and Tuomi (2022) emphasise the importance of policy direction in AI in education, while UNESCO (2023) recommends institutional guidance covering ethics, data protection, and user responsibility. Teachers' uncertainty about which application best suited a particular instructional purpose shows that support is needed before prompt construction begins: teachers must first be able to match the tool to the pedagogical task.

Interconnection between categories

The three barrier categories reinforced one another. Limited applied training, an institutional condition, contributed to weak prompt-formulation skill at the individual level; unstable connectivity reduced the value of skills teachers had already developed; and uncertainty about suitable applications increased dependence on incidental technical help. Rahayu et al. (2026)

similarly reported that structured generative-AI training can strengthen teachers' digital literacy in preparing learning materials. The present findings therefore support Ertmer and Ottenbreit-Leftwich's (2010) argument that resources alone are insufficient: knowledge, confidence, pedagogy, and organisational conditions must develop together.

Teachers' experience of the barriers

Teachers' lived experience was characterised by pragmatic acceptance rather than either uncritical enthusiasm or outright rejection. They valued AI because it reduced preparation effort and broadened teaching ideas, yet ease of use was constrained by prompt formulation, feature mastery, and the need to verify outputs. The recurring expressions "very helpful" and "makes things much easier" capture the textural side of the experience - what AI felt like in everyday work - while uneven competence, network reliability, and access to support help explain the structural conditions that limited deeper integration.

Trust took a calibrated form. Teachers did not describe AI output as self-validating; instead, verification was treated as part of using the technology responsibly. This pattern aligns with AI-literacy frameworks that place evaluation and ethical judgement alongside operational competence (Ng et al., 2021; UNESCO, 2024) and with the caution urged in educational use of generative AI, where teachers retain responsibility for checking accuracy, bias, and contextual appropriateness (Kasneci et al., 2023).

Pedagogically, teachers responded to barriers by preparing alternatives that did not depend on connectivity, adjusting the form of media presentation to the devices available, and managing student involvement during AI-supported activities. These responses show that technology did not replace pedagogical judgement; teachers continuously adapted technological possibilities to classroom conditions. In TPACK terms, the experience illustrates how pedagogical and content knowledge mediate the practical value of technological tools (Mishra & Koehler, 2006). At primary level, this adaptation can also increase rather than simply reduce teachers' work because media preparation is accompanied by the need to supervise and structure students' engagement (Jamilah et al., 2025).

Professionally, teachers responded through self-directed learning and peer exchange. They sought tutorials and references through online sources and shared experiences with colleagues when formal mentoring was insufficient. This adaptive strategy helped sustain use, but it also had limits: the quality of independently accessed guidance varied, and teachers did not always receive expert feedback on whether a particular AI practice was pedagogically or ethically appropriate. Informal learning should therefore be treated as a resource to be connected to structured professional development, not as a substitute for institutional mentoring (Desimone, 2009).

Emotionally, teachers' accounts combined enthusiasm about AI's usefulness with reflective awareness of personal limitations. Rejection of AI and fear of teacher replacement did not emerge as prominent themes in the analysed accounts; this absence is interpreted cautiously rather than as proof that such concerns do not exist. More consistently, teachers described a need to remain in control of the instructional decision and to verify what AI produced. This combination of acceptance and caution is compatible with responsible AI use, in which technological assistance remains subordinate to professional and pedagogical judgement (Chan & Tsi, 2024; UNESCO, 2024).

Observation findings and essential meanings

Observation of ten aspects of AI-supported lesson delivery is summarised qualitatively in Table 4.

Table 4. Qualitative summary of observed AI-supported learning

Aspect observed	Qualitative pattern in available observations
Availability of digital devices	Available, but not evenly accessible
Availability and stability of network	Available; intermittent instability
Use of AI applications by teachers	Observed, but not routine across all observed lessons
Fit of AI use to objectives and material	Generally aligned when AI was used
Teacher-student interaction	Active during AI-supported activities
Student response and involvement	Generally positive
Technical difficulty visible in teachers	Variable across teachers
Teacher efforts to overcome obstacles	Adjustment and fallback strategies observed
Availability of ICT staff support	Available, but incidental and uneven
Classroom atmosphere	Generally engaged during AI-supported activities

The observation record broadly converged with the interviews. Digital devices and AI-supported activities were present, but access and network stability were uneven, technical difficulty varied between teachers, and ICT support was not consistently available at the point of use. When AI was used, teacher-student interaction and student involvement were generally positive. At least one

observed lesson did not use AI, which is consistent with the earlier finding that AI was more firmly established in preparation than in routine classroom delivery. Because the available observation record is qualitative, the table is interpreted as contextual corroboration rather than as a frequency estimate.

Synthesis of the sixteen teacher accounts produced four essential meanings. First, barriers were experienced as learning challenges rather than terminal obstacles: teachers continued experimenting despite difficulty with prompts, devices, or networks. Structurally, this persistence occurred within an institutional climate that encouraged technology use and within teachers' own perception that AI was useful. Second, AI was understood as a support tool whose outputs remained subordinate to teacher judgement; usefulness coexisted with the obligation to check accuracy and contextual appropriateness. Third, self-directed learning emerged as an adaptive response to limited formal mentoring, with teachers seeking tutorials and collegial help when structured support was insufficient. Fourth, prudence was experienced as professional responsibility: verification was not merely a technical correction but part of the teacher's responsibility for material presented to children. Accounts from the principal, foundation managers, ICT technician, and administrative staff were used to corroborate the conditions surrounding these experiences, but were not included in the synthesis of the teachers' phenomenological essence.

Taken together, the composite essence is that teachers experienced AI integration as an ongoing professional learning process. AI was valued and continued to be used, but its classroom integration remained negotiated through uneven competence, unstable or unevenly distributed infrastructure, and non-systematic support. The barriers were therefore interpreted less as reasons to abandon AI than as conditions requiring adaptation, verification, and continued learning. This synthesis addresses the second research question by linking what teachers experienced with the institutional and technical conditions through which those experiences acquired meaning (Moustakas, 1994; Creswell & Poth, 2018).

Implications and limitations

Theoretically, the findings support the applicability of Ertmer's (1999) first- and second-order barrier distinction in this particular foundation-run primary-school context and suggest two contextual refinements. First, external barriers did not take the form of complete technological absence; they appeared as insufficiency, instability, logistical friction, and uneven distribution. Second, evaluative caution toward AI output could coexist with limited application fluency. These observations should be treated as context-bound propositions that warrant examination in other settings, not as general revisions to the underlying framework.

Practically, three recommendations follow. Training in AI literacy should focus on the practice of constructing prompts that begin from learning objectives, accompanied by practice in verifying AI output, designed in differentiated form given the uneven readiness of teachers. Infrastructure strengthening should target network capacity and coverage and the addition of devices, together with governance of storage and lending so that devices are easily reached from classrooms. Technical support should be institutionalised through the designation of mentoring personnel, the preparation of guidance on selecting AI applications, and the scheduling of periodic mentoring, so that it no longer depends on incidental mechanisms.

Several limitations qualify the interpretation. The study was conducted at a single school over a relatively short field period, so the findings are intended for contextual understanding rather than statistical or population generalisation. Observation covered a limited set of lessons and the available record does not provide a frequency basis for every qualitative tendency, which limits the strength of observational corroboration. Interviews were conducted once with each informant and lasted approximately twenty to thirty minutes; this focused format may have constrained the depth with which some lived experiences could be explored. In addition, the foundation actively promoted technology use through the IFS programme, creating a possibility of social-desirability bias in teachers' positive accounts. Finally, students' perspectives on AI-supported learning were not explored in depth. Future studies should use longer or repeated interviews, more systematic observation across subjects and grades, multiple school sites, and direct student perspectives.

Conclusion

The barriers experienced by teachers in utilising AI at SD IT Darul Fikri North Bengkulu were multidimensional and clustered into three interrelated categories. Competence barriers involved difficulty formulating precise prompts, basic mastery of AI features, the need to verify output accuracy, uneven readiness, and training that teachers experienced as insufficiently applied. Infrastructure barriers involved unstable or uneven network coverage, insufficient and unevenly distributed devices, and logistical constraints that sometimes prompted reliance on personal devices. Technical and institutional

support barriers involved incidental ICT assistance, uncertainty in selecting appropriate applications, and a gap between institutional policy and routine classroom implementation.

Across the sixteen teacher accounts, these barriers were experienced through adaptive pedagogical, professional, and emotional responses and converged on four essential meanings: barriers were treated as learning challenges rather than reasons to stop; AI was understood as a support tool rather than a replacement for pedagogical judgement; self-directed learning developed in response to limited mentoring; and verification of AI output was understood as part of professional responsibility. The study suggests that where basic AI-supporting infrastructure has already been introduced, constraints may shift toward capacity, distribution, competence, and institutionalised support rather than disappear. It also shows, within this case, that evaluative caution can coexist with limited technical fluency. Future research should extend the analysis across several schools, use longer or repeated phenomenological interviews, observe a larger and more clearly documented set of lessons, and incorporate students' experiences of AI-supported learning.

Acknowledgment
The authors thank the principal, teachers, and staff of SD IT Darul Fikri North Bengkulu and the managers of the Darul Fikri Education and Da'wah Foundation for their openness and participation in this research.

Funding
This research received no external funding.

Conflict of Interest
The authors declare no conflict of interest.

Author Contributions
Hendry Firmansyah: conceptualization, methodology, investigation, data curation, writing—original draft. Adi Asmara: supervision, validation, writing—review and editing. Tomi Hidayat: supervision, methodology, writing—review and editing.

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