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Transforming Prospective Elementary Teachers' Social Studies Learning through Generative AI in the Digital Era

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ABSTRACT
The rapid integration of Artificial Intelligence (AI) into higher education is transforming how prospective elementary school teachers access, interpret, and construct knowledge in Social Studies education. This study examines changes in learning patterns among prospective elementary school teachers in AI-supported Social Studies education, identifies factors associated with these changes, and explores instructional strategies used to maintain critical and reflective learning. Using a qualitative exploratory design, the study was conducted at Universitas Iskandar Muda, Banda Aceh, Indonesia. Data were collected through classroom observations, in-depth interviews with two lecturers and two prospective teachers, and document analysis. Data were analyzed interactively through data reduction, data display, and conclusion drawing. The findings reveal a shift from predominantly literature-based and reflective learning toward faster, AI-assisted information seeking and knowledge production. Participants associated this transformation with technological development, digital learning culture, academic workload, limited academic literacy, generational characteristics, and lecturers' pedagogical practices. Although AI was perceived to improve the efficiency of information retrieval and broaden access to learning resources, participants also expressed concerns about reduced critical reflection, weaker social argumentation, and less intensive academic interaction when AI was used uncritically. In response, lecturers employed problem-based, inquiry-based, reflective, and collaborative learning, supported by AI literacy development, to encourage verification, interpretation, and critical engagement with AI-generated information. These findings highlight the importance of pedagogically guided AI integration in developing adaptive, critical, reflective, and human-centered Social Studies education.

INTRODUCTION

The increasing use of Artificial Intelligence (AI) in education is transforming how prospective teachers learn, often outpacing education institutions' readiness to develop adaptive and ethical learning systems (Yambal & Waykar, 2025). The emergence of generative AI platforms such as ChatGPT, Gemini, and Copilot has positioned technology not

merely as a learning tool but as an integral part of the academic culture of prospective teachers (Scott-Herring, 2024). Through these technologies, students can generate summaries, complete assignments, and construct academic arguments within seconds, often without engaging in extensive literature exploration or independent inquiry (Meylani, 2024). This development has created a new paradox in higher education. On the one hand, AI enhances access to knowledge and improves learning efficiency. On the other hand, it raises concerns regarding the erosion of critical thinking, social reflection, and academic integrity among prospective teachers (Partyko et al., 2024). This issue is particularly significant in Primary School Teacher Education (PGSD), especially within Social Studies education, as prospective elementary school teachers are expected to cultivate students' character, social awareness, and critical thinking skills in an increasingly digital society (Tapung, 2024).

This phenomenon has become increasingly evident among prospective teachers in the Faculty of Teacher Training and Education at Universitas Iskandar Muda, particularly within the Primary School Teacher Education (PGSD) program, where the use of AI in daily academic activities has intensified. Preliminary observations indicate that prospective teachers frequently rely on AI to complete assignments, summarise learning materials, and instantly generate responses to questions in Social Studies courses. Classroom discussions, which previously encouraged critical engagement, have gradually shifted as students increasingly rely on AI-generated answers rather than engaging in independent literature exploration and in-depth academic dialogue (Kharis & Indriyani, 2024). In addition, lecturers have begun to encounter difficulties in distinguishing between students' original ideas and AI-generated written work (Octaberlina et al., 2024). This situation suggests that the transformation of prospective teachers' learning patterns is occurring more rapidly than higher education institutions' pedagogical readiness to manage the use of Artificial Intelligence (Selmi et al., 2025).

Social Studies education within Primary School Teacher Education (PGSD) programs. PGSD programs are ideally designed to develop prospective teachers with strong critical thinking skills, social literacy, and the ability to analyse societal issues reflectively (Williams, 2005). From a social constructivist perspective, prospective teachers are viewed as active participants who construct knowledge through academic dialogue, social interaction, and empirical experience. The integration of technology into education should therefore strengthen reflection and collaboration rather than replace human thinking through instant automated processes (Luo, 2024). In the context of twenty-first-century education, the use of AI should also align with the principles of ethical digital learning and human-centred education, ensuring that technology serves as a tool to enhance the intellectual capacities of prospective teachers rather than diminish them (Alexandrowicz, 2024). This perspective underscores that Social Studies education extends beyond the transmission of academic content; it also functions as a space for cultivating civic intelligence and fostering responsible social decision-making.

Empirical evidence indicates that the adoption of AI among prospective teachers is advancing far more rapidly than higher education institutions' capacity to manage this transformation pedagogically. Numerous studies have shown that prospective teachers increasingly rely on AI to complete assignments, summarise learning materials, obtain instant answers, and even construct academic arguments without conducting an adequate literature review or critically evaluating sources (Din, 2025). Generative AI has become a primary academic support tool for many university students in their daily learning activities. In Social Studies education, this trend is reflected in the declining intensity of critical classroom discussions, the growing tendency of prospective teachers to accept

information without thorough verification, and a reduced engagement with primary academic sources. These developments suggest a significant shift in learning patterns, from reflective, inquiry-based learning to instant learning driven by technological automation.

The transformation of learning through Artificial Intelligence (AI) has changed how prospective teachers acquire, process, and use information in Social Studies (IPS) education at the higher education level. The use of AI can facilitate access to information and support academic activities, while also raising questions about how prospective teachers verify information, construct arguments, engage in reflection, and maintain intellectual independence during the learning process (Dilmi & Sakri, 2024; Yavich, 2025). These issues cannot be adequately understood solely by measuring the benefits or risks of AI; there is still a need for empirical understanding of students' and lecturers' experiences, changes in learning patterns, and the pedagogical strategies employed in Social Studies education (Daukšienė & Mačianskienė, 2025). Other concerns include increasing challenges related to academic integrity, the validity of learning assessment, and changes in academic culture within higher education institutions.

These changing learning patterns are shaped by multiple interconnected factors, including the accessibility of AI technologies, the digital culture of contemporary prospective teachers, academic pressures, and the limited readiness of higher education instructional designs to respond effectively to the era of Artificial Intelligence (Popenici & Kerr, 2017). Many assessment systems continue to rely heavily on written assignments, which can be readily generated through AI-powered tools (Yeralan & Laura, 2023). At the same time, prospective teachers' digital ethics literacy remains insufficiently developed, leading many to perceive AI primarily as a means of accelerating task completion rather than as a tool for intellectual inquiry and knowledge construction. These conditions highlight the need for new pedagogical approaches that integrate AI into Social Studies education in a critical, ethical, and reflective manner. Concepts such as human-centred AI learning, reflective learning, and critical digital pedagogy have become increasingly important for ensuring that technology supports, rather than replaces, meaningful learning processes. Such approaches position prospective teachers as active intellectual agents who critically engage with information, reflect on social realities, and construct knowledge through inquiry, dialogue, and evidence-based reasoning (Rahma et al., 2025).

Research on Artificial Intelligence in education has expanded considerably, encompassing a wide range of perspectives and areas of inquiry. Vargas-Murillo examined the opportunities and challenges associated with the use of ChatGPT in higher education, finding that AI can enhance learning efficiency while simultaneously raising concerns regarding academic integrity (Vargas-Murillo et al., 2023). Thararattanasuwan investigated changes in prospective teachers' learning behaviours resulting from integrating generative AI into everyday academic activities (Thararattanasuwan & Prachagool, 2024). Ruslaini explored the development of critical thinking without addressing the role of AI technologies (Ruslaini et al., 2023), whereas Azkia et al. provided a comprehensive analysis of critical thinking in mathematics education without linking it to Artificial Intelligence (Azkia et al., 2024). Despite these contributions, most existing studies have concentrated on educational technologies, critical thinking skills, or the general effectiveness of AI in learning environments. Research specifically examining the transformation of learning patterns among prospective elementary school teachers in Social Studies education remains limited, particularly within the Faculty of Teacher Training and Education at Universitas Iskandar Muda. This study is significant because it goes beyond examining AI as a learning technology to investigate its implications for social reflection, academic integrity, and critical

thinking among prospective elementary school teachers. Accordingly, this study aims to analyse the transformation of learning patterns among prospective elementary school teachers in Social Studies education in the era of Artificial Intelligence, identify the factors driving these changes, and formulate relevant instructional strategies to strengthen academic quality and critical thinking skills amid the rapid advancement of AI technologies.

RESEARCH METHODS

This study employed a qualitative, exploratory descriptive design to examine changes in learning patterns among prospective elementary school teachers in Social Studies education in the era of Artificial Intelligence (Sugiyono, 2019). The study was conducted in the Primary School Teacher Education (PGSD) Program at Universitas Iskandar Muda, Banda Aceh, within Social Studies courses involving technology-supported learning. Participants comprised two lecturers and two prospective elementary school teachers. They were purposively selected for their active involvement in AI-supported Social Studies learning and their ability to provide relevant experiences and information. Data were collected through classroom observations, semi-structured in-depth interviews, and analysis of learning documents. Interviews focused on participants' experiences with AI, changes in learning patterns, factors influencing these changes, and lecturers' instructional responses. Observations examined classroom interaction, AI use, discussion processes, and pedagogical responses. The document corpus consisted of students' assignments, learning records, and other relevant academic materials. Data collection was conducted from April 2026 to May 2026 and continued until the information obtained was considered sufficiently repetitive to address the research questions.

The researcher served as the primary instrument, supported by interview guides, observation protocols, and document analysis guidelines. Data were analysed through data reduction, data display, thematic coding, and interpretation. An audit trail was maintained through interview transcripts, observation notes, coding records, and analytical memos. Trustworthiness was strengthened through source and method triangulation and member checking. Prior to data collection, participants received an explanation of the research objectives, procedures, voluntary participation, confidentiality, and their right to withdraw. Written informed consent was obtained from all participants, and personal identities were replaced with pseudonyms in the analysis and reporting. The study followed applicable institutional ethical requirements.

Triangulation was conducted by the researcher through interviews, classroom observations, and analysis of students' assignments to examine the consistency of data concerning AI use and changes in learning patterns. Member checking was conducted by asking all participants to confirm the preliminary findings and the researcher's interpretations, particularly regarding changes in learning patterns, AI use, and lecturers' pedagogical responses. The participants were purposively selected based on their involvement in AI-supported Social Studies learning. Their characteristics are presented in Table 1.

Table 1. Characteristics of Research Participants and Their Involvement in AI-Supported Social Studies Learning

No.	Participant Code	Status	Semester	Involvement in AI-Supported Social Studies Learning
1	L1	Lecturer	–	Teaches Social Studies courses and uses technology/AI in learning

2	L2	Lecturer	–	Teaches Social Studies courses and uses technology/AI in learning
3	M1	Prospective Elementary School Teacher	6	Participates in Social Studies learning that incorporates AI
4	M2	Prospective Elementary School Teacher	6	Participates in Social Studies learning that incorporates AI

(Source: Data Processing, 2026)

Data were analyzed using the interactive model proposed by Miles, Huberman, and Saldaña (Miles et al., 2014). This consists of data reduction, data display, and conclusion drawing. During the data reduction stage, interview transcripts, observation records, and documentary evidence were selected, organized, and condensed in line with the study's research focus. The data display stage involved systematically organizing themes and patterns to facilitate interpretation of the transformation of prospective teachers' learning practices in Social Studies education within the context of Artificial Intelligence. The conclusion-drawing process involved critically interpreting empirical findings by relating field data to the theoretical perspectives of social constructivism, critical pedagogy, and digital learning in higher education. Data analysis was undertaken continuously throughout the research process, enabling the identification of emerging patterns, relationships, and meanings derived from the participants' experiences. This analytical approach provided a comprehensive understanding of the changing learning culture among prospective elementary school teachers in the AI era and generated a systematic, objective, and contextually grounded description of the evolving dynamics of Social Studies education amid the digital transformation of contemporary higher education.

RESULTS AND DISCUSSION

The Transformation of Learning Patterns Among Prospective Elementary School Teachers in the AI Era

The emergence of Artificial Intelligence (AI) has significantly transformed the learning patterns of prospective elementary school teachers in Social Studies education, particularly how they access, understand, and construct academic knowledge. Classroom observations revealed that the use of generative AI platforms such as ChatGPT, Gemini, and Copilot has become an integral part of prospective teachers' daily learning activities. These technologies are frequently utilized to search for references, summarise learning materials, complete assignments, and efficiently generate responses to social issues. One prospective teacher, Siska Nazia, stated, "AI makes it easier for me to understand Social Studies materials because the explanations are direct and simple." This finding indicates that AI is increasingly being positioned as an alternative learning resource capable of replacing some functions traditionally fulfilled by academic literature and scholarly discussion. From a social constructivist perspective, meaningful learning should be developed through active interaction, reflection, and the negotiation of meaning between learners and their social environment.

This transformation is further reflected in changes to the academic literacy practices of prospective teachers in Social Studies learning. Prospective teachers acknowledged that they no longer read scholarly articles in their entirety, preferring instead to obtain AI-generated summaries. Observational data showed that when lecturers assigned journal articles or readings on social issues, students often relied on AI to explain the key points rather than engaging in independent critical

reading. One participant remarked, "Reading journal articles takes too much time, so I usually ask AI to explain the main ideas." This phenomenon illustrates a shift from deep reading toward selective and instant reading practices. Cognitive learning theory suggests that critical thinking develops through in-depth reading, analysis of arguments, and reflective engagement with information. While AI enhances learning efficiency, it may simultaneously reduce opportunities for academic reflection. These findings suggest that digital transformation not only changes learning tools but also reshapes the cognitive processes through which prospective teachers understand and analyse social issues.

Changes in learning patterns are also evident in the dynamics of classroom discussions. Prior to the widespread use of AI, prospective teachers generally engaged in discussions based on their own readings and interpretations of social phenomena. Recent observations indicate that classroom discussions have become shorter and less exploratory because many students arrive with AI-generated responses before discussions begin. One lecturer noted, "Students' answers now appear very polished, but it is sometimes difficult to identify their original thinking." This finding suggests that AI is influencing the nature of academic interaction among prospective teachers. Critical pedagogy views dialogue as a fundamental mechanism for developing critical consciousness and reflective engagement with social realities. When dialogical processes are increasingly replaced by machine-generated responses, Social Studies education risks losing its emancipatory function as a space for cultivating social awareness and critical thinking.

Interview data further revealed that prospective teachers primarily use AI for reasons of academic efficiency. Participants perceived AI as a practical tool for completing assignments more quickly amid increasing academic demands. One prospective teacher, Khairul Ikhwan, explained, "When assignments accumulate, AI helps me develop an outline for my answers much faster.

Classroom observations showed that AI was used in essay-based assignments and social case analyses. These findings indicate that changes in learning patterns cannot be separated from structural pressures in higher education, which demand high levels of academic productivity within limited timeframes. From a behaviourist perspective, students' behaviour is influenced by environmental demands and reward systems. When learning systems place greater emphasis on outcomes than on learning processes, students tend to adopt strategies that facilitate the completion of academic tasks. In this context, Artificial Intelligence functions as a pragmatic tool that accelerates academic work, although its use does not always promote deep knowledge internalisation or meaningful intellectual engagement.

The use of AI also influences prospective teachers' ability to construct social arguments independently. Classroom observations revealed that although many prospective teachers were able to produce well-organised and systematically structured written assignments, they often encountered difficulties when asked to explain or defend their work orally. One lecturer in the Primary School Teacher Education (PGSD) program, Muda Genali Sakti, noted that "some prospective teachers were unable to defend their arguments when asked to elaborate on the content of their assignments." This finding suggests that AI may contribute to the development of superficial understanding in Social Studies learning. From a metacognitive perspective, academic understanding is not solely reflected in the ability to generate written responses but also in the capacity to independently reflect upon, justify, and further develop arguments. Excessive reliance on AI may reduce essential metacognitive processes, including critical evaluation, intellectual reflection, and academic decision-making. These findings indicate that the digital efficiency provided by AI does not necessarily correspond to deeper internalisation of social knowledge

among prospective teachers. While AI can facilitate the production of academic outputs, it may simultaneously limit learners' opportunities to engage in the reflective and analytical processes required for meaningful understanding and sustained intellectual development.

The transformation of learning patterns is also reflected in changes in the social interactions of prospective teachers during Social Studies learning. Prior to the widespread use of AI, prospective teachers frequently engaged in face-to-face discussions with their peers to complete assignments and analyse social issues. Following the widespread adoption of AI, group interactions appeared to decline as students increasingly relied on AI applications to find answers independently. One lecturer remarked that "prospective teachers now tend to remain silent during discussions because they already have their own answers generated by AI." This phenomenon indicates a shift from collaborative learning toward a more individualised form of digital learning. According to Vygotskian constructivist theory, knowledge is constructed through social interaction and the exchange of ideas among individuals (Kitchener, 1996). The reduction of academic dialogue resulting from the growing dominance of AI suggests that technology is beginning to replace some of the social functions traditionally embedded in the learning process (Lin et al., 2023). This issue is particularly significant in Social Studies education, which emphasises not only content mastery but also the development of social empathy, communication skills, and collective awareness of societal issues among prospective teachers (Putri et al., 2024).

On the other hand, the study found that AI positively contributes to prospective teachers' academic self-confidence. Several participants, including Siska Nazia, reported feeling more confident in responding to lecturers' questions after receiving explanations from AI-based tools. They perceived AI as a valuable resource for understanding social issues that had previously been considered difficult or abstract. One participant stated, "AI helps me understand social conflicts and Social Studies concepts through simpler and more accessible explanations." This finding highlights the pedagogical potential of AI to enhance access to knowledge for prospective teachers. Educational technology perspectives suggest that digital learning tools can simplify complex concepts, making them easier for learners to comprehend. In this regard, AI should not be viewed solely as a threat to the quality of learning, as it can also support more adaptive and personalised learning experiences. These findings indicate that the central issue lies not in the existence of AI itself, but rather in how the technology is utilised critically, ethically, and proportionately within the context of Social Studies education.

The findings also reveal an epistemological shift in the way prospective teachers validate academic knowledge. Prospective teachers acknowledged that they directly use AI-generated responses without verifying them against other scholarly sources. One prospective teacher, Khairul Ikhwan, stated, "When AI provides a complete answer, I usually use it directly." This phenomenon suggests that AI is increasingly being positioned as an alternative authority of knowledge within the learning process. From the perspective of educational epistemology, the validity of knowledge should be established through scientific verification, critical reading, and the rational evaluation of arguments. When prospective teachers accept AI-generated responses without engaging in critical assessment, their learning orientation shifts from inquiry-based learning toward passive acceptance of information. This condition indicates that AI has the potential to reshape academic culture by replacing the active search for meaning with the rapid consumption of algorithmically generated information.

In response to these changes, lecturers have begun adapting their instructional strategies in Social Studies education. Classroom observations revealed that several lecturers redesigned assignments to emphasise field observations, local case

studies, and oral presentations, thereby reducing students' dependence on AI-generated content. One lecturer explained, "I now ask prospective teachers to present and explain their assignments directly in front of the class more frequently." Such strategies reflect efforts to preserve reflective learning practices amid the growing dominance of digital technologies. Humanistic learning theory emphasises the importance of educational experiences that foster self-awareness, responsibility, and authentic engagement with social realities (Gao, 2015). Experiential learning approaches are therefore essential to ensure that prospective teachers not only produce academic responses but also develop a meaningful understanding of social contexts. These pedagogical adaptations demonstrate that the transformation of prospective teachers' learning patterns has also stimulated broader changes in the instructional paradigm of Social Studies education in higher education institutions.

This study demonstrates that the transformation of learning patterns among prospective elementary school teachers in the era of Artificial Intelligence is multidimensional. Artificial Intelligence has enhanced learning efficiency, expanded access to knowledge, and accelerated the learning process in Social Studies education (Meylani, 2024). At the same time, the intensive use of AI may weaken academic literacy practices, critical reflection, dialogic interaction, and the intellectual independence of prospective teachers (Couto & Martins, 2025). One lecturer summarised this challenge by stating that "the greatest challenge today is not preventing the use of AI, but ensuring that prospective teachers continue to think critically." This statement highlights that the central issue in higher education is no longer the adoption of technology itself, but rather how to balance digital efficiency with the quality of students' intellectual engagement. From the perspective of critical digital pedagogy, technology should serve as a tool to enhance human intellectual capacity rather than replace learners' reflective processes and critical consciousness (Galván, 2022). The findings suggest that Social Studies education in the era of Artificial Intelligence requires a new pedagogical framework that integrates technology in adaptive, ethical, reflective, and human-centred ways. Such an approach is essential to ensure that prospective teachers continue to develop strong critical-thinking skills, intellectual autonomy, and social awareness as they navigate the ongoing digital transformation of education.

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Factors Influencing the Transformation of Prospective Teachers' Learning in the AI Era

Artificial Intelligence has emerged as the most influential factor shaping the learning patterns of prospective elementary school teachers in Social Studies education. The availability of platforms such as ChatGPT, Gemini, and Copilot enables prospective teachers to access information rapidly through their personal digital devices (Magrill & Magrill, 2024). Classroom observations revealed that students were more likely to consult AI applications than to seek information from textbooks or scholarly journals. One prospective teacher remarked, "AI provides answers much faster than having to read numerous references." This statement illustrates that efficiency and speed have become key considerations in students' learning behaviors. From the perspective of educational technology theory, this transformation demonstrates that technology no longer functions merely as a supplementary learning tool but has evolved into a force that shapes a new academic culture centered on instant access to information (Kaur, 2017). These findings suggest that digital transformation is fundamentally reshaping how prospective teachers acquire, construct, and engage with knowledge in Social Studies education.

Academic pressure also emerged as a significant factor driving the intensive use of AI among prospective teachers. Interview findings revealed that participants perceived their academic workload as increasingly demanding and that they had limited time to complete tasks. As a result, they tended to adopt strategies considered the most practical and efficient for completing academic assignments. One prospective teacher, Siska Nazia, explained, "When assignments accumulate and deadlines are approaching, AI helps me complete my work more quickly." Classroom observations further indicated that AI usage increased noticeably during periods leading up to assignment submissions and semester examinations. This phenomenon suggests that contemporary higher education culture increasingly prioritizes academic productivity and efficiency. From the perspective of rational choice theory, individuals tend to select alternatives they perceive as the most effective means of achieving their objectives. The use of AI among prospective teachers reflects decision-making processes strongly influenced by time efficiency and desired academic outcomes.

The study also found that limited academic literacy practices contribute to the transformation of prospective teachers' learning patterns. Most participants preferred concise information to in-depth engagement with scholarly articles. One prospective teacher stated, "Reading lengthy articles often makes me lose interest, so it is easier to ask AI instead." Observations conducted in the university library revealed a decline in students' engagement with academic journals and printed literature. This trend indicates a shift from deep reading practices toward the consumption of instant information. According to cognitive learning theory, critical thinking develops through sustained processes of reading, comprehension, analysis, and reflection. When prospective teachers become increasingly accustomed to receiving immediate answers from AI, opportunities for critical analysis and intellectual reflection may diminish. These findings suggest that digital transformation not only changes learning media but also influences the cognitive patterns through which prospective teachers understand and interpret social issues within Social Studies education.

The digital social environment further reinforces these changes in learning patterns. Prospective teachers are immersed in a social media culture characterized by speed, condensed information, and short-form content consumption. Classroom observations revealed that students increasingly prefer learning through short videos, infographics, and concise explanations rather than engaging with complete academic texts. One prospective teacher, Siska Nazia, stated, "We are now more accustomed to learning quickly through digital media than spending a long time reading." This digital culture fosters a pragmatic learning orientation that prioritizes immediate outcomes and rapid access to information. Social learning theory suggests that individual behavior develops through continuous

interaction with the surrounding social environment (Thyer & Myers, 1998). In this context, the digital environment shapes learning habits that favor speed and convenience over in-depth intellectual exploration. Consequently, the transformation of prospective teachers' learning patterns is influenced not only by AI technologies but also by the broader digital culture that characterizes contemporary generations and their everyday social experiences.

The assessment strategies employed by lecturers also play a significant role in shaping students' use of AI. Observations indicated that many assignments continue to emphasize theoretical summaries and conceptual essays, tasks that can be readily completed using generative AI tools. One prospective teacher explained, "If the assignment only requires summarising theories, AI can immediately generate the answer." This finding suggests that assessment design substantially influences how students integrate technology into their academic work. Lecturers who implemented assignments based on field observations, social reflection, and local case analyses appeared more successful in reducing students' dependence on AI-generated content. From a constructivist perspective, effective learning should encourage learners to construct knowledge through authentic experiences and social reflection. When assessment practices focus primarily on reproducing information, students are more likely to delegate cognitive processes to technology rather than actively construct knowledge themselves.

Psychological factors also emerged as a significant influence on the transformation of prospective teachers' learning patterns. Several participants reported feeling more confident after using AI as a tool to support their understanding of Social Studies content. One prospective teacher, Khairul Ikhwan, stated, "AI makes me more confident in answering questions because its explanations are easy to understand." Classroom observations similarly indicated that students who had previously been passive during discussions became more willing to express their opinions after receiving assistance from AI-generated explanations. These findings suggest that AI provides a sense of academic security for prospective teachers who struggle to comprehend abstract social concepts. From the perspective of Bandura's self-efficacy theory, individuals' confidence increases when they perceive adequate support in accomplishing specific tasks (Kudo & Mori, 2015). In this context, Artificial Intelligence functions as a cognitive support system that helps prospective teachers feel more capable of meeting academic demands (Boulay, 2016). However, while AI can enhance academic confidence and facilitate learning, excessive reliance on such technologies may, over the long term, reduce students' capacity for independent thinking and autonomous problem-solving. This finding highlights the importance of balancing AI-assisted learning with opportunities that encourage critical reflection, intellectual independence, and the development of higher-order thinking skills.

The study also found that limited digital ethical literacy is a significant factor influencing prospective elementary school teachers' use of AI. Many participants demonstrated an insufficient understanding of the appropriate boundaries of AI use in academic activities. Classroom observations revealed that prospective teachers frequently adopted AI-generated responses without verifying them or critically evaluating the reliability of the information. One lecturer noted that "many prospective teachers do not yet understand the difference between technological assistance and academic dependence." This observation suggests that AI is often perceived merely as a tool for accelerating task completion rather than as a resource requiring critical engagement. From the perspective of digital literacy theory, effective technology use must be accompanied by the ability to evaluate, verify, and critically reflect upon information (Wilson et al., 2015). When digital ethical literacy remains underdeveloped, the use of AI may undermine academic integrity and weaken the quality of intellectual reflection in Social Studies learning.

Institutional factors also play an important role in shaping the transformation of prospective teachers' learning patterns. Interview findings indicated that clear academic policies governing the use of AI in teaching, learning, and assessment have not

yet been fully established. One lecturer explained that "there are still no comprehensive guidelines defining the acceptable limits of AI use in classroom activities." As a result, prospective teachers tend to use AI according to their own interpretations, often without structured academic guidance.

Changes in the social interaction patterns of prospective teachers also emerged as a significant finding of this study. Classroom observations indicated that prospective teachers increasingly engaged in individual learning through AI rather than participating in direct discussions with their peers. One participant remarked, "Once we already have an answer from AI, we usually do not spend much time discussing it." This situation reflects a decline in collaborative academic interactions that traditionally characterise meaningful learning processes. From Vygotsky's social constructivist perspective, knowledge is developed through dialogue, social interaction, and the exchange of ideas among individuals (Hausfather, 1996). As AI increasingly assumes functions that were previously fulfilled through academic dialogue, Social Studies learning risks losing the reflective social space that constitutes a fundamental element of social education (Bu, 2022). These findings suggest that AI not only transforms how prospective teachers learn but also reshapes the social relationships that underpin classroom learning processes.

The findings further reveal that changes in the learning patterns of prospective elementary school teachers in Social Studies education are influenced by technological, cultural, academic, pedagogical, psychological, and institutional factors. While Artificial Intelligence offers greater efficiency and easier access to knowledge, it simultaneously encourages tendencies toward instant learning and reduced critical reflection. One lecturer concluded that "the greatest challenge today is not prohibiting AI, but ensuring that prospective teachers continue to think critically when using it." This statement underscores that the central issue lies not in the existence of AI itself, but in how higher education institutions manage and integrate the technology through pedagogically sound, ethically responsible, and human-centred approaches. In the era of Artificial Intelligence, Social Studies education requires instructional strategies that not only adapt to technological advancements but also preserve academic literacy, critical dialogue, and social awareness as essential foundations of teacher education.

Instructional Strategies for Strengthening Academic Quality and Critical Thinking Skills

The findings indicate that lecturers have begun adapting Social Studies instructional strategies in response to the increasing use of Artificial Intelligence among prospective elementary school teachers. This shift is reflected in the transition from predominantly lecture-based instruction toward more participatory, reflective, and dialogic learning approaches. Lecturers no longer focus solely on assessing final outputs but increasingly emphasise the thinking processes demonstrated by prospective teachers throughout learning activities. Classroom observations revealed that students were more actively engaged when lecturers employed contemporary social issues and case studies rather than one-way theoretical explanations. One lecturer stated, "Prospective teachers must be trained to think before seeking answers from AI." This statement reflects a growing awareness that Social Studies education in the digital era should not only promote content mastery but also preserve prospective teachers' capacity for social reflection and critical reasoning. From the perspective of critical pedagogy, education should cultivate reflective consciousness through dialogue and engagement with authentic social problems rather than merely transmitting academic information.

Problem-Based Learning (PBL) emerged as the most frequently employed strategy for strengthening prospective teachers' critical thinking skills. Lecturers introduced social issues such as community conflicts, intolerance, poverty, and digital misinformation as analytical contexts within Social Studies instruction. Prospective teachers were not only encouraged to seek information through AI tools but were also

required to compare AI-generated responses with peer-reviewed journals and primary academic sources. One participant explained, "We were asked to verify AI-generated answers using academic journals to determine whether the information was accurate." This approach fostered students' ability to evaluate and verify information amidst the overwhelming flow of digital data. According to social constructivist theory, knowledge is developed through active processes of exploration, reflection, and validation. Classroom observations demonstrated that prospective teachers became more critical in questioning the credibility and reliability of information sources after participating in problem-based learning activities. These findings suggest that AI does not necessarily diminish the quality of learning when integrated through appropriate pedagogical strategies.

Reflective learning was also identified as a crucial strategy for reducing prospective teachers' dependence on generative AI. Lecturers required students to maintain reflective journals after completing technology-assisted Social Studies assignments. In these journals, students were asked to describe their thinking processes, justify their selection of information, and articulate their personal understanding of the learning materials. One prospective teacher remarked, "The lecturer asked us to explain what we genuinely understood ourselves, not merely what was generated by AI." This practice encouraged greater awareness of individual cognitive processes. From a metacognitive perspective, reflection constitutes a fundamental component of deep and meaningful learning. Classroom observations further revealed that prospective teachers who regularly engaged in reflective activities demonstrated stronger arguments and more coherent reasoning than those who relied primarily on instant AI-generated responses. These findings indicate that reflective learning plays a significant role in preserving intellectual independence amid the rapidly evolving digital learning culture.

Dialogic learning also emerged as an increasingly prominent approach in Social Studies instruction. Lecturers frequently employed open discussions and social debates rather than relying on one-way presentations. Prospective teachers were required to defend their arguments orally without depending on AI-assisted tools. One lecturer noted that, "Direct discussions prevent prospective teachers from relying solely on instant answers generated by technology." This approach reflects lecturers' efforts to strengthen students' reasoning abilities through academic and social interaction. According to Vygotsky's social constructivist theory, learning develops through dialogue, the exchange of ideas, and the negotiation of meaning among individuals (Shotter, 1993). Classroom observations indicated that prospective teachers became more active and confident when learning activities were conducted through dialogic engagement and authentic social issues. These findings suggest that human interaction continues to play a crucial role in the learning process, despite the growing presence of AI technologies in academic settings.

Changes in assessment practices also constituted an important finding of this study. Lecturers have gradually reduced assignments focused on reproducing theoretical content and replaced them with field observations, community interviews, and analyses of local social phenomena. One prospective teacher explained that, "We now spend more time conducting fieldwork because lecturers want to see our original thinking." This approach limits students' ability to rely entirely on AI when completing Social Studies assignments. From Kolb's experiential learning perspective, knowledge is constructed through direct experience and reflection on empirical realities. Classroom observations demonstrated that field-based learning enabled prospective teachers to develop a deeper and more contextual understanding of social issues. These findings indicate that authentic social experiences remain an indispensable source of learning that cannot be fully replaced by digital technologies.

This study also found that lecturers have begun integrating AI literacy into Social Studies instructional practices. Rather than prohibiting the use of Artificial Intelligence, lecturers emphasise the ethical use of technology, the verification of information, and the validation of academic sources. One lecturer stated that, "AI should be used as a tool to support thinking, not as a substitute for thinking." This perspective reflects the growing recognition of AI literacy as an essential competency in contemporary higher education. From the standpoint of digital literacy theory, the ability to utilise technology effectively must be accompanied by the capacity to critically evaluate, verify, and reflect upon information (Ihsan, 2026). Classroom observations revealed that prospective teachers became more cautious in using AI-generated responses after gaining a deeper understanding of the potential biases, inaccuracies and limitations of digital information. These findings suggest that strengthening AI literacy represents a crucial strategy for maintaining academic quality and fostering responsible technology use among prospective teachers in the era of Artificial Intelligence.

Collaborative learning has also been maintained as a fundamental component of Social Studies instruction. Lecturers organised discussion groups that required prospective teachers to collaboratively analyse social issues while minimising reliance on AI-generated responses. One prospective teacher noted that, "Group discussions make us think more deeply than simply asking AI for answers." Classroom observations further revealed that collaborative interactions enabled students to understand social issues from diverse perspectives. According to social constructivist theory, knowledge is constructed through interaction and the exchange of experiences among individuals (Adams, 2006). Collaborative learning encourages prospective teachers to develop their skills in argumentation, meaning negotiation, and collective social reflection (Ruys et al., 2010). These findings indicate that AI technology cannot fully replace the essential role of social interaction in the Social Studies learning process. Instead, collaborative engagement remains a critical mechanism for fostering critical thinking, perspective-taking, and deeper understanding of complex social realities.

Inquiry-based learning was also employed by lecturers to strengthen prospective teachers' social analytical skills. Students were required to formulate simple research questions, collect field data, and subsequently compare their findings with information generated by AI. One prospective teacher explained that, "We were asked to gather our own data before using AI as a point of comparison." This approach positioned AI as a supplementary tool rather than the primary source of knowledge. According to inquiry learning theory, critical thinking develops through questioning, investigation, and independent evaluation of information. Classroom observations indicated that prospective teachers became more actively engaged in social exploration when learning activities were structured through an inquiry-based approach. These findings suggest that Social Studies education can preserve its reflective and analytical character despite the rapid advancement of digital technologies. By encouraging independent investigation and evidence-based reasoning, inquiry-based learning enables prospective teachers to engage critically with both empirical data and AI-generated information, thereby fostering deeper understanding and intellectual autonomy.

Project-based social learning also emerged as an effective strategy for strengthening the academic quality of prospective elementary school teachers. Students were assigned to design and implement social education projects related to environmental issues, digital culture, and community literacy through direct engagement with local communities. One prospective teacher remarked that, "When we interact directly with the community, we gain a deeper understanding of social issues in real-life contexts." According to project-based learning theory, learning becomes more meaningful when students are actively

involved in addressing authentic problems (Mohedo & Bújez, 2014). Classroom observations indicated that prospective teachers demonstrated higher levels of motivation and engagement when learning activities were directly connected to societal realities. These findings suggest that, even in the era of Artificial Intelligence, Social Studies education should maintain a strong connection between academic theory and empirical social realities (Yao & Hu, 2025). By engaging prospective teachers in authentic social experiences, project-based learning fosters critical reflection, contextual understanding, and the practical application of knowledge, thereby reinforcing both academic competence and social responsibility.

Lecturers have increasingly adopted authentic assessment practices to maintain the academic integrity of prospective elementary school teachers. Assessment is no longer based solely on written products but also on students' ability to explain their reasoning processes and defend their arguments orally. One lecturer noted that, "We now place greater emphasis on evaluating how prospective teachers think rather than merely assessing the final product of their assignments." This approach reduces the likelihood that students will passively rely on AI-generated outputs without fully understanding the academic content. According to authentic assessment theory, educational evaluation should measure learners' actual thinking abilities and reflective competencies (Hagler, 2017). Classroom observations revealed that prospective teachers became more cautious in using AI because they were required to justify and elaborate on their arguments directly during class discussions. This strategy helps preserve critical reflection and intellectual accountability in Social Studies learning.

Participants perceived that using AI offered opportunities for critical reflection and helped them analyze arguments in Social Studies. Indicators of critical reflection included students' ability to identify key ideas, compare AI-generated information with academic sources, and respond to social issues discussed in class. Argumentative analysis was identified through providing reasons, connecting evidence to claims, and evaluating the strengths and weaknesses of an argument. These findings were interpreted based on participants' perceptions and classroom observations rather than as an objective measurement of critical thinking ability.

The findings further indicate that effective instructional strategies in the era of Artificial Intelligence must be adaptive, dialogic, and reflective. Approaches such as problem-based learning, reflective learning, collaborative learning, inquiry-based learning, project-based learning, blended learning, and authentic assessment have proven effective in enhancing the academic quality and critical-thinking skills of prospective elementary school teachers (Nawangsari et al., 2022). The promotion of AI literacy and digital ethics also emerged as an essential component in safeguarding academic integrity amid the growing influence of generative technologies. As one lecturer concluded, "AI cannot be avoided; therefore, the responsibility of education is to teach prospective teachers how to think critically while using technology." This statement highlights that the central challenge facing higher education is not resisting technological advancement but ensuring that technology enhances, rather than replaces, the intellectual capacities and social awareness of future educators. Consequently, Social Studies education in the AI era requires a pedagogical transformation that preserves its humanistic, critical, and reflective foundations while enabling prospective teachers to engage meaningfully with complex social realities.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

RR. Conceptualization, methodology, investigation, data curation, formal analysis, writing – original draft, and project administration. **A.M.** Methodology, investigation, formal analysis, validation,

and writing – review & editing. **J.T** Validation, resources, visualization, and writing – review & editing. **M.I.** Supervision, validation, resources, and writing – review & editing. All authors contributed to the interpretation of the findings, critically reviewed the manuscript, and approved the final version for publication.

CONCLUSION

The findings suggest that Artificial Intelligence and digital technologies have impacted how prospective elementary teachers engage with Social Studies education at Universitas Iskandar Muda. Participants' experiences and classroom observations reveal a preference for more rapid, technology-aided learning methods, especially for accessing, summarising, and processing academic information. While these technologies enhance access to information and may improve learning efficiency, participants' accounts and observations also highlight challenges related to critical reflection, social analysis, and academic literacy. Instructional practices such as problem-based learning, reflection, collaboration, inquiry-based learning, along with the development of digital literacy, are identified as valuable approaches for maintaining academic engagement and fostering critical thinking. These findings emphasize the importance of adaptive, human-centered pedagogy that encourages prospective teachers to use AI in a critical, ethical, and responsible manner.

This study has several limitations. It was conducted at a single institution, Universitas Iskandar Muda, and involved a small purposively selected group of two lecturers and two prospective elementary teachers. The findings also relied in part on participants' self-reported experiences, which may have been influenced by social desirability bias, while the researcher's positionality and interpretation may have shaped the analysis. The cross-sectional design does not permit firm conclusions about changes in learning patterns over time or establish the long-term effects of AI use on critical thinking. Accordingly, the findings should be interpreted within the specific context of the PGSD program studied, and transferability to other institutions should be considered only where similar educational, technological, and participant characteristics are present.

Future research should involve multiple institutions and a broader range of participants to examine how AI-supported learning practices vary across different educational contexts. Longitudinal studies and systematic assessments of learning outcomes could further investigate changes in critical thinking, academic literacy, and social analysis over time. Further qualitative research could also examine how lecturers and prospective teachers negotiate the balance between AI-assisted efficiency and meaningful academic engagement.

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