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Generative AI, Cognitive Offloading, and Ability Beliefs: A Case Study from an Islamic Secondary School in South Kalimantan, Indonesia

Hendro Yulius Suryo Putro[1]*, Shoofii Syammari[2], Novi Rosita Rahmawati[3]

[1,2]Universitas Lambung Mangkurat, Banjarmasin, South Kalimantan, Indonesia
[3]Universitas Islam Negeri Syekh Wasil Kediri, Kediri, East Java, Indonesia

*Corresponding author, Surel: hendro.putro@ulm.ac.id

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Abstract

This study examines how six students and three teachers in one private Islamic senior secondary school in South Kalimantan, Indonesia (coded SMAI-X), described generative AI use, beliefs about the changeability of ability, and classroom feedback practice, against a contested evidence base on both AI-related cognitive offloading and growth-mindset interventions. Using a qualitative multiple-case design, data were collected through semi-structured interviews, student process journals, AI interaction logs, and weekly reflection entries, and analyzed through within-case profiling, boundary-explicit thematic coding, and cross-case comparison. Three patterns emerged: several students treated a functioning AI-generated output as sufficient for task closure without independent verification; some students used explicit fixed-ability language when accounting for specific difficulties; and teachers' feedback typically named a shortcoming without an actionable next step, within a routine offering limited revision opportunity. These patterns were synthesized into a hypothesized, non-causal process model. Islamic epistemological commitments to effortful knowledge-seeking (*ijtihad*) are used as a conceptual lens for interpreting these patterns, positioning Islamic education as a theoretical contribution of the study rather than only its research setting. Findings are bounded to a small number of cases in one classroom and should not be generalized; the cross-sectional design does not support causal inference, and reliance on self-report raises the possibility of social desirability effects. Longitudinal or experimental designs are needed to test the proposed model's directionality, and equity-focused attention to feedback structure and device access is recommended for similar classroom contexts.

Keywords: cognitive offloading; generative AI; implicit theories of ability; reflective practice; teacher feedback

1. Introduction

The rapid diffusion of generative AI tools into everyday student practice has reopened long-standing questions about what a completed academic task represents. Recent work situates this shift within the concept of cognitive offloading, delegating reasoning or memory demands to an external tool rather than carrying them internally (Risko & Gilbert, 2016). Several recent studies

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converge on a similar pattern across different student populations: using large language models for research tasks has been found to reduce students' cognitive load while also producing lower-quality reasoning and argumentation (Stadler et al., 2024) , and higher AI use has been linked to greater cognitive offloading and, in turn, lower critical thinking, with younger users showing higher dependence on AI tools than older users (Gerlich, 2025). This body of work remains concentrated in higher education and adult knowledge work; comparatively little of it examines how offloading is enacted, checked, or left unchecked inside a secondary-school classroom's day-to-day task and feedback cycle, the gap this study addresses.

A second, partly independent line of inquiry concerns students' beliefs about whether ability itself can change. Implicit theories of intelligence theory (Dweck, 2006) distinguish an entity ("fixed") view, in which ability is a stable trait, from an incremental ("growth") view, in which ability develops through effort and strategy. This theory has motivated a large intervention literature whose evidentiary status is now actively contested. Two large-scale meta-analyses reported that the overall correlation between mindset and academic achievement was weak ($k = 273$, $N = 365{,}915$) and that the overall effect of growth-mindset interventions on achievement was small ($k = 43$, $N = 57{,}155$), while noting that students of low socioeconomic status or those academically at risk showed some support for the theory's tenets (Sisk et al., 2018). A related meta-analysis found a small effect size ($d = 0.05$) using a quality-filtered set of studies (Macnamara & Burgoyne, 2022). These conclusions have themselves been disputed on methodological grounds: a heterogeneity-attuned re-analysis of the same literature yielded more nuanced, theory-consistent conclusions than a traditional aggregate approach (Tipton et al., 2023). This unresolved debate is directly relevant to the present study's design: rather than assuming growth mindset operates uniformly, fixed-ability beliefs are treated as one pattern among several that may or may not co-occur with a given case's AI-use behavior.

Students scored below the OECD average in mathematics, reading, and science in PISA 2022, with results in all three domains among the lowest ever measured for Indonesia by PISA (OECD, 2023). Only 18% of 15-year-old students in Indonesia attained at least Level 2 proficiency in mathematics, against an OECD average of 69%, and socio-economic status was identified as a predictor of performance (OECD, 2023). Within Islamic schooling specifically, growth mindset has been examined mainly as a character-education outcome linked to religious habituation and Islamic values (Baidarus & Fithri, 2025; Fairuz et al., 2026), and descriptive feedback has been shown, in a qualitative case study of Fiqh learning, to reduce cognitive anxiety and support a shift away from fixed, dogmatic thinking (Farhaty et al., 2025). Teacher feedback and Islamic educational values have also been examined as joint predictors of self-

regulated learning among madrasah students (Rifqoh et al., 2026). Generative AI use among Indonesian secondary students, meanwhile, has been documented mainly through survey and phenomenological studies showing that students primarily use these tools for instant answer retrieval rather than deep learning (Kresnandya & Rizaldi, 2025) and that teachers face ethical and practical tensions in adapting AI to their classrooms (Kurniawan, 2026). At the level of teacher strategy specifically, a qualitative case study of growth-mindset formation through Islamic reflective learning in a Madrasah Ibtidaiyah found that Islamically framed feedback, routine self-reflection (*muhasabah*), and stories of inspirational Islamic figures were associated with an increase in students' reported willingness to attempt difficult tasks (Ubaidillah et al., 2026), illustrating one pathway through which explicit, values-based feedback practice might counter the fixed-ability language documented later in this study. Digital transformation in Islamic schooling more broadly has been linked to teacher professionalism and, through it, to student digital literacy (Ariyani et al., 2026), to interactive media's capacity to strengthen critical thinking when it supports deep rather than surface learning (Rahmi et al., 2026), and to school-level efforts to hold technology adoption, local wisdom, and religious moderation together rather than treating them as competing priorities (Ilmudinulloh et al., 2024; Vitasari & Sassi, 2024). This context matters for the present study not as a causal explanation but as institutional background: an assessment culture oriented toward measurable output, operating alongside uneven digital access, plausibly shapes both how generative AI is used at the individual task level and how classroom feedback is structured, the two phenomena this study examines jointly.

The Islamic school setting in this study is treated here as more than a sampling frame. Classical Islamic epistemology grounds the pursuit of knowledge in ijtihad, literally the exertion of effort, a concept developed across Islamic legal and educational thought to describe the sustained, disciplined effort a person exercises in reasoning toward understanding (Kamali, 2003). Knowledge-seeking is correspondingly framed in Islamic educational thought as a lifelong obligation realized through effort rather than as a fixed endowment, a framing consistent with the Islamically grounded, effort-oriented feedback practices documented in comparable Indonesian Islamic school settings (Rifqoh et al., 2026; Ubaidillah et al., 2026). This framing sits in direct tension with the entity view of ability that fixed-ability language expresses (Dweck, 2006). Read through this lens, a student's fixed-ability statement is not simply a psychological belief to be logged as a code; it is also a departure from the epistemic stance that the student's own educational tradition articulates for how understanding is properly pursued. This study treats that tension, between an effort-centered epistemology explicit in the participating school's tradition and the fixed-ability language documented in Section 3.2, as a substantive interpretive question taken

up in the Discussion, rather than treating the school's religious character as incidental to where the data happened to be collected.

These literatures point to a specific and comparatively unexamined intersection. Most cognitive-offloading research to date is quantitative, higher-education-focused, and treats offloading as a general disposition rather than a pattern that plays out differently across individual students with different access, incentives, and feedback environments. Most growth-mindset research measures beliefs via validated psychometric scales at a single time point, which does not capture how a fixed-ability belief is invoked, in a student's own words, to account for a specific difficulty encountered during a specific task. Classroom feedback research on the link between comment type and revision behavior (Hattie & Timperley, 2007) has rarely been examined alongside AI-mediated task completion within the same classroom setting, and within the Indonesian Islamic-school context specifically, no study identified for this review has examined how unverified AI-assisted task completion, explicit fixed-ability language, and feedback structured without a revision opportunity co-occur within the same set of student and teacher cases.

This study addresses that intersection through a qualitative multiple-case design situated in one classroom at SMAI-X, a private Islamic senior secondary school in South Kalimantan, Indonesia. Rather than testing a hypothesized causal pathway, the study asks how these elements appear, individually and in relation to one another, across a small set of richly described cases, with explicit attention to boundaries of interpretation and to competing explanations the data cannot rule out. Specifically, the study asks: (1) how do students describe their use of generative AI in relation to verifying or explaining a task outcome; (2) how, and under what circumstances, do students invoke beliefs about the changeability of ability when accounting for a specific academic difficulty; (3) how does teacher feedback practice structure or constrain opportunities for task revision; and (4) how, if at all, do these three patterns co-occur within individual cases.

This study does not claim to establish that generative AI use causes reduced verification, that fixed-ability beliefs are widespread among Indonesian adolescents, or that a particular feedback style produces a particular mindset. Its contribution is a case-level, boundary-explicit account of how these elements appeared to relate to one another in one classroom, offered as a basis for the process model proposed in the Findings and Discussion and for future research designed to test directionality that the present design cannot establish.

2. Method

2.1 Research Design

This study used a qualitative multiple-case study design (Yin, 2018) (Stake, 2006) to examine how generative AI use, beliefs about ability, and classroom feedback practice related to one another within an intact classroom setting. A case study design was selected because the phenomena of interest, how a student comes to accept an AI-generated output, how a belief about ability is invoked to explain a specific difficulty, how a teacher's comment does or does not lead to revision, are embedded in situated classroom routines that a single-time-point survey would not capture with comparable depth. Each student participant constituted one case; teacher participants were treated as a second, related unit of analysis whose accounts contextualized rather than independently verified student-reported experience, consistent with an embedded multiple-case design in which within-case analysis precedes cross-case comparison (Yin, 2018).

2.2 Case and Site Boundaries

The case boundary was set at one Grade XI classroom at SMAI-X, a private Islamic senior secondary school in South Kalimantan, Indonesia, bounded further by an eight-month period corresponding to the participating teachers' tenure with this class. This boundary was chosen to hold the assessment structure, subject teachers, and peer context approximately constant across student cases, so that differences observed across cases could be interpreted against a shared instructional environment rather than confounded by cross-school variation. The single-site boundary is a deliberate design choice that increases within-context comparability at the cost of cross-context generalizability; this trade-off is revisited in Section 4.7.

2.3 Participants and Recruitment

Six students (coded S01–S06) and three subject teachers (coded G01–G03, teaching mathematics, Indonesian language, and informatics respectively) were recruited from within the bounded classroom (Table 1a, Table 1b). All names used in this article, including the school name, are codes; no participant or institution is identified by their real name, consistent with the confidentiality procedure described below. Student participants were selected to represent variation along two dimensions relevant to the research questions: frequency and stability of access to generative AI tools, and, where discernible prior to data collection, differing reported orientations toward AI use. This purposive, maximum-variation approach (Patton, 2015) was intended to surface a range of patterns rather than to produce a representative sample of the class or school.

2.4 Confidentiality and Anonymization

To protect participant identity, all students and teachers are referred to only by case codes (S01–S06; G01–G03) rather than by name or pseudonym, and the participating school is referred to only by the code SMAI-X rather than by its actual name. Interview excerpts, journal entries, and interaction logs were reviewed to remove or generalize any detail, such as a distinctive place name, family detail, or uncommon phrasing, that could otherwise make a participant identifiable, while preserving enough of the original wording to support the analytic claims made in this article. Consent, assent, and confidentiality procedures followed the participating institution's own research-permission process; because student participants were minors, parental or guardian awareness of participation was sought through that same institutional process rather than through the researcher directly.

2.5 Data Sources and Instruments

Four data sources were used, permitting triangulation within each case (Table 3, Table 4): (1) semi-structured interviews with all six students and three teachers, organized around AI use practices, task completion strategies, beliefs about ability, and, for teachers, feedback practice, referenced throughout this article using item codes (e.g., S01 Q9, G01 Q6); (2) student process journals, completed by a subset of students, used to record task-level decisions, including moments of AI use, closer in time to the task itself than the retrospective interview allowed; (3) AI interaction logs, capturing prompts and outputs exchanged with AI tools for at least two cases, used to cross-check interview and journal accounts of how AI output was used; and (4) weekly reflection entries, used to assess whether difficulties identified in interviews were also identified and acted upon in a more routine, less retrospective format. Not every data source was available for every case (Table 4); this asymmetry is treated as a feature of naturally occurring classroom data and is factored into the case-by-case corroboration reported in Table 4.

2.6 Data Analysis

Analysis proceeded in three stages. First, within-case analysis produced a descriptive profile for each student and teacher case (Table 1a, Table 1b), summarizing access context and observed or reported orientation prior to thematic coding, consistent with recommended case study procedure of establishing case-level description before cross-case comparison (Yin, 2018). Second, thematic coding (Braun & Clarke, 2006) was applied across interview transcripts, journal entries, and logs, generating codes grouped into four analytic foci, relatively fixed ability beliefs, unverified cognitive offloading, limited reflective practice, and limited constructive feedback, each defined by a working indicator and an explicit boundary of interpretation specifying what the code did and did not warrant claiming (Table 2). Third, cross-case analysis compared coded patterns across the six student cases and three teacher cases, using a case-

ordered matrix (summarized in Table 4) to identify which interview claims were corroborated by an independent source and which remained open questions or admitted an alternative explanation (Miles et al., 2014). This stage produced the thematic structure in Figure 1 and the process model in Figure 2.

2.7 Trustworthiness

Several procedures were used to support the credibility of the analysis, following established qualitative criteria (Guba & Lincoln, 1985). Triangulation across interview, journal, log, and teacher-interview sources was applied case by case rather than assumed at the level of the sample as a whole, with points of non-corroboration reported explicitly rather than resolved in favor of the interview account (Table 4). An explicit boundary of interpretation was defined for each analytic focus prior to finalizing the thematic structure (Table 2), constraining how far a given excerpt could be extended in interpretation. Thick description of each case (Table 1a, Table 1b) and prolonged engagement with the classroom over an eight-month period further supported the credibility of the findings (Merriam & Tisdell, 2016).

2.8 Researcher Positionality

The researcher's relationship to the participating classroom, prior experience with generative AI in educational settings, and the steps taken to manage this positioning during data collection and interpretation are acknowledged as a relevant part of the analytic process, consistent with reflexive practice in qualitative case study research (Creswell & Poth, 2018).

3. Findings

The findings reported below are drawn from six student participants (S01–S06) and three subject teachers (G01–G03) situated within a single Grade XI classroom at SMAI-X, a private Islamic senior secondary school in South Kalimantan, Indonesia (Table 1a and Table 1b). Participants varied along two dimensions relevant to the analysis: frequency and stability of access to generative AI tools, and the reported orientation underlying its use. Access ranged from personal, consistently available devices (S01, S04) to shared devices constrained by limited data plans (S03, S06), while reported orientations spanned task completion under time pressure (S01), grade and image protection (S02, S04), and perceived aptitude limitations (S05). This heterogeneity is treated throughout as an analytic resource rather than as noise to be averaged over, consistent with a multiple-case design in which within-case particularity is expected to qualify cross-case pattern (Yin, 2018).

Table 1a. Characteristics of the six student participants

Code	Age / Gender	AI use	Access context	Observed / reported orientation
S01	16 / male	Almost daily	Personal phone; stable access	Completion under time pressure
S01	16 / male	Almost daily	Personal phone; stable access	Completion under time pressure
S03	17 / male	1–2 days/week	Shared phone; limited data	Limited access and reliance on external answers
S04	16 / female	Almost daily	Personal laptop; stable access	Avoiding visible errors and unfavourable evaluation
S05	18 / female	2–3 days/week	Personal phone; regular data plan	Perceived lack of language aptitude
S06	17 / male	4–5 days/week	Shared laptop; home Wi-Fi	Obtaining functioning outputs without explaining logic

Note. All students are Grade XI students at SMAI-X, a private Islamic senior secondary school in South Kalimantan, Indonesia. Codes are used throughout in place of names to protect participant identity.

Table 1b. Characteristics of the three teacher participants

Code	Subject	Experience	Classroom practice
G01	Mathematics	12 years; 8 months with this class	Marks and general comments; little individual error review
G02	Indonesian language	9 years; 8 months with this class	Single submission; limited actionable revision feedback
G03	Informatics	7 years; 8 months with this class	Output functioning emphasized; limited explanation of debugging

Coding was organized around four analytic foci, each anchored to a working indicator and an explicit boundary of interpretation (Table 2): relatively fixed ability beliefs, unverified cognitive offloading, and limited reflective practice on the part of students, and limited constructive feedback on the part of teachers. These boundaries, for example, that a single expression of low task confidence does not, by itself, constitute evidence of a stable fixed-mindset profile, were applied consistently during coding and are reflected in the qualified language used throughout this section.

Table 2. Analytic distinctions and operational boundaries

Analytic focus	Working indicator	Source anchors	Boundary of interpretation
Relatively fixed ability beliefs	Explicit statements that underlying ability is innate or difficult to change.	S01 Q9; S04 Q9; S05 Q9; S06 Q9.	Low confidence alone is insufficient; no validated low-growth-mindset score exists here.
Unverified cognitive	Using AI output without	S01 Q4; S04 Q4; S06 Q4; H6 logs.	Offloading can be strategic in other cases; the present cases

Analytic focus	Working indicator	Source anchors	Boundary of interpretation
offloading	substantive checking or attempting to explain its reasoning.		do not include those patterns.
Limited reflective practice	Little evaluation of errors, reconsideration of strategy, or follow-up revision after a difficulty is noticed.	S03 Q8; S05 Q8; weekly reflections.	Awareness can coexist with little follow-up. Completing a reflective form is not proof of habitual reflection.
Limited constructive feedback	General evaluation without sufficiently actionable information, revision opportunity, or follow-up.	G01 Q6; G02 Q6; G03 Q6; student Q13.	Brevity alone does not establish poor feedback; no teacher-quality scale or national estimate is available.

3.1 Task Completion Prioritized over Understanding

Across five of the six student cases, data converged on a pattern in which a functioning output was treated as sufficient grounds for task closure, independent of whether the underlying reasoning had been checked or understood. This pattern was most directly articulated by S06: "*saya hanya mengejar berjalan*" ("I only aim to make it run") (S06, Q18). The accompanying process journal (H1) corroborated this account, recording that a single successful execution was treated as confirmation that the task was complete, with no subsequent test of edge cases or alternative inputs. A structurally similar pattern was observed for S04, for whom reassurance generated by the same AI system that had produced the original output appeared to substitute for independent verification: "*Bagi saya waktu itu konfirmasi dari AI sudah cukup*" ("For me at that time, confirmation from AI was enough") (S04, Q4). This account was consistent with both the H6 process journal and the corresponding interaction log, which recorded no independent recalculation following the AI's confirmation (Table 3).

The route into this pattern was not uniform across cases, however, and the data support at least two distinguishable pathways. For S01, time pressure was implicated directly, with journal and log data depicting the copying of an AI-generated answer under a submission deadline (Table 4). For S03, by contrast, the same surface behavior, low independent verification, co-occurred with markedly constrained access, in which a shared, data-limited device shaped

reliance on both peers and AI when available. Because access and choice are conceptually separable, this case is reported as an open question rather than as an instance of the same underlying pattern as S01 or S06 (Table 4).

3.2 Ability Represented as Relatively Fixed

A second pattern emerged from direct interview statements in which students characterized underlying ability as resistant to change. S01 stated: "*kemampuan dasarnya sulit berubah*" ("underlying ability is difficult to change") (S01, Q9). A comparable, domain-specific statement was offered by S05, who attributed language performance to an inherent trait rather than a developable skill: "*Menurut saya kemampuan bahasa banyak ditentukan bakat*" ("I think language ability is largely determined by talent") (S05, Q9).

Coding for this theme was deliberately conservative: only explicit claims about the changeability of ability were included, and expressions of task-level uncertainty that did not make such a claim (observed, for instance, in S03's and S06's accounts) were excluded (Table 2). For S05, the fixed-ability statement co-occurred with a reported difficulty engaging with English-language instructional material (Table 4). This co-occurrence is noted descriptively; in the absence of an independent measure of language proficiency, no claim is made about the direction or existence of a relationship between the two.

3.3 Feedback Structured without Opportunity for Revision

On the instructional side, the predominant feedback pattern across all three teacher cases was evaluative commentary that identified a shortcoming without specifying a corrective action. G01 described a representative response to student error: "*Jika salah biasanya saya tulis kurang teliti atau belajar lagi*" ("If it is wrong, I usually write 'not careful enough' or 'study more'") (G01, Q6). G02 identified a related structural constraint operating at the level of classroom routine rather than individual comment content: "*Biasanya satu kali pengumpulan*" ("Usually there is a single submission") (G02, Q6).

This account indicates that revision was not built into the standard task cycle in this classroom; once submitted, work was evaluated and the class proceeded to a new task rather than returning to the original for correction. Student-reported experiences of receiving general evaluative comments without an accompanying opportunity to revise (Table 2, working indicator for limited constructive feedback) were consistent with this description. Given the study's scope, this finding is reported as a characterization of observed practice among the three participating teachers in one classroom, and not as an estimate of feedback quality among teachers generally.

Table 3. Source excerpts, working translations, and illustrative code-to-theme links

Source	Excerpt and working translation	Coding	Analytic reading
S01 Q9	ID: "*kemampuan dasarnya sulit berubah*." EN: "underlying ability is difficult to change."	*FM-BAWAAN*; Theme 2	A relatively fixed view of underlying ability.
S02 Q10	ID: "*Saya tidak membuat daftar kesalahan*." EN: "I do not make a list of my mistakes."	*RP-TANPA-EVALUASI*; Theme 1	No systematic review is described; not evidence that reflection never occurs.
S03 Q8	ID: "*Saya tahu ada yang belum paham tetapi tidak menindaklanjuti.*" EN: "I know there is something I do not understand, but I do not follow it up."	*CO-SADAR; RP-TANPA-TINDAK*; Theme 1	Awareness of difficulty coexists with little follow-through.
S04 Q4	ID: "*Bagi saya waktu itu konfirmasi dari AI sudah cukup.*" EN: "For me at that time, confirmation from AI was enough."	*CO-PASIF; RP-TANPA-VERIFIKASI*; Theme 1	Reassurance from the same AI is accepted without an external check.
S05 Q9	ID: "*Menurut saya kemampuan bahasa banyak ditentukan bakat*." EN: "I think language ability is largely determined by talent."	*FM-BAWAAN*; Theme 2	An explicit aptitude belief, interpreted with the remainder of Q9.
S06 Q18	ID: "*saya hanya mengejar berjalan*." EN: "I only aim to make it run."	*HASIL-SEBAGAI-TUJUAN*; Theme 1	A functioning output is prioritized over explanation.
G01 Q6	ID: "*Jika salah biasanya saya tulis kurang teliti atau belajar lagi*." EN: "If it is wrong, I usually write 'not careful enough' or 'study more.'"	*FB-UMUM*; Theme 3	General evaluative feedback without a specified next step.
G02 Q6	ID: "*Biasanya satu*	*FB-TANPA-*	Interpreted with Q6's

Source	Excerpt and working translation	Coding	Analytic reading
	kali pengumpulan." EN: "Usually there is a single submission."	*SIKLUS*; Theme 3	description of moving to a new task without follow-up.

3.4 Cross-Case Pattern and Proposed Process Structure

Figure 1 situates the three themes, task completion prioritized over understanding, ability represented as relatively fixed, and feedback structured without revision, in relation to a shared classroom context characterized by output-focused assessment, uneven access to AI tools, and salience of grades. The connecting lines in Figure 1 denote analytic organization only; no claim of causal direction, temporal sequence, or relative prevalence among themes is intended.

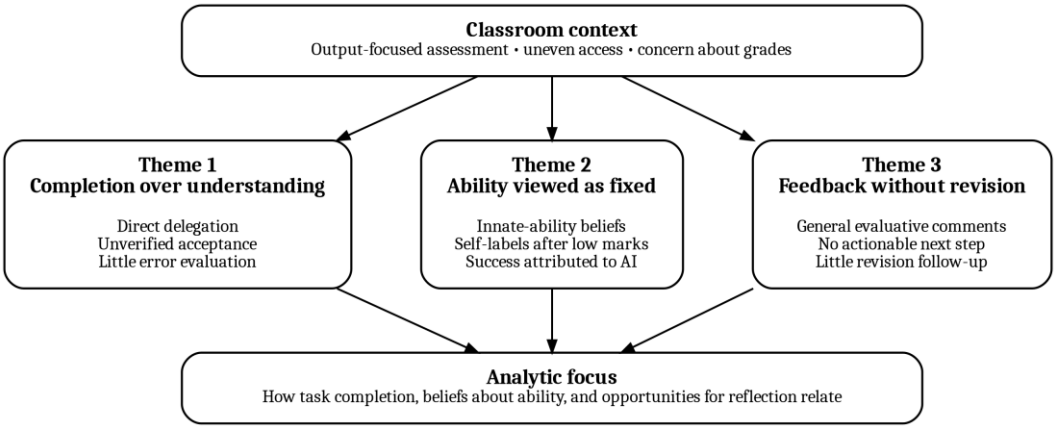


Figure 1. Thematic structure derived from student and teacher data. The three themes organize task completion, relatively fixed ability beliefs, and feedback without revision. Connecting lines represent analytic organization, not causal direction, temporal change, or theme prevalence.

Table 4 documents, case by case, the extent to which interview accounts were corroborated by an independent data source, process journals, interaction logs, or teacher interviews, and identifies the interpretive question that remains open in each instance. In every case, at least one alternative reading was retained. S02's pursuit of an extended AI-generated response, for example, is compatible with a performance-protection concern that is conceptually distinct from a fixed-ability belief, and the two were not conflated in coding. Similarly, S03's comparatively low frequency of AI use could not, on the available data, be attributed to independent work practice rather than to restricted device access; the two explanations remain empirically indistinguishable within this dataset.

Table 4. Within-case source comparison and unresolved questions

Case focus	Interview anchor	Other sources	Question or limit
S01 / completion pressure	Q4: copies the answer; Q9: ability is difficult to change.	Journal H1 and H6 log depict copying; G01 Q6 describes general feedback.	Time pressure and pre-existing beliefs may explain the pattern; no direction of influence is established.
S02 / protecting grades	Q10: low marks threaten perceived intelligence; Q13: asks AI for a longer answer.	H4 reflection describes no follow-up; G02 Q6 depicts a single-submission routine.	Strong grades or polished work do not show understanding; performance concern and mindset remain distinct.
S03 / constrained access	Q17–18: non-use reflects access and reliance on peers.	Only H2 and H6 are logged; H6 includes storing and copying an answer.	Low AI frequency does not mean independence; distinguish access, opportunity, and choice.
S04 / preserving competence	Q4: accepts confirmation from the same AI; Q9: underlying ability is fixed.	H6 journal and log describe reassurance without recalculation.	Repeated prompting is not necessarily verification; anxiety is not itself a fixed-ability belief.
S05 / perceived lack of aptitude	Q8–9: translation is not understood; language ability attributed to talent.	H2 journal concerns English; H6 observation concerns mathematics.	No English teacher or observation validates the language account; domains cannot be treated as interchangeable.
S06 / functioning output	Q8: code runs without explanation; Q18: functioning is the goal.	H1 journal depicts a single working example; G03 Q6 prioritizes output.	Testing one output is limited checking, not proof of reflective learning; H6 is a different task domain.

Building on this cross-case comparison, Figure 2 presents a process model linking perceived difficulty or evaluative threat, immediate delegation to AI, task completion without verification, limited evaluation and revision, attribution of success to the tool, and a fixed interpretation of ability. The model is presented as a recurring configuration observed across the analyzed cases rather than as a validated causal sequence; as indicated in Figure 2, the connecting arrows denote hypothesized relationships only, and the cross-sectional, small-sample design does not support longitudinal or causal inference. The model is offered as a structure for subsequent, more targeted investigation rather than as an established explanatory mechanism.

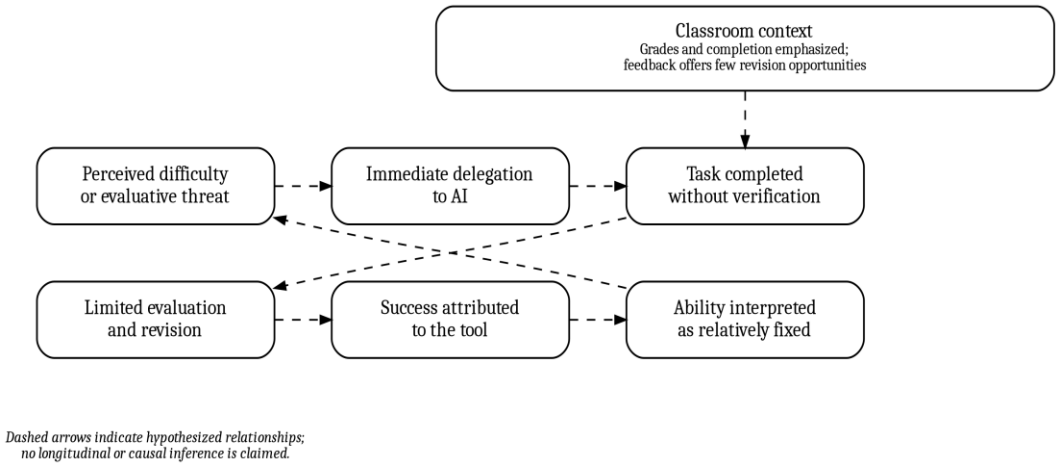


Figure 2. Process model based on the analytic pattern. Dashed arrows indicate hypothesized relationships; no longitudinal or causal inference is claimed.

4. Discussion

4.1 Synthesis of Principal Findings

Three interrelated patterns emerged from this multiple-case analysis: a tendency to treat a functioning AI-generated output as sufficient grounds for task closure (Section 3.1), explicit statements by several students that underlying ability is relatively resistant to change (Section 3.2), and a teacher feedback style that identified shortcomings without specifying a path to revision (Section 3.3). Considered together with the classroom context common to all cases, output-focused assessment, uneven device access, and salience of grades, these patterns suggest a configuration in which verification of one's own reasoning is neither modeled by feedback practice nor demanded by task structure (Figure 1).

4.2 Task Completion without Verification: Offloading or Adaptive Strategy?

The pattern described in Section 3.1 is consistent with cognitive offloading, the use of external tools to reduce the internal cognitive demand of a task (Risko & Gilbert, 2016). The case data, however, support a more qualified reading than a general offloading account would imply. For S06 and S04, offloading appeared unverified in a specific sense: the AI's own output was treated as its own confirmation, without an independent check (Table 3), a pattern consistent with experimental findings that using large language models reduces cognitive load while also producing lower-quality reasoning and justification (Stadler et al., 2024). This aligns with concerns that generative AI's fluent, confident output format may discourage the kind of self-generated error-checking that effortful, “desirably difficult” engagement is thought to support (Bjork & Bjork, 2011).

At the same time, the comparison between S01 and S03 in Section 3.1 cautions against treating this pattern as a single phenomenon. Offloading under

time pressure (S01) and reduced verification under constrained access (S03) are not obviously the same behavior with different causes; they may instead reflect distinct relationships between students and the task environment, one shaped by a completion incentive, the other by resource scarcity. This distinction matters because interventions targeting the first (for example, task pacing) would not necessarily address the second (for example, equitable access), and conflating them risks a mismatched response. The case data cannot adjudicate which mechanism dominates in this classroom, or whether both operate simultaneously for different students; this is registered as a limitation rather than resolved here.

4.3 Fixed-Ability Statements: Mindset Language or Something Narrower?

The explicit statements by S01 and S05 that ability is difficult to change (Section 3.2) resemble the entity theory of intelligence described in implicit theories of ability research (Dweck, 2006), in which ability is represented as a fixed trait rather than a quality that effort and strategy can develop. This study, however, did not administer a validated mindset instrument, and the coding boundary applied here, requiring an explicit statement, and excluding low task-level confidence alone (Table 2), was set deliberately to avoid overextending two or three interview statements into a claim about stable trait-level beliefs. It would therefore be an overstatement to describe S01 or S05 as having "a fixed mindset" in the psychometric sense the literature typically intends; what the data support is that these students used fixed-ability language when accounting for a specific difficulty, a narrower and more defensible claim.

The co-occurrence noted for S05, a fixed-ability statement alongside reported difficulty with English-language instructional material (Table 4), invites a competing explanation worth naming explicitly. Rather than reflecting a general belief about the malleability of ability, S05's statement may function locally, as an account offered specifically for a domain in which comprehension difficulty was already present, without extending to other domains. Distinguishing a domain-specific attribution from a general implicit theory of ability is not possible with the present interview data, and debates over the domain-specificity of mindset effects in large-scale intervention research (Dweck & Yeager, 2019; Yeager & Dweck, 2020, 2023) suggest this distinction carries different implications for intervention design.

The epistemological tension introduced in the Introduction is directly relevant to the fixed-ability statements documented in Section 3.2. Where S01 and S05 described ability as difficult to change, that account sits in some tension with the effort-centered epistemology of ijtihad and with the lifelong, effort-based framing of knowledge-seeking articulated in Islamic educational thought (Kamali, 2003), [A3.1][A4.1]and with the Islamically framed, effort-oriented feedback practice found to support resilience and reduce fixed, dogmatic

thinking in comparable Indonesian Islamic school settings (Farhaty et al., 2025; Rifqoh et al., 2026; Ubaidillah et al., 2026). [A5.1] [A6.1] This is not read here as evidence that these two students' religious commitments were somehow inconsistent; a fixed-ability statement made about a specific academic difficulty, as Section 4.3 argues, is a narrower claim than a general trait-level belief, and the tension identified here concerns the explanatory language available to students in the moment, not their broader worldview. The practical implication is that feedback practice already consistent with this school's own epistemic tradition, naming effort and strategy explicitly rather than naming a shortcoming alone, may be a locally resonant starting point for addressing the pattern described in Section 3.3, a possibility the present case-level design can motivate but not test. This reading is offered as this study's central theoretical contribution to Islamic education: a reframing of fixed-ability language as a tension internal to the school's own epistemic tradition, rather than as a finding for which the Islamic school setting served only as the site of data collection.

4.4 Feedback without Revision: A Structural Rather Than Individual Account

The pattern reported for G01 and G02 in Section 3.3, evaluative comments that name a shortcoming without indicating a next step, embedded within a single-submission task cycle, is consistent with the long-standing distinction in the feedback literature between feedback that operates at the level of the task or self ("not careful enough") and feedback that operates at the level of process or self-regulation, the latter being more strongly associated with subsequent improvement (Hattie & Timperley, 2007). Read this way, the pattern observed here is less a claim about these three teachers' individual skill and more a description of a task structure, one submission, one evaluation, no built-in return, within which even well-intentioned comments have limited opportunity to translate into revision.

This reading has a direct bearing on the interpretation offered in Section 4.2. If students rarely encounter feedback that specifies what to do differently, then the absence of independent verification when using AI output may be read not only as a property of the tool interaction itself, but as consistent with, though not necessarily caused by, a broader classroom pattern in which verification and revision are not modeled or required elsewhere. The two patterns are presented here as consistent with one another, not as cause and effect; the case design, with three teachers and six students drawn from a single classroom, cannot separate a teacher-level influence on student behavior from a shared institutional or assessment-level factor affecting both independently (Figure 2).

4.5 The Proposed Process Model as a Hypothesis, Not a Finding

Figure 2 organizes the patterns above into a recurring configuration, perceived difficulty, delegation to AI, unverified completion, limited evaluation, attribution of success to the tool, and a fixed reading of ability, that appeared, in varying combinations, across several of the six student cases. It is important to be explicit about what this model does and does not claim. It does not assert that this sequence occurs in this order for every student, that one element causes the next, or that the pattern would recur outside this classroom. What the case data support is that these elements were observed to co-occur within individual cases in a manner internally coherent enough to warrant statement as a hypothesis for further, purpose-designed investigation, for example, a longitudinal or experimental design capable of testing directionality, which the present cross-sectional multiple-case design cannot provide.

4.6 Alternative Explanations Not Ruled Out

Several alternative readings of the findings deserve explicit statement rather than being set aside. First, what appears as reduced verification (S01, S03, S04, S06) may in some instances reflect appropriate reliance on a tool for a task perceived as low-stakes, rather than a general disposition toward offloading; the interview and journal data available here cannot distinguish strategic non-verification from unreflective non-verification in every instance. Second, the fixed-ability statements documented in Section 3.2 may be partly elicited by the interview context itself, students asked directly about difficulty may reach for available cultural or classroom scripts about talent and ability, rather than reporting a belief they would spontaneously articulate elsewhere. Third, the correspondence between teacher feedback style and student verification behavior discussed in Section 4.4 remains a plausible co-occurrence rather than an established relationship; family, peer, and prior schooling factors outside the scope of this study could independently shape both. These limitations, together with the study's small, single-site sample and cross-sectional design, are addressed further in Section 5.

4.7 Implications

Considered cautiously, the findings suggest that classroom-level responses to AI use in this setting might usefully target the feedback and task-revision structure rather than the AI tool itself, for instance, by building a return-and-revise step into task cycles, which existing feedback theory suggests is where evaluative comments most often fail to translate into learning (Hattie & Timperley, 2007). Any such implication is offered as a direction suggested by this case pattern, not as a tested recommendation; the present design did not evaluate whether such a change would alter the patterns observed here.

5. Conclusion

This multiple-case study examined how six students and three teachers in one Grade XI classroom at SMAI-X, a private Islamic senior secondary school in South Kalimantan, described the use of generative AI, beliefs about the changeability of ability, and classroom feedback practice. Three patterns were identified: a tendency to treat a functioning AI-generated output as sufficient for task closure without independent verification, explicit statements by some students that underlying ability is relatively difficult to change, and a teacher feedback style that named shortcomings without specifying a path to revision. These patterns appeared, to varying degrees and through different routes, across several of the six student cases, and were read alongside a classroom context in which task completion and grades were emphasized and opportunities for revision were limited.

Within the bounds of this design, the study offers three contributions. First, it provides a case-level account of how AI use, verification behavior, and beliefs about ability can co-occur in a single classroom, attentive to the boundaries and alternative explanations the data could not rule out, rather than as a uniform behavioral type. Second, it distinguishes explicit fixed-ability statements from general low task confidence, a coding boundary that resists collapsing brief interview remarks into a claim about stable trait-level mindset. Third, it proposes a process model (Figure 2) linking task difficulty, delegation to AI, unverified completion, and a fixed reading of ability, framed explicitly as a hypothesis for further, purpose-designed investigation rather than as a validated sequence.

A fourth contribution follows directly from the first three: by reading fixed-ability language against the participating school's own effort-centered epistemology of knowledge-seeking (*ijtihad*), [A7.1] [A8.1] this study treats Islamic education as a conceptual lens for interpreting the findings, not only as the setting in which the data were collected.

These contributions are bounded by clear limitations. The findings describe a small number of cases within one classroom and one school, and do not establish that generative AI use causes reduced verification, that classroom feedback style shapes students' beliefs about ability, or that the patterns observed here would recur in other settings. The cross-sectional interview and journal data limit causal or directional claims throughout, and reliance on self-report for both AI use and reflective practice introduces the possibility of social desirability effects. No claim is made that the impact of generative AI on students' ability beliefs or learning behavior has been demonstrated by this study; what is offered is a descriptive, case-bounded account of how these elements appeared to relate to one another in the specific classroom examined.

Future research designed to test the process model proposed here, for example, through longitudinal tracking of verification behavior across a school term, or through experimental variation in feedback structure, would be needed to establish whether the relationships suggested in this study hold beyond the cases examined, and whether they extend to classrooms with different assessment structures or levels of AI access. Extending this line of inquiry to Islamic schools with differing degrees of technology access and to co-educational and single-sex settings within Indonesia would also help clarify how far the process model proposed here travels beyond a single classroom.

The main conclusions of the study should be presented in a short conclusions section. Do not repeat earlier sections. Limitations of your study should be addressed. Recommendations for future research related to your topic should also be mentioned.

Declaration of AI and AI-Assisted Technologies

The authors used ChatGPT (OpenAI) during manuscript preparation for language editing and readability improvement. All AI-assisted content was reviewed and revised by the authors, who take full responsibility for the final manuscript.

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