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AI integration in history education: Perceptions of teachers and students in Palangka Raya

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Abstract. The integration of artificial intelligence (AI) into history education remains underexplored in peripheral regions of Indonesia, where infrastructure limitations and concerns about cultural representation intersect with the imperative to innovate pedagogy. This mixed-methods study examined teachers' and students' perceptions of AI integration in history learning in Palangka Raya, Central Kalimantan. Participants included 220 Grade XI students and six history teachers from six public senior high schools, selected through purposive sampling for school selection and maximum variation sampling to ensure diversity in socioeconomic background, technological access, and geographic location. Data collection involved a validated 30-item questionnaire measuring five perceptual dimensions (AI understanding, attitudes, readiness, expectations, and barriers), along with 12 in-depth student interviews and six semi-structured teacher interviews. Quantitative analysis revealed moderate AI understanding (M = 3.19), strongly positive attitudes (M = 4.09), moderate readiness (M = 3.28), high expectations (M = 4.10), and awareness of implementation barriers (M = 2.75). Thematic analysis identified strong convergence on AI's complementary role rather than a replacement for human educators. Both groups emphasized concerns about cultural representation and infrastructure constraints. The findings recommend context-responsive AI content co-designed with local communities and equity-focused infrastructure investment to support inclusive digital pedagogy in marginalized regions.

Introduction

The Fourth Industrial Revolution has profoundly reshaped educational landscapes globally, with artificial intelligence (AI) emerging as a transformative force in pedagogy and content development. While urban educational institutions in advanced economies increasingly leverage AI tools for personalized learning, interactive simulations, and adaptive instruction, peripheral regions face distinct challenges in which infrastructural limitations, digital literacy gaps, and concerns about cultural representation intersect with technological adoption imperatives (Bozkurt et al., 2021; Chen et al., 2020). This disparity is particularly pronounced in history education, a discipline demanding not merely informational transmission but also critical interpretation, multiperspectival analysis, and culturally responsive pedagogy (Seixas & Morton, 2013; Wineburg, 2001). As AI systems increasingly mediate access to historical knowledge, questions of epistemological justice and cultural representation become urgent, especially in contexts where dominant algorithmic training datasets risk marginalizing subaltern narratives (Fadhilaturrahmi & Ananda, 2025).

In Indonesia, digital transformation has advanced unevenly across the country. While national Internet penetration is expected to reach 80.66% in 2025, connecting over 229 million people, stark regional disparities persist: Jakarta achieves 91.35% penetration, while West Sulawesi records only 53.03% (Imaduddin & Firdaus, 2025). Java accounts for approximately 41.7% of Indonesia's internet users despite representing only a minority of the country's geographic area, illustrating concentrated digital access that exacerbates educational inequalities. Beyond connectivity, digital divides manifest in device availability, digital literacy competencies, and gender disparities, with male usage at 82.73% compared with 78.57% for females (Halim & Hidayat, 2025). These structural constraints significantly impact the potential for educational technology integration in peripheral provinces such as Central Kalimantan, where schools struggle with bandwidth limitations, device shortages, and gaps in teacher digital competence (Asmayawati et al., 2024). Moreover, 76.71% of Indonesia's population does not utilize the Internet for economic activities, suggesting that digital access alone is insufficient without accompanying literacy and application skills critical for educational contexts.

The integration of AI in history education offers substantial pedagogical affordances. AI tools can streamline historical research by automating natural language processing and narrative analysis, enabling educators to prioritize interpretative teaching over procedural tasks (Volodin, 2025; Yao, 2025; Widana, 2020). This "digital magnifying glass" effect supports the development of critical thinking and historical consciousness through individualized feedback, multimodal representations, and interactive simulations that enhance engagement beyond traditional textbook-centered instruction (Afzaal et al., 2024; Almasri, 2024). In resource-constrained settings, AI has the potential to democratize access to primary sources, expert analyses, and diverse historiographical perspectives that were previously unavailable due to geographic isolation or library limitations. In Indonesian history education, AI could facilitate the exploration of regional narratives that are often marginalized in nationally standardized curricula, thereby supporting a more pluralistic historical understanding.

However, significant risks are associated with these opportunities. AI systems inherit biases embedded in training datasets, potentially perpetuating dominant narratives at the expense of subaltern histories (Volodin, 2025). In the Indonesian context, this manifests as the risk of algorithmic reinforcement of Javanese-centric or Western historiographical frameworks that marginalize non-Javanese regional experiences, including the indigenous epistemologies of Kalimantan's Dayak communities (Williyan et al., 2024). This "illusion of objectivity" can simplify complex histories, undermining multiperspectival analysis essential for robust historical thinking (Elmersjö, 2022). Ethical concerns extend to the impact on student creativity and critical thinking if AI provides ready-made interpretations that discourage intellectual struggle, potentially fostering passive consumption rather than active historical reasoning (Ivanov, 2023; Reyes-Parra et al., 2024). Addressing these risks requires culturally responsive AI development that incorporates diverse datasets representing local perspectives and pedagogical frameworks that emphasize critical awareness of algorithms alongside technological literacy (Bearman et al., 2023; Good & Hof, 2024).

Palangka Raya, the capital of Central Kalimantan province, exemplifies peripheral Indonesian educational contexts where AI integration prospects intersect with infrastructural constraints and cultural representation stakes. As a mid-sized provincial capital (population approximately 300,000), Palangka Raya occupies an intermediate status between metropolitan centers like Jakarta and remote rural districts, making it representative of numerous provincial capitals navigating modernization pressures while maintaining distinct regional identities. The city hosts regional educational initiatives, including IT-based teacher-training programs at institutions such as SMP Muhammadiyah Palangka Raya, demonstrating local commitment to digital integration despite

resource constraints (Hikmah et al., 2022). However, infrastructure challenges persist: while public high schools possess basic ICT facilities, bandwidth constraints and device shortages limit consistent technology utilization. Critically, Palangka Raya's educational context is inseparable from Central Kalimantan's indigenous Dayak epistemologies and regional historical narratives, which are often marginalized in national curricula dominated by Javanese and colonial perspectives (Sumiatie et al., 2021). Local histories, including Tiwah funerary ceremonies, Dayak governance systems, resistance against Dutch colonization, and figures like Tjilik Riwut, remain underrepresented in standardized materials, creating stakes for culturally responsive AI content development that either reproduces or challenges existing patterns of marginalization.

The existing literature on AI in education focuses disproportionately on STEM disciplines in metropolitan or Western contexts, leaving substantial gaps in humanities applications in peripheral regions (Rizvi et al., 2023; Zawacki-Richter et al., 2019; Widana et al., 2021). Studies examining AI in history education remain particularly scarce, with most investigations focusing on advanced economies with robust technological infrastructures. This research gap is problematic because the interpretive, values-oriented, and culturally contested nature of history education generates unique implementation considerations distinct from STEM fields, where content is less ideologically laden. Furthermore, stakeholder perceptions, particularly those of teachers and students, are critical determinants of successful technology integration, as adoption depends not only on technical functionality but also on perceived usefulness, cultural appropriateness, and trust shaped by social, psychological, and infrastructural factors (Kizilcec, 2024; Zhang & Zhang, 2024). However, empirical investigations into how educators and learners in peripheral regions of Indonesia perceive AI integration in history education are virtually absent, despite these contexts representing the majority of educational realities across the archipelago (Sugihartini & Swisnandy, 2025). This study addresses this gap by examining teacher and student perceptions in Palangka Raya, emphasizing learner-centered and context-aware approaches that are essential for culturally sensitive implementation (Asmayawati et al., 2024; Williyan et al., 2024).

Theoretically, this study integrates three complementary frameworks. The Technology Acceptance Model (TAM) posits that perceived usefulness and ease of use affect the decision to adopt (Davis, 1989; Venkatesh & Davis, 2000), providing a baseline understanding of instrumental acceptance factors. However, the individualistic assumptions of the Technology Acceptance Model (TAM) require augmentation when applied in contexts beyond affluent ones, where structural determinants also play a significant role (Tarhini et al., 2017). Therefore, this study incorporates Technological Pedagogical Content Knowledge (TPACK), which emphasizes the interplay of technological, pedagogical, and content knowledge domains, recognizing that effective integration requires disciplinary epistemological grounding alongside technical competence (Mishra & Koehler, 2006; Widana et al., 2019). In history education, TPACK underscores that AI tools must support, rather than undermine, core disciplinary competencies, including evidence evaluation, perspective recognition, and ethical judgment. Finally, critical pedagogy perspectives inform the analysis of power dynamics, algorithmic bias, and cultural representation, countering technological determinism by foregrounding questions of epistemological justice and educational equity (Freire, 2020; Hooks, 2014; Subhaktiyasa, 2024). This integrated framework enables a multidimensional analysis that extends beyond technical acceptance to encompass social, pedagogical, and equity dimensions critical in peripheral contexts such as Palangka Raya.

This study aims to (1) examine high school students' and teachers' perceptions of AI integration in history learning across dimensions of understanding, attitudes, readiness, expectations, and barriers; (2) identify convergences and divergences between stakeholder perspectives; (3) explore contextual factors, including infrastructure, teacher competence, and cultural representation, shaping these perceptions; and (4) offer recommendations for culturally responsive AI integration

in provincial Indonesian history education. The guiding research questions are as follows: What are the levels of AI understanding, attitudes, readiness, expectations, and perceived barriers among students in history learning? How do history teachers perceive the potential, challenges, and ethical considerations of AI? What are the principal convergences and divergences between student and teacher perceptions? What infrastructural, pedagogical, and cultural factors shape these perceptions in Palangka Raya's educational ecology?

Method

Research Design

This study employed a concurrent mixed-methods research design to comprehensively investigate the perceptions of AI integration in history education among high school teachers and students in Palangka Raya, Central Kalimantan. Grounded in the methodological principles outlined by Creswell and Pablo-Clark, this design strategically merges quantitative survey data, which capture overarching perceptual trends, with qualitative interview data that elucidate the contextual and experiential subtleties underpinning these trends. Such integration facilitates methodological triangulation, thereby strengthening the internal validity and interpretive depth of the study findings (Creswell & Plano Clark, 2011; Denzin, 2012).

This design is theoretically anchored in the Technology Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK) framework. These dual lenses enabled the study to assess not only quantifiable constructs such as perceived usefulness and ease of use (Davis, 1989) but also more nuanced dimensions related to the integration of technology into pedagogical practices (Mishra & Koehler, 2006; Zhafira et al., 2025). The theoretical synergy supports a more holistic understanding of both the cognitive and contextual dimensions of AI adoption in educational settings and enables a critical interrogation of potential self-reported biases commonly associated with questionnaire-based attitudinal surveys. Nonetheless, the concurrent nature of this mixed-methods approach introduces inherent challenges, particularly in terms of synchronizing and integrating datasets during the analysis phase. To address this, this study incorporated iterative cross-validation techniques throughout data interpretation to ensure consistency and coherence across data sources (Adhikari & Timsina, 2024). This iterative analytic process not only reinforces interpretive reliability but also enhances the study's contribution to emerging discussions on AI in secondary education contexts.

Research Context and Sampling

The research was conducted in Palangka Raya, the provincial capital of Central Kalimantan, a region characterized by emerging digital infrastructure, socioeconomic diversity, and significant indigenous Dayak historical narratives (Tengah, 2022). Six public senior high schools (SMAN 1, 2, 3, 4, 5, and 10) were selected purposively to reflect variations in geographic location (urban core versus peripheral riverside areas), technological resources, and accreditation status. This sampling strategy ensured representation of diverse local educational contexts rather than assuming uniform access to technology (Robinson et al., 2015).

Quantitative phase participants comprised 220 grade XI students distributed as follows: SMAN 1 (n=40), SMAN 2 (n=40), SMAN 3 (n=40), SMAN 4 (n=35), SMAN 5 (n=35), and SMAN 10 (n=30). Grade XI focus ensures a consistent developmental stage, minimizing age-related perceptual variability. Six history teachers (one per school, with 10–18 years of experience) also participated. The sample size supports a descriptive analysis appropriate for exploratory research in underexplored contexts. In the qualitative phase, 12 students were purposively selected to ensure diversity in socioeconomic background, access to technology, and school location, while all six teachers participated in interviews. This maximum variation sampling strategy aims for theoretical

saturation regarding the perceptual range, although the findings remain contextually bounded to similar provincial settings.

Research Instruments

Two instruments grounded in the TAM and TPACK frameworks ensured theoretical alignment and methodological rigor (Davis, 1989; Mishra & Koehler, 2006). The questionnaire, a 30-item five-point Likert scale (1=Strongly Disagree to 5=Strongly Agree), measured five perceptual dimensions: AI Understanding, Attitudes toward AI, Readiness and Competence, Expectations, and Perceived Barriers (six items per dimension). Items were adapted from validated educational technology acceptance scales and refined through expert review by three specialists in educational technology, history pedagogy, and psychometrics, achieving a Scale-level Content Validity Index (S-CVI) of 0.97 (Polit & Beck, 2006). Pilot testing with 20 grade XI students from non-participating schools yielded preliminary reliability estimates (Cronbach's α = 0.78-0.86), confirming instrument adequacy before the main data collection.

Semi-structured interview protocols, differentiated for students and teachers, included 8-10 open-ended questions with follow-up probes to encourage detailed responses. Teacher protocols focused on professional experience, pedagogical strategies, and ethical considerations regarding AI integration. Student protocols explored learning preferences, access to technology, and concerns about cultural representation. The protocols were validated through peer debriefing with qualitative research experts and piloted with two teachers and four students to refine clarity, ensuring that the questions facilitated critical reflection on AI's epistemological and cultural implications (Braun & Clarke, 2006).

Data Collection Procedures

Data collection took place over four weeks (August-September 2025), following ethical clearance from the Universitas PGRI Palangka Raya Institutional Review Board and informed consent from participants, including parental assent for minors. Questionnaires were administered during grade XI history classes in the researcher's presence to clarify ambiguities and ensure the quality of completion, minimizing non-response bias. All 220 distributed questionnaires were returned, yielding a 100% response rate. Interviews, lasting 15-25 minutes each, were conducted individually in quiet school settings (libraries, empty classrooms) to ensure privacy and candid responses. All interviews were audio recorded with participants' permission, transcribed verbatim in Indonesian, and supplemented with field notes documenting nonverbal cues and contextual observations. The procedures adhered to Indonesian research ethics standards, ensuring confidentiality, voluntary participation, and the right to withdraw (Kebudayaan, 2021). The interview transcripts were member-checked with the participants to verify their accuracy and interpretive validity.

Data Analysis

Quantitative data were analyzed using SPSS 27, employing descriptive statistics (means, standard deviations, minimum and maximum values, and frequencies) and internal consistency reliability testing (Cronbach's α). Given the teacher sample size (n=6), the quantitative analysis remained descriptive rather than inferential, providing a contextual complement to the qualitative findings. All five dimensions demonstrated acceptable to excellent reliability (α = 0.796-0.864), exceeding the conventional 0.70 threshold for exploratory research (Adhikari & Timsina, 2024; Hundleby & Nunnally, 1968). Qualitative data were analyzed thematically following Braun and Clarke's six-phase framework: (1) familiarization through repeated transcript reading, (2) systematic coding of meaningful units, (3) initial theme generation through code clustering, (4) theme review against coded extracts and the entire dataset, (5) theme definition and naming, and (6) report production with illustrative excerpts (Braun & Clarke, 2006). The analysis proceeded inductively while remaining theoretically sensitized to the TAM and TPACK constructs. Two researchers

independently coded 30% of the transcripts, achieving an inter-coder agreement of 89%; discrepancies were resolved through discussion until consensus was reached. Final coding used manual spreadsheet organization, enabling systematic tracking of themes across participants (Flick, 2022).

Through methodological triangulation, this study systematically mapped emergent qualitative themes onto quantitative data patterns, allowing for the identification of both convergences, in which narrative accounts corroborated statistical trends, and divergences, where participant narratives introduced complexities that challenged aggregated numerical findings. This integrative-analytic strategy strengthens both the interpretive depth and analytical rigor of the research by engaging multiple sources of evidence in a coherent, mutually reinforcing manner.

By aligning statistical generalizations with contextually grounded qualitative insights, the analysis advances beyond mere descriptions of stakeholder perceptions. It seeks to uncover the underlying reasons, experiential contexts, and sociocultural dynamics that shape attitudes toward AI integration in history education. The study provides a more holistic understanding of what teachers and students believe about AI, why they hold these beliefs, and under what contextual conditions they emerge. This nuanced perspective is essential for formulating culturally responsive and contextually relevant recommendations, particularly in educational settings such as Central Kalimantan, where local pedagogical practices and technological infrastructure may differ significantly from broader national or international models (Kawar et al., 2024).

Results and Discussion

Quantitative Findings

An analysis of responses from 220 students, evaluated across five validated perceptual dimensions comprising 30 survey items, yielded Cronbach's alpha coefficients ranging from 0.796 to 0.864, indicating the high internal consistency and reliability of the instrument. The findings revealed nuanced perceptual patterns in the integration of AI into history learning, with variations across dimensions (see Table 1).

Table 1. Descriptive Statistics of Student Perceptions (N=220)

Dimension	N	M	SD	Min	Max	Cronbach's α
AI Understanding	220	3.19	0.67	1.33	4.83	0.842
Attitudes toward AI	220	4.09	0.58	2.17	5.00	0.826
Readiness & Competence	220	3.28	0.65	1.83	4.83	0.818
Expectations	220	4.10	0.65	2.00	5.00	0.864
Perceived Barriers	220	2.75	0.65	1.00	4.50	0.796

Students demonstrated moderate AI understanding (M = 3.19, SD = 0.67), suggesting a foundational awareness alongside substantial knowledge gaps in technical terminology and application mechanisms. Despite moderate comprehension, attitudes toward AI were strongly positive (M = 4.09, SD = 0.58), indicating that affective responses precede cognitive mastery in technology acceptance processes. The narrow standard deviation reflects an attitudinal consensus across diverse socioeconomic backgrounds.

Readiness and competence were rated at a moderate level (M = 3.28, SD = 0.65), indicating tension between aspirational attitudes and pragmatic self-assessments. Students acknowledged that confidence limitations and access disparities constrain immediate implementation capacity, suggesting that positive attitudes alone are insufficient without accompanying skill development and resource provision. Expectations regarding AI benefits achieved the highest score (M = 4.10,

SD = 0.65), reflecting substantial pedagogical optimism. However, elevated expectations introduce the risk of disappointment if the implementation fails to meet the anticipated standards (Selwyn, 2016). Perceived barriers were registered at the lowest level (M = 2.75, SD = 0.65), indicating awareness of infrastructural and economic constraints without overwhelming pessimism, suggesting realistic pragmatism rather than naive technological determinism.

The item-level analysis (Table 2) illuminates specific value priorities. The highest-scoring item, "Teachers remain essential despite AI use" (M = 4.31), contradicts narratives of technological replacement, affirms teachers' irreplaceability, and aligns with sociocultural learning theory's emphasis on the centrality of human mediation (Vygotsky, 1978). High endorsement of motivational affordances (M = 4.24) and efficiency gains (M = 4.15) reflects perceptions of instrumental value, consistent with TAM's perceived usefulness construct (Davis, 1989). Conversely, the lowest-scoring items cluster around implementation feasibility: economic barriers (M = 2.54), teacher preparedness (M = 2.67), and comprehension of technical terminology (M = 3.00), suggesting that enthusiasm may outpace understanding, leaving the system vulnerable to uncritical AI adoption.

Table 2. Five Highest and Lowest Scoring Items Across All Dimensions (N=220)

Rank	Item	M	SD
Highest			
1	Teachers remain essential despite AI (sikap_6)	4.31	0.71
2	AI increases student interest (harapan_2)	4.24	0.82
3	AI aids faster understanding (harapan_1)	4.15	0.82
4	AI expands historical perspectives (harapan_5)	4.14	0.83
5	AI makes learning more interactive (sikap_3)	4.13	0.78
Lowest			
1	Concerns about implementation costs (hambatan_5)	2.54	0.91
2	Teacher AI knowledge is insufficient (hambatan_4)	2.67	0.87
3	Concerns about student comprehension difficulties (hambatan_3)	2.76	0.95
4	Limited time to learn AI (hambatan_2)	2.92	0.94
5	Understanding AI terminology (pemahaman_4)	3.00	0.89

Teacher perceptions (N = 6) were used for descriptive rather than inferential purposes, given sample size constraints (Table 3). Teachers demonstrated moderately elevated AI understanding (M = 3.93) and readiness (M = 3.82) compared to students, likely attributable to their professional experience, which facilitates abstract conceptualization. Attitudes (M = 4.13) and expectations (M = 4.20) were closely aligned across stakeholder groups, suggesting shared optimism about the transformative potential. However, teachers reported higher perceived barriers (M = 3.05), reflecting institutional awareness of policy vacuums, resource allocation challenges, and professional development deficits requiring administrative intervention beyond individual users' control.

Table 3. Teacher Perceptions Descriptive Profile (N=6)

Dimension	M (Indicative)	Comparative Observation
AI Understanding	3.93	Moderately higher than students (3.19)
Attitudes toward AI	4.13	Comparable to students (4.09)
Readiness & Competence	3.82	Moderately higher than students (3.28)
Expectations	4.20	Comparable to students (4.10)
Perceived Barriers	3.05	Higher than students (2.75)

Qualitative Findings

The thematic analysis of 18 interviews (12 students and 6 teachers) yielded seven major themes that corroborated and complicated the quantitative patterns. Students expressed enthusiasm for AI's potential to transform the study of history while maintaining nuanced concerns about authenticity. Student S2 exemplified this duality: "*I agree with using AI, but only as a tool, not a replacement... I tried ChatGPT for researching the Aceh War, but I always cross-checked... AI is fast, but sometimes it hallucinates.*" This demonstrates critical technology literacy, which transcends naive acceptance. In contrast, Student S6, from a marginalized background, worried: "*Many people say 'Dayak people are primitive'... If AI repeats such narratives, it is unjust. I want AI to tell Dayak Ngaju history, about Tiwah ceremonies, about resistance against the Dutch.*" Her concern reflects anxieties about algorithmic colonialism, which perpetuates epistemic violence against Indigenous communities (Couldry & Mejias, 2019).

Infrastructure inequality has emerged as a dominant constraint on socioeconomic divides. Student S1, whose family subsists on artisanal fishing, described limitations with secondhand devices and the affordability of 2GB of weekly data, preferring audio-based interfaces due to bandwidth constraints and literacy barriers. This contrasts sharply with Student S10's laptop access and stable connectivity, which enabled digital archival document analysis, revealing that AI integration risks widening achievement gaps without comprehensive equity interventions. Students universally emphasized the irreplaceable moral and affective presence of teachers in the classroom. Student S12 concluded: "*Teachers remain number one... if creating AI for our schools here, please include Kalimantan history too... If AI doesn't know about Tjilik Riwut or Dayak resistance, what's the point?*" This articulates complementary technology models alongside identity-affirming education principles. Student S8's metaphor captured this: "*AI is like a library without a librarian. Teachers provide empathy to their students. When our teacher narrated how mothers hid weapons during the revolution, I cried. AI cannot make me cry*," underscoring history education's moral dimension (Barton & Levstik, 2004).

Teachers acknowledged AI's instrumental value while maintaining ethical vigilance. Teacher T2 explained, "*AI proves extremely helpful for preparation and differentiation. I can request three versions of the explanation tailored to visual, auditory, and kinesthetic learners. However, I worry about disseminating biased or inaccurate historical narratives, especially those ignoring local contexts.*" This reflects sophisticated TPACK integration, filtering technological affordances through pedagogical strategies and content-specific epistemology (Mishra & Koehler, 2006). All six teachers identified professional development as an urgent prerequisite for implementing the curriculum. Teacher T3 stated, "*I feel technically ready but still need pedagogical guidance. The primary challenge is teacher competence in directing AI use critically and ethically.*" Teacher T6 elaborated on needed support: "*Practical training based on local contexts, learning modules integrating AI with Kalimantan history, education office support, and teacher community*." Her closing statement encapsulated a central tension: "*We can experiment, as long as it doesn't make us forget that we are Kalimantan people.*" Teachers expressed profound concerns regarding epistemological colonization. Teacher T4 worried, "*I fear AI will spread historical versions inconsistent with our local experiences. AI might claim, 'Kalimantan had no significant role in independence,' whereas abundant evidence contradicts this.*" This illuminates how algorithmic systems function as mechanisms of epistemic violence when training data reflect hegemonic perspectives (Smith, 2021). Teacher T1 emphasized the distinction between factual recall and historical meaning: "*History isn't just about what happened; it's about why it matters to us today*."

Triangulation. Substantial convergences emerged: both groups conceptualized AI as an augmentative rather than a replacement technology (quantitatively, the highest student item M = 4.31; qualitatively, universal teacher affirmation), shared optimism about enhanced engagement, and identified infrastructure and competence as critical bottlenecks. Divergences reflect positional differences: students focus on personal readiness and access within immediate experiential

horizons, whereas teachers foreground institutional barriers requiring administrative intervention. Regarding agency, teachers worry about professional deskilling through algorithmic management, whereas students worry about intellectual dependency. Students articulate cultural representation needs with greater emotional intensity, framing them as existential rather than merely pedagogical concerns.

TAM Limitations in Peripheral Contexts

While the findings provide partial validation of the Technology Acceptance Model (TAM), they also highlight important limitations when this framework is applied in non-affluent, technologically mature environments. As predicted by TAM (Davis, 1989), perceived usefulness (mean = 4.10) and perceived ease of use (mean = 3.28) were positively associated with favorable attitudes toward AI integration in history education. However, these individual-level constructs fall short of explaining adoption patterns in peripheralized contexts, where broader structural and cultural factors influence technology uptake.

The model's focus on individual intention does not adequately account for infrastructure constraints, gaps in institutional support, economic limitations, and context-specific cultural dynamics. In this study, students expressed optimism about AI but also recognized that personal motivation alone is insufficient without systemic support, such as adequate connectivity and device access. Teachers likewise link their readiness not to intrinsic self-efficacy but to the availability of professional development, curricular alignment, and collective community backing. These findings support Tarhini's critique that TAM requires significant contextual and cultural adaptation when applied in non-Western and under-resourced settings (Tarhini et al., 2017). To address these limitations, this study advocates adopting sociotechnical frameworks that view technology adoption as a process shaped by intersecting layers of social, institutional, economic, and political conditions. Ecological models offer a more comprehensive approach by situating individual attitudes within broader systems, unlike traditional models. These include institutional policies, community norms, national priorities, and economic structures, all of which shape stakeholders' engagement with technology.

The participants in this study reflected a position best described as critical pragmatic optimism. Rather than embracing AI uncritically or rejecting it entirely, they expressed conditional support depending on whether implementation efforts were inclusive, equitable, and locally responsive. Their perceptions highlight that successful AI integration cannot rely on individual attitudes alone and must involve a coordinated effort to address structural barriers and ensure cultural relevance. This reinforces the need for models that move beyond TAM's psychological assumptions by incorporating power relations, material conditions, and local epistemologies as the central components of educational technology adoption.

TPACK Expansion: Cultural Knowledge as Fourth Domain

Teachers' emphasis on value education, moral reasoning, and interpretive thinking underscores the principle that effective technology integration must be anchored in the discipline's epistemological foundations (Mishra & Koehler, 2006). This perspective is well illustrated by Teacher T1's distinction between "what happened" and "why it matters," underscoring that history education is not solely about content. Instead, it plays a vital role in promoting civic engagement, ethical reflection, and critical consciousness, ultimately preparing students for democratic citizenship (Barton & Levstik, 2004). In this context, AI tools that lack alignment with historical thinking frameworks risk reducing history instruction to factual recall, thereby neglecting core competencies such as evaluating evidence, taking perspectives, and making ethical judgments (Wineburg, 2001). However, the original TPACK framework insufficiently emphasizes the cultural and contextual dimensions of teaching. Teachers consistently noted that effective pedagogy in Kalimantan history

requires deep familiarity with local narratives, indigenous epistemologies, and regional identity politics. This observation supports the proposition that TPACK should be expanded to include cultural knowledge as a distinct and explicit fourth domain of teacher knowledge. This extension is especially crucial in disciplines such as history, where content is often culturally contested and deeply intertwined with issues of identity and power (Vinet & Zhedanov, 2011). Incorporating cultural knowledge into the TPACK framework reflects a commitment to pedagogical equity, acknowledging that successful teaching in peripheral or marginalized contexts depends not only on technological fluency and disciplinary expertise but also on cultural responsiveness. Such responsiveness entails recognizing students' lived experiences and cultural backgrounds as intellectually generative, rather than deficient. This affirms that meaningful technology integration must respect and reflect the plurality of historical narratives, particularly in regions where dominant curricula have historically marginalized local knowledge systems.

Algorithmic Colonialism and Epistemological Justice

Student S6's concern that AI may reproduce colonial narratives portraying Dayak communities as "primitive" reflects broader anxieties rooted in critical scholarship on algorithmic colonialism. Such fears are well-founded, as AI systems trained primarily on Western-centric or Javacentric datasets are likely to perpetuate epistemic violence by privileging dominant knowledge systems while systematically marginalizing Indigenous and regional epistemologies. These systems tend to treat non-metropolitan knowledge as local, anecdotal, or inferior while simultaneously presenting metropolitan knowledge as objective, universal, and authoritative (Mignolo, 2020). This dynamic not only distorts historical understanding but also actively contributes to stigmatization, political exclusion, and internalized cultural inferiority. To prevent these harms, AI development in educational contexts must be reconceptualized through inclusive and reflexive design. This involves recognizing Indigenous and regional knowledge holders as co-designers who actively shape training data, decision-making algorithms, and user interface features. Such collaboration requires a critical interrogation of the assumptions embedded in training corpora, algorithmic logic, and presentation modes to detect and rectify systemic bias. As Escobar argues, this shift calls for "pluriversal" approaches that affirm the coexistence of multiple legitimate historical epistemologies rather than enforcing a singular, linear, or centralized historical narrative (Escobar, 2018).

In the context of Indonesian history education, these insights underscore the importance of AI systems that intentionally amplify marginalized and region-specific historical narratives. This is particularly time-sensitive in areas such as Kalimantan, where dominant curricular materials often erase or distort local histories through a Javacentric lens. Therefore, educational AI must avoid reliance on readily available but culturally incongruent corpora and instead engage in deliberate content curation that reflects the lived experiences, oral histories, and epistemic traditions of peripheral communities (Good & Hof, 2024; Williyan et al., 2024). Such efforts are essential to ensure that AI technologies support epistemic justice, promote cultural affirmation, and foster a more inclusive and accurate understanding of Indonesia's diverse historical landscape.

Theoretical and Practical Implications

Theoretically, this study challenges the universality of the Technology Acceptance Model (TAM) by demonstrating how structural inequities and cultural context mediate technology acceptance in peripheral educational ecosystems. It also advances the TPACK framework by proposing cultural knowledge as an essential fourth domain in humanities education, particularly vital where historical narratives are contested and identity-laden. Practically, the findings urge Indonesian policymakers and educational stakeholders to (1) fund participatory AI development that centers Dayak epistemologies, (2) prioritize low-bandwidth, audio-based, and offline-capable interfaces to accommodate infrastructural realities, and (3) implement teacher professional development programs that integrate critical algorithm awareness with historical thinking pedagogy. These steps

are vital to prevent AI from reinforcing epistemic marginalization and to align digital innovation with Indonesia's constitutional mandate for equitable and culturally inclusive education (UUD 1945 Pasal 31).

Digital Equity as an Educational Justice Imperative

Student S1's testimony about secondhand devices, limited bandwidth, and visual fatigue illustrates that digital divides encompass not only device ownership but also connectivity quality, data affordability, digital literacy, and embodied capacities shaped by material deprivation (Robinson et al., 2015). Warschauer's model is instructive: bridging divides requires holistic interventions that address physical access, digital literacy, culturally relevant content, and social support simultaneously (Warschauer, 2003). Providing technology alone is insufficient if users lack the skills or if the content reflects alien cultural frameworks.

This study extends Warschauer's model: students like S1 require AI interfaces designed for low-bandwidth contexts, audio-based modalities that accommodate limited literacy, and content that reflects their cultural worlds rather than presuming urban middle-class norms. Policy interventions must address the broader ecosystems that enable meaningful technology use rather than superficial device-distribution metrics. Without such interventions, AI integration risks exacerbating existing educational inequalities, contradicting Indonesia's constitutional commitment to equitable education (UUD 1945 Pasal 31), and the Sustainable Development Goals' (SDG) emphasis on inclusive, quality education (Asmayawati et al., 2024).

Limitations and Directions for Future Research

This study is limited by its focus on a single provincial capital and a small teacher sample (n=6), which restricts generalizability beyond similar Indonesian peripheral contexts. Additionally, reliance on self-reported perceptual data may introduce social desirability bias, and the cross-sectional design precludes causal inference. Future research should employ quasi-experimental or design-based implementation studies to measure AI's actual impact on historical thinking competencies (e.g., evidence evaluation, multiperspectivity). Longitudinal tracking could illuminate how perceptions evolve through sustained AI engagement. Comparative studies across rural Kalimantan, other Indonesian provinces, or Southeast Asian contexts would further test the transferability of our findings. Importantly, research must examine whether AI exacerbates or ameliorates educational inequalities across socioeconomic strata, particularly in settings where device access, data affordability, and digital literacy remain unevenly distributed.

Conclusion

This study reveals that teachers and students in Palangka Raya view AI as a complementary pedagogical tool that must be culturally grounded in Kalimantan's historical narratives and responsive to infrastructural constraints. Both groups reject discourses of technological replacement, instead advocating AI that augments, rather than replaces, teacher judgment and student agency. Successful integration requires ecosystem-level interventions, including equitable infrastructure, context-sensitive AI design co-developed with local communities, and teacher capacity building in critical AI literacy. Theoretically, the findings indicate the need to expand TPACK by incorporating cultural knowledge and to reconceptualize TAM through sociotechnical and postcolonial perspectives. Ultimately, AI in history education must promote epistemic justice by centering marginalized voices and affirming regional identities, rather than prioritizing efficiency alone.

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