

Research Article

Drama education and artificial intelligence in sixth-grade geography lessons: An approach to cultivating critical thinking

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This study investigates the potential of combining drama education and artificial intelligence in sixth-grade geography lessons to cultivate students' critical thinking. Twelve original teaching scenarios were designed, integrating Artificial Intelligence tools with drama-based techniques, and implemented with 46 sixth-grade students in a public urban primary school. A mixed-methods approach was employed, collecting both quantitative and qualitative data. The findings indicate that the synergy between Artificial Intelligence and drama education enhanced student participation, supported multimodal understanding of geographic concepts, and promoted reflective thinking and problem-solving skills. Qualitative observations revealed increased engagement, collaboration, and expressive learning. The study highlights the pedagogical value of integrating digital technologies with creative arts, offering evidence for innovative, human-centered approaches that foster active and reflective learning in primary geography lessons.

Keywords: Artificial intelligence; Critical thinking; Drama education; Mixed-methods research; Sixth-grade geography

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1. Introduction

Cultivating critical thinking is a key objective of contemporary education, particularly in an era where access to information is immediate, yet the ability to evaluate it remains a challenge. In primary education, critical thinking development is closely linked to skills such as observation, interpretation, synthesis, evaluation, and problem-solving core components of the critically minded future citizen (Susanti, 2024). Educational policy increasingly emphasizes the importance of fostering these competencies early in schooling, a formative period for shaping cognitive habits and learning attitudes (Md, 2019). However, promoting critical thinking among young learners requires engaging, meaningful, and enjoyable learning experiences that are developmentally appropriate and responsive to children's needs (Siburian et al., 2023).

The integration of Artificial Intelligence [AI] in education offers new opportunities to support students' metacognitive and reflective abilities. AI technologies can process information and generate knowledge in ways that replicate higher-order thinking processes, essential to human learning (UNESCO, 2024). When implemented under pedagogically sound conditions, AI can effectively support critical thinking development (Hwang et al., 2020). Human-centered AI, which prioritizes human perspectives in design and implementation, ensures that technological interventions are useful, effective, and beneficial to learners (Shneiderman, 2022). Recent studies highlight AI applications in personalized learning and digital

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assessment, yet its integration with creative disciplines particularly drama education remains underexplored but highly promising for innovative, human-centered learning (Yetişensoy, 2026).

Drama education provides a space for self-expression, collaboration, and human connection (Port, 2017). Through lived experience, multisensory engagement, and collective participation, drama fosters creativity, communication, and critical thinking (Lenakakis, 2024). Drama-based interventions encourage students to visualize, symbolize, and act within a safe environment, strengthening their ability to reason, evaluate, and collaborate (Munk et al., 2024). When combined with AI, drama education can create interactive, multimodal learning experiences that promote reflective thinking and problem-solving.

This study explores the potential of integrating drama education and AI in sixth-grade geography lessons to cultivate students' critical thinking. Twelve original teaching scenarios were implemented, combining AI tools with drama-based techniques. Using a mixed-methods approach, the research investigates how these innovative strategies support the development of critical thinking, drawing on both quantitative and qualitative evidence.

2. Literature Review

2.1. Artificial Intelligence in Education

AI applications have increasingly been employed to support students in analyzing arguments, formulating hypotheses, and engaging in self-directed inquiry across multiple disciplines. These tools not only facilitate access to vast amounts of information but also enable learners to process, evaluate, and synthesize knowledge in ways that mirror higher-order cognitive functions (Zhou & Peng, 2025). Jun et al. (2024) propose a model for enhancing learners' critical thinking through AI, emphasizing the alignment of AI's analytical capabilities with learners' specific needs to scaffold structured problem-solving and reflective thinking. Similarly, Hong and Guo (2024), in a study involving 1,050 first-year English majors across four colleges, found that the integration of generative AI tools into writing instruction resulted in measurable improvements in students' abilities to evaluate evidence, construct coherent arguments, and engage in reflective assessment. Oates and Johnson (2025) further demonstrated that ChatGPT can serve as an effective tool for fostering critical evaluation, showing that when students are asked to assess the quality, coherence, and reliability of AI-generated content, they enhance their abilities in argumentation, interpretation, and decision-making, which are fundamental components of critical thinking. Acuyo Cespedes (2025) further reports that faculty view generative AI as pedagogically beneficial for enhancing teaching and learning when it is positioned as a complementary tool that anchors instructional reflection and supports meaningful engagement rather than supplanting human reasoning.

In the context of sixth-grade Geography lessons, AI technologies such as ChatGPT have shown significant potential for supporting students' cognitive and socio-emotional development when exploring contemporary environmental challenges. Chang and Kidman (2023) report that ChatGPT can assist learners in examining complex local and global issues, fostering analytical reasoning and informed decision-making. Similarly, Stampfl et al. (2024) integrated ChatGPT into drama-based role-playing activities, demonstrating improvements in participants' critical thinking, reflective dialogue, and problem-solving skills. These studies highlight the potential of AI to provide dynamic, interactive, and personalized learning experiences. However, the promise of AI is accompanied by potential risks.

Nevertheless, AI's promise is accompanied by risks. Over-reliance on AI can lead to superficial learning or academic dishonesty, while unequal access may exacerbate existing educational inequalities. Ayala-Pazmiño (2023) emphasizes the importance of nurturing human capabilities alongside technological literacy, ensuring that AI complements rather than replaces human creativity and critical reasoning. Stuchlikova and Weis (2024) caution that excessive reliance on AI may result in superficial learning if students are not guided to critically question and interpret AI-generated content. Therefore, pedagogical frameworks must ensure that students remain active, critically engaged participants when interacting with AI, combining technological affordances with guided inquiry and reflective practices (Yetişensoy, 2026). Furthermore, research underscores that digital technologies yield meaningful educational outcomes only when integrated within structured pedagogical designs that promote active engagement and higher-order thinking rather than passive consumption (Pratiwi et al., 2025). Moreover, AI can be leveraged to create multimodal learning environments where students interact with visual, textual, and simulation-based content, enhancing both engagement and conceptual understanding (Kotsidis & Anastasiades, 2025).

2.2. Drama Education

Drama education provides an experiential and collaborative learning environment that fosters self-expression, creativity, and reflective engagement (Alam et al., 2024). As a multidimensional pedagogical practice, it merges creative expression with experiential and embodied modes of learning, engaging students cognitively, emotionally, and physically. This holistic engagement cultivates not only artistic sensibilities but also essential life skills, intercultural awareness, and dispositions for critical reflection (Kondoyianni et al., 2013). Within the classroom, drama operates as a microcosm of social interaction, offering students a safe space to rehearse ways of thinking, feeling, and acting in relation to others, while also reflecting shared cultural and performative conventions that support individual and community development (Kondoyianni et al., 2013; Lenakakis et al., 2018).

Through role-playing, improvisation, and performative activities, learners develop a deeper understanding of complex phenomena, improve memory retention, and strengthen problem-solving, analytical, and metacognitive skills (Jjarrah, 2019; Zhao et al., 2020). Empirical evidence demonstrates that improvisational dialogue and role-play exercises enhance evaluative and reflective capacities (Astuti et al., 2022), while drama-based activities simultaneously nurture artistic sensibilities and critical thinking (Cody, 2013). Furthermore, studies by Nurhasanah (2022) and Pekdoğan and Korkmaz (2016) indicate that drama practices promote analytical reasoning, collaborative problem-solving, and the ability to synthesize and generalize knowledge across contexts.

Drama education encourages students to experiment with ideas and navigate moral dilemmas in a supportive environment, enabling them to visualize, symbolize, and act on complex concepts. Techniques inspired by Boal's Theatre of the Oppressed, forum theatre, and social drama help learners explore multiple perspectives, critically assess social and environmental issues, and engage with both cognitive and affective dimensions of learning (Kaptani et al., 2024).

When integrated with AI tools, drama education is further enhanced by dynamic, interactive, and personalized learning experiences. AI-driven applications, including scenario generators, text-based platforms, and visual simulations, complement embodied learning by offering students the opportunity to engage in exploratory problem-solving, metacognitive reflection, and informed decision-making (Habib et al., 2024). The combination of AI and drama allows learners to critically analyze information, evaluate perspectives, and develop structured reasoning skills while maintaining active, collaborative engagement in creative tasks (Ma et al., 2025).

This integrative approach transforms learning into a rich, multimodal process that supports cognitive, emotional, and social development. By bridging AI technologies with experiential drama strategies, educators can cultivate students' autonomy, empathy, and higher-order thinking capacities, demonstrating the potential of innovative, human-centered pedagogies that combine technology with the arts to foster reflective and critically aware learners (Gerlich, 2025).

2.3. Integrating AI and Drama Education to Develop Critical Thinking in Sixth-Grade Geography Lessons

Critical thinking is a foundational skill for autonomy, navigating complex contemporary issues, and participating consciously in democratic processes (Baron, 2024). Modern perspectives conceptualize critical thinking as a practical and transferable cognitive skill, encompassing problem analysis, evidence evaluation, decision-making, and reflective judgment (Saiz & Rivas, 2023; UNESCO-UNEVOC, 2024). Critically minded students extend these abilities beyond the classroom, applying reasoning and evaluative skills to everyday life, collaborative problem-solving, and civic engagement (Conwright, 2023; Fisher, 2019).

Sixth-grade Geography lessons play a central role in fostering these competencies, as students examine both physical and human systems, understand interconnections between natural and social environments, and develop responsibility toward sustainable practices. By integrating AI and drama into Geography lessons, educators can create highly interactive, multimodal learning environments. Generative AI models provide personalized engagement with spatial, cultural, and environmental issues, enabling students to investigate real-world challenges, simulate scenarios, and receive adaptive feedback. Drama-based activities, including role-play, improvisation, and Boal-inspired techniques, activate collaboration, creative problem-solving, and critical interpretation of information, thereby strengthening reflective and analytical thinking (Chang & Kidman, 2023; Ma et al., 2025).

In sixth-grade classrooms, blended models combining AI tools, data analysis, and drama activities can focus on topics such as sustainable development, local identity, and environmental stewardship. By engaging with AI-driven digital characters and participating in embodied learning experiences, students encounter multiple perspectives, develop metacognitive strategies, and cultivate reflective reasoning.

Experimental implementations of these interdisciplinary approaches have demonstrated measurable improvements in critical thinking, argumentation, problem-solving, and information management skills, highlighting the pedagogical value of combining technology with creative, experiential learning (Anderson, 2023; Ma et al., 2025). Moreover, integrating AI and drama promotes student agency, encouraging learners to take initiative, negotiate meaning collaboratively, and develop socially responsible and critically engaged identities within the classroom and broader society.

3. Method

3.1. Research Design

This study investigated the impact of integrating artificial intelligence tools and drama-based pedagogy on the development of critical thinking skills among 11-year-old students during the 6th-grade Geography course. The central research question guiding the study was: To what extent and in what ways can an educational intervention program, based on the integration of AI tools and drama techniques, enhance the critical thinking skills of 6th-grade students in Geography?

A mixed-methods research design (Creswell & Creswell, 2018; Creswell & Plano Clark, 2011) was employed, combining quantitative and qualitative approaches to capture both measurable learning outcomes and rich contextual insights. Specifically, a quasi-experimental design with pre- and post-testing was used to assess the intervention's effectiveness, complemented by qualitative data derived from classroom observation, reflective diaries, focus group discussions, and interviews.

The study unfolded in three sequential phases. In the first phase, a validated questionnaire assessing critical thinking skills was administered as a pre-test. In the second phase, twelve instructional sessions incorporating AI-based tools and drama pedagogy were implemented over two months. In the third phase, the same instrument was re-administered as a post-test, allowing for comparative analysis of potential changes in students' critical thinking skills. The research unfolded in three phases. In the first phase, the validated questionnaire was administered to the full sample as a pre-test. During the second phase, the twelve instructional scenarios were implemented across a two-month period as part of the regular Geography curriculum. These scenarios integrated AI-based tools and drama pedagogy, seeking to foster students' capacity for analysis, evaluation, and creative problem-solving. In the third phase, the same questionnaire was re-administered as a post-test to both groups, enabling comparison of potential changes in critical thinking skills. The study concluded with the analysis and dissemination of the results, which synthesised both the quantitative and qualitative strands of evidence.

3.2. Educational Intervention

The educational intervention was designed around selected units (15-23, 27, 30, and 32) of the official 6th-grade Geography textbook, aligning with the national curriculum objectives. The sessions were grounded in drama pedagogy principles and leveraged AI-based learning technologies, including Character.AI, ChatGPT, HeyGen.AI, and MagicSchool.AI, to foster active participation, collaborative problem-solving, and embodied learning.

Each 50-minute session followed a consistent structure. It began with activation exercises that promoted bodily awareness, collaboration, and creative expression, followed by narrative storytelling related to the lesson content. These narratives incorporated ethical dilemmas, misinformation scenarios, and problem-solving challenges, prompting students to evaluate evidence and construct meaning critically. Each session concluded with reflective discussions, enabling students to articulate insights and consolidate learning outcomes.

3.3. Participants

Participants were recruited through convenience sampling from a public primary school in the Attica region that was accessible to the researchers. Permissions were obtained from the school administration and the relevant educational authorities prior to data collection.

The final sample comprised 46 students in the 6th grade, divided into two intact classes: the control group ($n = 22$, Class 6.1) and the experimental group ($n = 24$, Class 6.2). Both groups followed the same Geography curriculum, but only the experimental group participated in the intervention integrating AI tools and drama-based learning activities.

3.4. Data Collection

3.4.1. Quantitative instruments

Quantitative data were collected using a revalidated version of the Dima et al. (2021) questionnaire, designed to assess critical thinking across five domains: observation, induction, reliability assessment, abstraction, and problem solving. The instrument contained 24 multiple-choice items (A/B/C/D format), with one correct answer per item. Its theoretical foundations were grounded in the critical thinking frameworks of Ennis (1993) and Starkey (2010).

3.4.2. Qualitative Instruments

To capture students' engagement and reflective processes, qualitative data were obtained through multiple tools: participant observation, focus group interviews, storytelling activities, hot-seating exercises, the "critical friend" technique, and a researcher diary. Furthermore, the AI-driven platform Character.AI was used as a dialogic tool to stimulate inquiry and perspective-taking during the intervention.

3.4. Data Analysis

Quantitative data were analyzed using pre-test and post-test comparisons to measure changes in students' critical thinking skills between the control and experimental groups. Statistical tests appropriate for quasi-experimental designs (e.g., paired-samples and independent-samples analyses) were applied to determine the significance of differences observed.

Qualitative data from observations, interviews, and reflective diaries were analyzed through thematic analysis, following the procedures outlined by Clarke and Braun (2017). Coding focused on identifying patterns of engagement, reflective depth, and instances of critical thinking in students' interactions and discourse. The integration of quantitative and qualitative findings provided a comprehensive understanding of both outcomes and processes.

3.5. Ethical Procedures

The study adhered to the ethical standards for educational research. Informed consent was obtained from school authorities, parents, and students. Participants were informed of their right to withdraw at any time without penalty. Data confidentiality and anonymity were maintained throughout the study, and all digital materials produced through AI platforms were used in compliance with data protection regulations. The intervention was designed to ensure psychological safety and promote respectful, inclusive classroom interactions.

4. Findings

4.1 Quantitative Findings

This section presents the quantitative findings of the study, focusing on the comparison of pre- and post-test results between the experimental and control groups. The quantitative data were first processed, coded, and analyzed using statistical methods in Jamovi (version 2.6.44) and the R programming language (Ihaka & Gentleman, 1996). Given the relatively small sample size ($n < 50$), the Shapiro-Wilk test was applied to assess the normality of the data. Results indicated that the dataset did not follow a normal distribution ($p < .05$). Therefore, the non-parametric Mann-Whitney U test was selected as the appropriate method to compare pre- and post-test scores between the two groups.

The pre-test results revealed no statistically significant differences between the control and experimental groups, confirming that the two groups were comparable before the implementation of the intervention. Specifically, the Mann-Whitney U test indicated no significant difference between the control group ($n = 22$, $M = 11.682$, $SD = 1.887$) and the experimental group ($n = 24$, $M = 12.625$, $SD = 2.901$), with $U = 192$, $p = .052 > .05$ and small effect size $r = 0.273$ (see Table 1). This confirms the baseline equivalence of the groups in terms of overall critical thinking performance.

Table 1

Results of the Mann-Whitney U tests for both groups based on overall performance in the pre-tests and post-tests

	Control Group		Experimental Group		U	p	r
	M	SD	M	SD			
Pre-tests	11.682	1.887	12.625	2.901	192	.052	.273
Post-tests	10.636	4.846	13.208	2.484	168	.017	.364

Following the intervention, the post-test results demonstrated clear differences between the two groups. The control group's scores tended to decrease, while the experimental group exhibited an upward trend, showing both a higher median and reduced variability. The Mann-Whitney U test confirmed a statistically significant improvement in the experimental group ($n = 24$, $M = 13.208$, $SD = 2.484$) compared to the control group ($n = 22$, $M = 10.636$, $SD = 4.846$), with $U = 168$, $p = .017 < .05$ and medium effect size $r = 0.364$. These results suggest that the integration of AI tools with drama pedagogy positively influenced the development of students' critical thinking.

Overall, the quantitative analysis demonstrates that while the control group's performance showed a slight decline, the experimental group benefited from the intervention, reflecting measurable gains in critical thinking. These results highlight the effectiveness of the designed instructional program, which combined AI technologies and drama-based pedagogical strategies, in fostering higher-order cognitive skills among sixth-grade students.

4.2. Qualitative Findings

The qualitative findings were analysed through a Thematic Analysis process, following the six-phase framework outlined by Clarke and Braun (2017). This procedure involved systematic familiarisation with the data, generation of initial codes, identification and refinement of recurring patterns, definition of coherent themes, and final interpretation. Data sources included classroom observations, students' reflective diaries, focus group discussions, and the researchers' field notes documented in the research diary. The critical thinking skills investigated had been predetermined and included observation, induction, problem-solving, abstraction, and verification of reliability. Through an iterative process of triangulation across these data sets, the analysis revealed overarching patterns corresponding to each skill. Within each of these skills, thematic analysis further identified subthemes that provided a deeper understanding of how students' critical thinking skills were developed and enhanced through the integrated use of AI tools and drama-based pedagogy.

Students' observation skills developed as they learned to attend to detail, interpret symbols, and move from passive to active noticing. During both AI-based tasks and embodied drama exercises, they displayed increasing attentiveness to subtle cues and relationships within visual, verbal, and performative materials. For instance, one student remarked, "I didn't realise how the river shape could show how people live nearby" (P4M), demonstrating growing precision in noticing spatial and social correlations. Another student observed, "The colour on the map tells more than just where things are" (P3F), suggesting the emergence of symbolic interpretation beyond surface-level observation. Through drama activities, this observational capacity extended into the realm of embodiment and imagination: "When I act it out, I see what I didn't see before" (P7M). The data indicated that observation evolved from mere visual attention into interpretive awareness that integrated sensory, emotional, and analytical perception a foundational step in the cultivation of critical thinking.

The identification of misinformation emerged as a central dimension of students' engagement with both AI-generated and human-mediated content. As students encountered digital outputs during collaborative exploration, they began to verify information, recognise bias, and engage in collaborative checking. Several participants demonstrated epistemic vigilance, as illustrated by the comment, "I need to check if the AI is telling the truth or just guessing" (P5F). Others revealed awareness of systemic bias within digital sources, such as "The AI keeps showing cities, but what about the villages?" (P2M). These insights were often accompanied by collective verification processes in which students compared information, cross-referenced data, and discussed reliability: "Let's look it up together; maybe both are half right" (P6F). Across sessions, students displayed increasing confidence in questioning authority and testing information validity. The identification of misinformation thus functioned as both a cognitive and social process, enabling students to exercise critical evaluation and collaborative reasoning in digital and dialogic contexts alike.

Students' problem-solving abilities developed in parallel with their capacity for perspective-taking, creative re-design, and evidence-based reasoning. Within the drama-based scenarios, they learned to acknowledge multiple perspectives and to generate alternative solutions through imaginative exploration. For example, one student reflected, "Maybe the people in the story have different needs, not just one side being right" (P9M), revealing an awareness of complexity and ethical plurality. Through improvisation, they proposed and tested new possibilities: "Let's imagine another ending where they share the land differently" (P6F). Meanwhile, AI-supported tasks encouraged them to justify their decisions based on data and prior knowledge: "We should see if this fits with what we already know before deciding" (P1M). Over time, problem-solving became a collaborative and reflective act, combining analytical reasoning with empathy

and imagination. This synthesis of logical and affective intelligence allowed students to navigate uncertainty and to construct well-grounded, context-sensitive solutions a key indicator of higher-order critical thinking.

The reasoning from the general to the specific was manifested in students' ability to apply abstract ideas to concrete situations, translating theoretical understanding into lived and embodied experience. As they engaged in group discussions and role-play, they began to demonstrate the capacity to operationalise general rules, adapt them to particular contexts, and connect them to their personal environment. One student stated, "If pollution affects all rivers, then this small one here will suffer too" (P8M), illustrating the transfer of general environmental principles to a specific local example. Others refined these generalisations through contextual reasoning, as expressed by, "Not every forest fire spreads the same way it depends on what's around" (P5M). The experiential nature of drama allowed students to anchor abstract knowledge in tangible experience, such as when one student reflected, "I saw this happen near our town when people cut too many trees" (P3F). These insights indicated an integration of scientific, ethical, and personal reasoning, highlighting the importance of embodied understanding in cognitive transfer.

Conversely, reasoning from the specific to the general captured students' ability to abstract from individual or local experiences to broader principles and frameworks of understanding. The data revealed a progression from isolated reflection to pattern recognition and generalisation. Students articulated connections between distinct cases: "What happened here could happen in other places too" (P4F), illustrating inductive reasoning grounded in comparative analysis. Others moved toward generalisation of human behaviour and social patterns: "I think people everywhere act like this when they feel left out" (P9M). As they integrated personal experiences into broader conceptual structures, their reflections demonstrated an emerging metacognitive awareness: "If we consider what happens in our neighbourhood, this solution might work differently elsewhere" (P2F). Through these processes, students engaged in reflective integration that linked emotion, experience, and reasoning, allowing them to formulate general conclusions based on lived understanding.

Across all sessions, the triangulation of data from classroom observation, reflective diaries, and focus group discussions consistently confirmed the dynamic interplay of these cognitive, emotional, and embodied processes. The integration of AI tools with drama pedagogy fostered an inclusive and dialogic learning environment that nurtured not only cognitive precision but also creativity, empathy, and collaborative meaning-making. Students learned to analyse information critically, to interpret symbols and narratives, to question assumptions, and to construct and deconstruct arguments through sustained reflection and interaction. The qualitative findings thus provide rich evidence that the synergy of AI and drama-based learning significantly enhanced sixth-grade students' critical thinking, enabling them to move fluidly between observation and abstraction, between personal insight and general principle, and between individual reflection and collective understanding.

5. Discussion

This study examined the dynamic interplay between AI and drama education in 6th-grade Geography education, aiming to enhance students' critical thinking skills. The findings demonstrate that an interdisciplinary and multimodal approach combining the affordances of digital technologies with experiential learning through drama education significantly fosters student engagement, active participation, and the development of higher-order thinking skills. Through the implementation of this educational program, students were positioned as active co-constructors of knowledge rather than passive recipients, strengthening their abilities to observe, interpret, evaluate, and argue core components of critical thinking. Both quantitative and qualitative data indicated measurable improvements in critical thinking in the experimental group, while the control group exhibited relatively stagnant performance, underscoring the effectiveness of the integrative approach.

The qualitative analysis revealed that students engaged in complex reasoning processes during the intervention. They demonstrated increased curiosity, reflective thinking, and collaborative problem-solving, as illustrated by statements such as "I discovered something!" and "Let's investigate it." These expressions reflect the activation of evaluative and metacognitive skills. Students' exposure to multiple sources of information including AI-generated content and role-playing scenarios supported their ability to critically assess and verify knowledge. Moreover, the integration of personal experiences into class discussions fostered empathy, perspective-taking, and nuanced understanding of character motivations, further enhancing their capacity for reflective judgment. These qualitative findings provide rich evidence that the combination of AI tools and drama education encourages embodied, collaborative, and critical engagement, reinforcing the quantitative outcomes.

The results align with emerging international research highlighting that AI can foster analytical and reflective skills when applied within human-centered pedagogical frameworks. Oates and Johnson (2025) demonstrated that using ChatGPT as a dialogic partner enhances students' argumentation and reasoning skills through iterative questioning and critical comparison of AI outputs. Similarly, Chang and Kidman (2023) found that generative AI in Geography classrooms stimulates cognitive flexibility and socio-emotional development, particularly when learners engage in reflective verification of AI-generated information. A recent systematic review by Chara-De lo Rios et al. (2025) emphasized that AI-based learning environments foster critical thinking only when instructional scaffolding is present to support learner autonomy and metacognitive regulation. Similarly, reflective engagement with AI tools has been identified as critical for promoting higher-order cognitive skills in educational contexts. Ajani et al. (2025) reported that leveraging artificial intelligence to enhance teaching and learning in higher education can significantly promote critical engagement and reasoning when AI use is embedded within pedagogically grounded frameworks that foreground active learner reflection and scaffolded interaction.

However, recent studies also caution against excessive cognitive offloading that is, students' over-reliance on AI-generated information without sufficient critical evaluation. Gerlich (2025) reported that frequent use of AI tools correlates negatively with critical thinking skills unless teachers intervene to stimulate reflection. Likewise, Jose et al. (2025) found that unguided interaction with AI may weaken cognitive engagement, whereas structured, inquiry-based interaction enhances it. The present study successfully avoided such pitfalls by situating AI as a co-learner and critical interlocutor within drama-based inquiry, rather than as an authoritative source of truth. This perspective is consistent with findings reported by Pratiwi et al. (2025), which emphasize that digital technologies must be embedded within structured pedagogical frameworks to prevent superficial engagement and to promote higher-order cognitive processes.

The findings also expand on previous work linking drama education to the cultivation of critical and metacognitive skills. Drama-based techniques such as hot-seating, narrative storytelling, conscience alley, and improvised dialogues enabled students to visualize complex situations, adopt alternative perspectives, and construct reasoned arguments. This supports prior research by Lenakakis (2024) and Astuti et al. (2022), who highlighted that drama education strengthens analytical reasoning, empathy, and collaborative problem-solving. Furthermore, Hu and Shu (2025) provides empirical evidence that group-based dramatic inquiry promotes the co-construction of knowledge and enhances students' critical awareness of social and environmental issues. These results align with Stampfl et al. (2024), who argue that embodied learning through drama amplifies metacognitive engagement, particularly when combined with digital storytelling and AI-assisted prompts.

In this study, AI-generated content served as both a stimulus and a challenge for students' reasoning. Through dramatized interactions, learners questioned, verified, and reconstructed AI narratives. This process cultivated skepticism, analytical reasoning, and reflective judgment core facets of critical thinking as defined by Facione (2020). The embodiment of ideas through role-play not only deepened cognitive engagement but also facilitated socio-emotional learning, as students learned to empathize with characters and to assess multiple viewpoints. These findings resonate with Hu and Wang (2025), who demonstrated that AI-driven simulations enhance critical reflection only when learners are encouraged to discuss and reinterpret information collaboratively.

Importantly, this study emphasizes the significance of human-centered AI design in education. As Shneiderman (2022) argues, AI should augment rather than replace human creativity and ethical reasoning. In this program, teachers acted as mediators guiding students through AI interactions, ensuring that technology supported not dominated the learning process. This approach aligns with Yetişensoy (2026), who advocates for pedagogical models where AI serves as a cognitive partner embedded in social learning contexts. By positioning students as active participants who interact with AI-driven characters, analyze information, and engage in dramatized problem-solving, the intervention fostered autonomy, critical reflection, and socially responsible decision-making (Dere & Doğan, 2025).

While the study demonstrates promising results, it also acknowledges limitations. The intervention was implemented within a specific subject (Geography) and age group, and the duration was relatively short. Longitudinal research is needed to examine whether improvements in critical thinking are sustained over time. Moreover, the approach requires adequate technological infrastructure and teacher training, as educators must be able to design and facilitate multimodal, AI-supported drama learning environments.

In conclusion, the integration of AI tools and drama education offers a powerful framework for developing critical thinking in primary education. By providing multimodal, interactive, and reflective

learning experiences, this approach equips students with essential skills for reasoning, problem-solving, and evaluating complex information in both academic and real-world contexts. The present study not only confirms the value of integrative educational interventions but also expands the theoretical understanding of how technology and drama education can synergistically enhance cognitive, metacognitive, and socio-emotional development in young learners. As AI continues to shape educational landscapes, fostering human-centered, ethically aware, and creatively embodied pedagogies will be essential for cultivating the next generation of critical thinkers.

6. Conclusion

In this study, both quantitative and qualitative results provided clear evidence addressing the research question. The critical thinking skills of students in the experimental group were significantly enhanced, whereas the control group showed little or no improvement. These findings suggest that a multimodal educational approach, which combines the affordances of AI applications with experiential learning through drama education, contributes substantially to students' active engagement in the learning process and the gradual development of higher-order thinking skills, confirming and extending previous research (Jafari, 2024; Stampfl et al., 2024). The integration of AI tools and drama education activates higher-order cognitive processes, encourages creative thinking, and promotes reflective and evaluative capacities throughout the educational experience. By engaging students in embodied, collaborative, and interactive learning experiences, this approach fosters not only analytical reasoning but also social-emotional and metacognitive growth, preparing students for complex problem-solving tasks both within and beyond the classroom. Overall, the study highlights the educational potential of combining innovative technology with human-centered drama education to cultivate critical, reflective, and autonomous learners.

Despite the promising outcomes, several limitations should be acknowledged. First, the sample size was relatively small ($N = 46$) and drawn from a single primary school in the Attica region, which may limit the generalizability of the findings. Second, the intervention spanned twelve sessions across two months, which may not fully capture the long-term impact of the approach on the development of critical thinking skills. Furthermore, while efforts were made to ensure objectivity in qualitative analysis, the presence of researchers as facilitators may have influenced student responses, particularly during reflective and dramatized activities.

Nevertheless, the study provides strong evidence supporting the pedagogical value of integrating AI tools with drama education to enhance critical thinking in primary education. The findings suggest that interdisciplinary, multimodal learning environments can foster cognitive engagement, encourage problem-solving, and promote deeper conceptual understanding, particularly in subjects such as Geography, where complex environmental and social issues require interpretation and ethical reflection. Additionally, the study contributes to the emerging discourse on human-centered AI in education, emphasizing the importance of designing technological interventions that complement, rather than replace, active learning and teacher facilitation (Anastasiades et al., 2024).

Future research should consider longitudinal designs with larger and more diverse samples, including multiple schools and varied socio-cultural contexts, to investigate the sustainability and transferability of these outcomes. It is also recommended to examine the role of specific AI tools, such as ChatGPT and Character AI, in supporting different dimensions of critical thinking, and to explore how professional development in both AI literacy and drama education can enhance fidelity of implementation. Finally, educational policymakers are encouraged to integrate creative, technology-enhanced pedagogical approaches into curricula to cultivate critically thinking, reflective, and emotionally intelligent citizens capable of navigating complex contemporary challenges.

AI usage: The authors used AI assistance for grammar checking.

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References

- Acuyo Cespedes, A. (2025). Pedagogical shifts in the age of GenAI: Faculty perspectives from a higher education context. *Journal of Pedagogical Sociology and Psychology*, 7(3), 35-48. <https://doi.org/10.33902/jpsp.202537244>
- Ajani, O. A., Gamede, B., & Matiyenga, T. C. (2025). Leveraging artificial intelligence to enhance teaching and learning in higher education: Promoting quality education and critical engagement. *Journal of Pedagogical Sociology and Psychology*, 7(1), 54-69. <https://doi.org/10.33902/jpsp.202528400>
- Alam, S., Madej, M., Warda, W. U., & Kobylarek, A. (2024). Utilizing process drama in education: A study of pedagogical perceptions. *XLinguae*, 17(2), 132-149. <https://doi.org/10.18355/XL.2024.17.02.09>
- Anastasiades, P., Kotsidis, K., Stratikopoulos, K., & Pananakakis, N. (2024). Human-centered artificial intelligence in education: The critical role of the educational community and the necessity of building a holistic pedagogical framework for the use of HCAI in the education sector. *Open Education – The Journal for Open and Distance Education and Educational Technology*, 20(1), 29-51. <https://doi.org/10.12681/jode.36612>
- Anderson, J. (2023, February 9). Educating in a world of artificial intelligence. *Harvard EdCast*. <https://www.gse.harvard.edu/ideas/edcast/23/02/educating-world-artificial-intelligence>.
- Astuti, W., Risnawati, M. P. & Anita, M. H. (2022). Promoting students' critical thinking skill by using role-play strategy. *Journal Pendidikan Tematik*, 3(3), 153-169. <https://www.siducat.org/index.php/jpt/article/view/652>.
- Ayala-Pazmiño, M. F. (2023). Artificial intelligence in education: Exploring the potential benefits and risks. *593 Digital Publisher CEIT*, 8(3), 892-899 <https://doi.org/10.33386/593dp.2023.3.1827>
- Baron, J. (2024). *Thinking and deciding* (5th Ed.). Cambridge University Press.
- Chang, C. H., & Kidman, G. (2023). The rise of generative artificial intelligence (AI) language models - challenges and opportunities for geographical and environmental education. *International Research in Geographical and Environmental Education*, 32(2), 85-89. <https://doi.org/10.1080/10382046.2023.2194036>
- Chara-De lo Rios, T., Solis-Trujillo, B., Perez-Ruiz, J., & Aquije-Mansilla, M. (2025). Systematic review of critical thinking using artificial intelligence. *Edelweiss Applied Science and Technology*, 9(3), 990-1001. <https://doi.org/10.55214/25768484.v9i3.5405>
- Clarke, V., & Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology*, 12(3), 297-298. <https://doi.org/10.1080/17439760.2016.1262613>
- Cody, T. L. (2013). *Drama education in New Zealand schools: The practice of six experienced drama teacher*. University of Canterbury.
- Conwright, A. (2023). Educating for democracy. *Learning for Justice*, 5, 44-47.
- Creswell, J.W., & Plano Clark, V.L. (2011). *Designing and conducting mixed methods research*. Sage.
- Creswell, J.W., & Creswell, J.D. (2018). *Research design: Qualitative, quantitative and mixed methods approaches*. Sage.
- Dere, Z., & Doğan, N. D. (2025). Teachers' artificial intelligence use and flexible thinking skills: Evidence from a predictive correlational study. *Journal of Pedagogical Research*, 9(4), 259-280. <https://doi.org/10.33902/JPR.202538236>
- Dima, A., Kaiafa, E. & Tsiaras, A. (2021). Drama education through storytelling strategy develops students' critical thinking skills. In E. Board (Eds.), *3rd International Conference on Advanced Research in Education* (pp. 248-260). Diamond Scientific Publishing. <https://doi.org/10.33422/3rd.educationconf.2021.03.223>
- Ennis, R. H. (1993). Critical thinking assessment. *Theory into Practice*, 32(3), 179-186. <https://doi.org/10.1080/00405849309543594>
- Facione, P. A. (2020). *Critical thinking: What it is and why it counts*. Insight Assessment.
- Fisher, A. (2019). What critical thinking is. In J. A. Blair (Ed.), *Studies in Critical Thinking* (2nd Ed., pp. 7-26). Windsor Studies in Argumentation.
- Gerlich, M. (2025). AI tools in society: Impacts on cognitive offloading and the future of critical thinking. *Societies*, 15(1), 6. <https://doi.org/10.3390/soc15010006>
- Habib, S., Vogel, T., Anli, X., & Thorne, E. (2024). How does generative artificial intelligence impact student creativity? *Journal of Creativity*, 34(1), 100072. <https://doi.org/10.1016/j.yjoc.2023.100072>

- Hong, H., & Guo, J. (2024). Cultivation of critical thinking skills: Exploring the impact of generative artificial intelligence-enabled instruction in English essay writing. *Journal of Contemporary Educational Research*, 8(8), 8. <https://doi.org/10.26689/jcer.v8i8.7999>
- Hu, Y., & Shu, J. (2025). The effect of drama education on enhancing critical thinking through collaboration and communication. *Education Sciences*, 15(5), 565. <https://doi.org/10.3390/educsci15050565>
- Hu, D., & Wang, Y. (2025). Generative AI as a tool for enhancing reflective learning in students. *AI and Society*, 40(2), 765-780.
- Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, 1, 100001. <https://doi.org/10.1016/j.caeai.2020.100001>.
- Ihaka, R., & Gentleman, R. (1996). R: A language for data analysis and graphics. *Journal of Computational and Graphical Statistics*, 5(3), 299-314. <https://doi.org/10.1080/10618600.1996.10474713>
- Jafari, E. (2024). Artificial intelligence and learning environment: Human considerations. *Journal of Computer Assisted Learning*, 40(5), 2135-2149. <https://doi.org/10.1111/jcal.13011>
- Jjarrah, H. Y. (2019). The impact of using drama in education on life skills and reflective thinking. *International Journal of Emerging Technologies in Learning*, 14(9), 4-19. <https://doi.org/10.3991/ijet.v14i09.7978>
- Jose, B., Cherian, J., Verghis, A.M., Varghise, S. M., & Joseph, S. (2025) The cognitive paradox of AI in education: Between enhancement and erosion. *Frontiers in Psychology*, 16, 1550621. <https://doi.org/10.3389/fpsyg.2025.1550621>
- Jun, H., Wenhao, Y., Ali, N., & Khan, A. B. (2024). The model of improving college students' critical thinking ability based on artificial intelligence. *International Journal of Academic Research in Business and Social Sciences*, 14(6), 478-492. <https://doi.org/10.6007/IJARBS/v14-i6/21686>.
- Kaptani, E., Ismail, S., Rifkin, F., & O'Neill, M. (2024). Forum theatre practice as lived activism. *Critical Social Policy*, 44(2), 325-339. <https://doi.org/10.1177/02610183231223950>
- Kondoyianni, A., Lenakakis, A. & Tsiotsos, N. (2013). Intercultural and lifelong learning based on educational drama. Propositions for multidimensional research projects. *Scenario*, 2, 27-47. <https://doi.org/10.33178/scenario.7.2.3>
- Kotsidis, K., & Anastasiades, P. (2025). E-learning open seminar on "Human-centered artificial intelligence in education: From theory to practice". *International Journal of Educational Technology and Learning*, 18(1), 35-40. <https://doi.org/10.55217/101.v18i1.901>
- Lenakakis, A. (Ed.). (2024). *Arts, the internet, and creativity: Educational approaches and applications*. School of Early Childhood Education, Aristotle University of Thessaloniki. <https://doi.org/10.12681/sece-auth.209>
- Lenakakis, A., Howard, J. L., & Felekidou, K. (2018). Play and inclusive education: Greek teachers' attitudes. *European Journal of Special Education Research*, 3(3), 129-163. <https://doi.org/10.5281/zenodo.1243040>
- Ma, X., Zhao, H., Guo, Z., Guo, Y., Liu, G., & Jiang, B. (2025). CO-OPERA: A human-AI collaborative playwriting tool to support creative storytelling for interdisciplinary drama education. *Cornell University*, 1(1), 1-9. <https://doi.org/10.48550/arXiv.2506.00791>
- Md, M. R. (2019). 21st Century Skill "Problem Solving": Defining the Concept. *Asian Journal of Interdisciplinary Research*, 2(1), 64-74. <https://doi.org/10.34256/ajir1917>.
- Munk, C. S., Antonsen, Y., & Andreassen, S. E. (2024). Devised theatre methodology to promote creativity in school. *Educational Action Research*, 33(2), 330-347. <https://doi.org/10.1080/09650792.2024.2326602>
- Nurhasanah, E. (2022). How does learning drama help students to build seven survival skills? *Budapest International Research and Critics Institute (BIRCI-Journal) Humanities and Social Sciences*, 5(1), 7184-7194.
- Oates, A., & Johnson, D. (2025). ChatGPT in the classroom: Evaluating its role in fostering critical evaluation skills. *International Journal of Artificial Intelligence in Education*, 35, 1793-1824. <https://doi.org/10.1007/s40593-024-00452-8>.
- Pekdoğan, S. & Korkmaz, H. İ. (2016). An Experimental study on development critical thinking skills via educational drama as a teaching method. *International Online Journal of Educational Sciences*, 8(3), 12-21. <https://doi.org/10.15345/iojes.2016.03.002>
- Port, J. S. (2017). *Towards a liberated classroom: Teacher perceptions on drama as a tool of social justice* [Master's thesis, Monash University]. <https://doi.org/10.4225/03/59c317261c157>
- Pratiwi, H., Riwarda, A., Hasruddin, H., Sujarwo, S., & Syamsudin, A. (2025). Transforming learning or creating dependency? Teachers' perspectives and barriers to AI integration in education. *Journal of Pedagogical Research*, 9(2), 127-142. <https://doi.org/10.33902/JPR.202531677>

- Saiz, C., & Rivas, S. F. (2023). Critical thinking, formation, and change. *Journal of Intelligence*, 11(12), 219-245. <https://doi.org/10.3390/jintelligence11120219>
- Shneiderman, B. (2022). *Human-centered AI*. Oxford University Press.
- Siburian, J., Corebima, A. D., Ibrohim, I., & Saptasari, M. (2019). The correlation between critical and creative thinking skills on cognitive learning results. *Eurasian Journal of Educational Research*, 19(81), 99-114. <https://doi.org/10.14689/ejer.2019.81.6>
- Stampfl, R., Geyer, B., Deissl-O'Meara, M., & Ivkić, I. (2024). Revolutionising role-playing games with chatgpt. *Advances in Artificial Intelligence and Machine Learning; Research*, 4(2), 2244-2257. <https://doi.org/10.48550/arXiv.2407.02048>
- Starkey, L. (2010). *Critical thinking skills success in 20 minutes a day* (2nd Ed.). Learning Express.
- Stuchlikova, L., & Weis, M. (2024). From information to insight: Reimagining critical thinking pedagogy in the age of artificial intelligence. In Š. Fejederlem (Ed.), *2024 International Conference on Emerging eLearning Technologies and Applications (ICETA)* (pp. 591-598). <https://doi.org/10.1109/ICETA63795.2024.10850787>
- Susanti, R. (2024). Effective strategies in developing critical thinking skills in elementary school age children. *West Science Interdisciplinary Studies*, 2(4), 732-736. <https://doi.org/10.58812/wsis.v2i04.785>
- UNESCO. (2024). *Artificial intelligence and the futures of learning*. <https://www.unesco.org/en/digital-education/ai-future-learning>.
- UNESCO-UNEVOC. 2024. *Critical thinking*. TVETipedia Glossary. <https://unevoc.unesco.org/home/TVETipedia%2BGlossary/lang=en/show=term/term=critical+thinking>
- Yetişensoy, O. (2026). AI-enhanced disaster education in middle schools: A mixed study from social studies classes. *Educational Technology & Society*, 29(1), 205-222. [https://doi.org/10.30191/ETS.202601_29\(1\).RP12](https://doi.org/10.30191/ETS.202601_29(1).RP12)
- Zhao, P., Wu, X., Hu, M., & Yang, Y. (2020). Teaching intensive reading in TESOL class. A mosaic model. *Open Journal of Modern Linguistics*, 10(4), 340-365. <https://doi.org/10.4236/ojml.2020.104020>
- Zhou, M., & Peng, S. (2025). The usage of AI in teaching and students' creativity: The mediating role of learning engagement and the moderating role of AI literacy. *Behavioral Sciences*, 15(5), 587. <https://doi.org/10.3390/bs15050587>