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RESEARCH ARTICLE

Integrating AI Tools and Drama Pedagogy in Digital Classrooms to Foster Critical Thinking and Inclusion in Primary Education

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Abstract: This study investigates the pedagogical potential of combining artificial intelligence (AI) tools with drama-based strategies in digital learning environments within primary education, focusing on the development of students' critical thinking skills. To this end, twelve original teaching scenarios were designed and implemented in a sixth-grade classroom, blending the use of AI-powered online applications with experiential drama techniques. These digital tools, accessed through computers and portable devices available in the classroom, supported learners in generating content, exploring multiple perspectives, and engaging in reflective dialogue. The intervention employed a mixed-methods research design and was conducted with a convenience sample of 46 11-year-old students attending an urban public primary school. Data were collected through pre- and post-intervention questionnaires, classroom observations, and focus group interviews. Quantitative results indicated a measurable improvement in students' ability to analyse, evaluate, and justify ideas, while qualitative data provided evidence of increased engagement, collaborative interaction, and deeper metacognitive awareness. The findings suggest that the purposeful integration of AI into classroom practice, when combined with creative and participatory learning methodologies such as drama, can contribute meaningfully to the cultivation of critical and reflective thinking in young learners. Moreover, this interdisciplinary approach was found to support inclusive participation by offering varied entry points for student expression and understanding. The study highlights the relevance of reimagining digital or mobile-supported pedagogy through the lens of artistic and dialogic learning, particularly in educational contexts that aim to equip students with essential 21st century skills. It also opens pathways for further research into how AI enhanced environments can foster equity, creativity, and cognitive engagement in primary classrooms.

Keywords: reflective learning, digital pedagogy, dialogic interaction, interdisciplinary education, inclusive practice, metacognitive development

1 Introduction

In today's educational landscape, where access to information is immediate but the ability to evaluate it remains limited, cultivating critical thinking is more important than ever. In primary education, this objective is particularly vital, as it supports the formation of thinking habits and learning attitudes from an early age. Critical thinking, which encompasses observation, interpretation, synthesis, evaluation, and problem-solving, is widely considered essential for shaping responsible and thoughtful future citizens (Md, 2019; Susanti, 2024). However, teaching critical thinking to young learners presents specific challenges. Students at this age require developmentally appropriate, meaningful, and enjoyable learning experiences to engage cognitively. As such, pedagogical strategies must connect intellectual development with experiential and creative learning (Siburian et al., 2023).

The integration of artificial intelligence (AI) in educational settings introduces new possibilities for targeted and inclusive interventions that promote metacognitive and reflective skills. AI has rapidly evolved and attracted increasing attention within education for the opportunities and challenges it brings to teaching and learning (Jafari, 2024). Its capacity to process information and generate knowledge in ways that mirror higher-order thinking makes it a promising tool for human learning (UNESCO, 2024). When embedded in sound pedagogical practice, AI can meaningfully support students' critical thinking development (Hwang et al., 2020). This is largely due to the principles of human-centered AI, which place human values at the core of

technological design (Shneiderman, 2022). While AI is currently used mainly in personalized learning and digital assessment, its intersection with the arts, particularly with drama-based education, remains underexplored, despite its potential for fostering creative and learner-centered experiences.

Drama in education provides a dynamic space for expression, reflection, and transformation (Port, 2017). Rooted in lived experience, language, and multisensory engagement, it supports communicative, collaborative, and creative learning environments. Its inclusive nature allows students of diverse backgrounds, abilities, and learning profiles to engage meaningfully in the learning process. Within drama-based pedagogies, students participate in symbolic representation and active exploration within a safe, imaginative space, developing both critical and creative thinking (Lenakakis, 2024). As an exploratory and collaborative practice, drama fosters deeper engagement with diverse topics and encourages students to think more critically (Munk, Antonsen, & Andreassen, 2024).

This study investigates the educational potential of combining AI and drama pedagogy to foster critical thinking in primary school students, while simultaneously promoting inclusion and equitable participation in the learning process. Twelve teaching scenarios were implemented with sixth grade learners, integrating AI tools such as ChatGPT, Character.AI, Heygen.AI, and Canva's AI features. These tools, accessed via portable devices such as tablets and laptops, were used to stimulate dialogic thinking, generate digital characters, and support visual content creation offering multimodal, adaptive, and student-centred learning pathways. In parallel, a range of drama-based techniques were employed, including hot seating, improvised dialogues, frozen images, dynamic tableaux. These strategies created a safe and experiential learning environment that encouraged exploration, empathy, and critical engagement through symbolic representation and embodied practice. Using a mixed-methods research design, this study explores the extent to which, and the ways in which, these innovative tools and approaches contribute to the development of students' critical thinking skills, drawing on both quantitative and qualitative data.

2 AI and drama in education: A theoretical framework for promoting inclusive and critical thinking

2.1 AI for inclusion and critical thinking in the digital classroom

Fostering critical thinking is a central goal of 21st-century education, particularly in contexts that aim to cultivate cognitive autonomy, responsibility, and social engagement (Conwright, 2023). In this regard, AI tools especially generative language models are increasingly recognised as powerful supports for both cognitive and inclusive educational practices. These technologies provide learners with new modes of engagement, facilitate real-time feedback, and promote reflection through dynamic language generation, prompting, and adaptive content delivery. Generative AI platforms such as ChatGPT, Character.AI, and Canva's AI features allow students to interact with simulated digital characters or create content-rich visuals that support learning across multiple modalities (Anderson, 2023). These tools, when accessed through portable devices like laptops and tablets, offer flexibility and immediacy, enabling differentiated learning pathways that accommodate students' diverse linguistic, cognitive, and cultural profiles (Ruiz-Rojas, Salvador-Ullauri, & Acosta-Vargas, 2024). Through dialogic exchanges with AI powered systems, learners can explore complex social and cultural topics, challenge assumptions, and formulate reasoned arguments—key aspects of critical thinking. Recent research highlights the pedagogical value of these technologies. For example, Ríos et al. (2025), in a systematic review, emphasise that AI tools with ethical design frameworks foster higher-order thinking, metacognitive awareness, and inclusive participation. They argue that adaptive features and accessible interfaces enable personalised scaffolding, especially for students with learning difficulties or those learning in a second language. Yuan and Hu (2024) further demonstrate that structured prompting strategies within generative AI systems significantly enhance learners' capacity for reflection, abstraction, and conceptual transfer—skills that lie at the heart of critical thinking development. In addition, Salas-Pilco, Xiao and Oshima (2022) point out that screen-based AI applications with multilingual language options help reduce barriers for students from diverse linguistic backgrounds. They note that when students can access content and express themselves in languages they are more comfortable with, their participation becomes more confident and autonomous. Similarly, Melo-López et al. (2025) confirm that AI tools supporting differentiated cognitive access such as read-aloud functions, text simplification, or multimodal interaction facilitate inclusive learning environments in which all students can

meaningfully engage. The inclusive potential of AI is further supported by studies that focus specifically on multilingual and mixed-ability classrooms. Ruiz-Rojas et al. (2024) found that collaborative use of Chat PDF and Canva enhanced students' capacity to analyse texts, construct arguments, and engage in shared inquiry. Building on this, Tariq (2024) explores the use of AI-powered language translation and voice-to-text tools in multilingual primary classrooms. His findings indicate that such tools not only enhance inclusion and linguistic accessibility, but also foster independent expression and critical awareness among learners. By removing communication barriers and offering tailored support, AI technologies enable students to interact more thoughtfully with content, express their ideas with greater clarity, and reflect on diverse perspectives within a collaborative classroom context.

These findings reinforce the idea that when used intentionally, AI does more than simply support access to content it transforms the pedagogical space (Brandhofer & Tengler, 2024). It positions learners not only as recipients of knowledge but as co-constructors of meaning, engaging in interactive inquiry and reflective decision-making. The portability of devices such as tablets and laptops further enhances this process by allowing students to engage with AI tools in personalised and immediate ways, making learning more adaptable to individual needs and circumstances. In sum, the integration of AI into digital classrooms is not merely a matter of technological innovation it represents a paradigm shift towards inclusive, dialogic, and critically engaged education. When paired with thoughtfully designed activities and ethical educational frameworks, AI tools can act as catalysts for cognitive development, personal agency, and equitable participation.

2.2 Drama-based learning for embodied cognition and equity

While AI provides cognitive scaffolding and personalised pathways, drama-based learning complements it by engaging learners through embodied, imaginative, and emotionally resonant practices. Drama in education provides a dynamic space for expression, reflection, and transformation (Port, 2017). It draws on lived experience, linguistic play, and multisensory engagement, supporting communicative, collaborative, and creative learning environments that allow all students to actively participate. Pedagogical approaches inspired by Augusto Boal's Theatre of the Oppressed such as role-play, forum theatre, and improvised dialogue enable students to step into multiple perspectives, simulate complex situations, and articulate their responses to social or ethical dilemmas. These embodied strategies promote cognitive flexibility, empathy, and ethical reasoning, which are critical for both democratic citizenship and higher-order thinking (Ma et al., 2025). Importantly, drama-based pedagogy offers low-stakes, emotionally supportive contexts where students can take risks, express themselves, and experiment with alternative viewpoints. This inclusive dimension of drama is particularly valuable for learners who may struggle with conventional verbal or written academic expression, such as neurodiverse students or those from linguistically minoritised backgrounds. Lenakakis (2024) highlights that drama, when combined with dialogic inquiry and collaborative analysis, helps students identify bias, examine assumptions, and make evidence-based arguments thus directly supporting the development of critical literacy. Similarly, drama pedagogy represents an innovative field within educational practice, as it merges pedagogical principles with theatrical techniques to create a learning framework grounded in experience, action, and collaboration. This teaching approach transforms the classroom into a safe space for expression and dialogue, where students are encouraged to develop personal, social, and cognitive skills (Mavroudis & Kondoyianni, 2020).

When AI tools are integrated into drama-based scenarios such as using Character.AI to simulate characters or Heygen AI to generate lifelike digital interlocutors students are offered an immersive, multimodal learning environment. This convergence allows them to negotiate meaning, interpret symbolic cues, and engage with content both intellectually and emotionally. Through co-constructing dialogue, responding to feedback, and embodying characters, learners activate deep forms of reflective and creative thinking. Inclusion is further reinforced when these drama strategies are adapted to accommodate different learning profiles. For example, students with speech impairments may use AI-generated voice tools, while visual learners may rely on digital storytelling or image-based improvisation. The flexibility and emotional resonance of drama provide an essential counterbalance to the algorithmic and text-based nature of AI, fostering equitable engagement for all.

Together, these insights suggest that drama and AI are not opposing pedagogical forces but mutually reinforcing tools. Drama offers embodiment, empathy, and expressive freedom; AI offers structure, responsiveness, and access. Their integration, when guided by critical pedagogy and inclusive design, can redefine classrooms as spaces of participation, inquiry, and transformation.

3 Materials and methods

The present study aimed to investigate the impact of AI tools and drama-based pedagogy on the development of critical thinking skills among 11-year-old students in the final year of primary education. The central research question guiding this inquiry 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 within an inclusive classroom environment?"

To address this question, a mixed-methods research approach was adopted, combining both quantitative and qualitative methods to provide a more comprehensive understanding of the phenomenon under study. Specifically, a quasi-experimental design was employed to measure the intervention's effectiveness through pre- and post-assessment, while qualitative data were collected through a range of tools. These methods offered deeper insights into how students engaged in critical thinking processes during the learning activities.

During the preparatory stage, a comprehensive literature review was conducted to establish the theoretical framework of the study. The purpose and specific research objectives were defined, and twelve targeted intervention sessions were designed. These sessions incorporated digital tools powered by AI, carefully selected to be both developmentally appropriate and engaging for the target age group. The activities also integrated drama-based methods to promote student voice, agency, and creative expression, while fostering inclusive classroom practices that addressed the diverse needs, backgrounds, and learning styles of all students. At this stage, the dependent variable was defined as critical thinking, while the independent variables expected to influence its development were identified as Artificial Intelligence and drama pedagogy. A convenience sampling method was selected, as the chosen primary school in the Attica region was easily accessible to the researchers. The research study was conducted in accordance with ethical standards for research involving human participants. Official approval for the implementation of the intervention was obtained from the local Directorate of Primary Education. In addition, the parents and legal guardians of all participating students were fully informed about the aims and procedures of the study and provided written consent for their children's participation. The total sample consisted of 46 sixth-grade students, of whom 22 were assigned to the control group (class 6.1) and 24 to the experimental group (class 6.2). For the purposes of quantitative data collection, the study employed a revalidated version of the Dima, Kaiafa and Tsiaras (2020) questionnaire. This student questionnaire was structured into five thematic categories, corresponding to the five critical thinking skills under investigation: observation, induction, reliability assessment, abstraction, and problem solving. It included 24 closed-ended multiple-choice questions (A/B/C/D format), with a single correct answer for each item. The questionnaire was based on the conceptual principles of Ennis (1993) and Starkey (2010), both of whom have conducted extensive research into the components and assessment of critical thinking.

A range of qualitative research tools was employed, including: the critical friend technique, a research diary, participant observation, focus group discussions, storytelling activities, the hot-seating technique, and the use of the AI-driven platform Character AI. These tools were particularly valuable in capturing students' diverse ways of thinking, expressing themselves, and participating in dialogic and collaborative processes.

During the second stage, which involved the main implementation of the study, the validated questionnaire was initially administered to the entire sample as a pre-test. Following this, the twelve targeted instructional scenarios were implemented over a period of two months, fully integrated into the classroom's weekly learning activities. These scenarios aimed to foster critical thinking through the combined use of Artificial Intelligence tools and drama-based techniques, within a learning environment that promoted equity, participation, and inclusion. Upon completion of the intervention, the same questionnaire was administered once again to all participating students as a post-test, allowing for a comparative analysis of potential changes in critical thinking skills. The study concluded with the third stage, which involved the dissemination of results and the drawing of conclusions based on the quantitative and qualitative data collected throughout the research process.

3.1 Design of pedagogical workshops

The pedagogical workshops were designed to foster active participation, collaboration, empathy, and critical thinking among students through the creative integration of AI tools via mobile digital devices and drama-based techniques. Held twice a week, the workshops were

implemented within a dynamic classroom environment that encouraged flexibility, interaction, and experiential learning. The thematic content was developed with careful consideration of the students' age-specific interests and developmental needs, aiming to engage learners meaningfully, strengthen their relationship with knowledge, and provide authentic and transformative learning experiences. Activities focused on real-world issues such as social dilemmas, environmental awareness, personal and collective identities, misinformation, and technological literacy promoting reflective thinking and social consciousness.

Each session began with warm-up activities designed to connect body, mind, and imagination. Through movement-based games, theatrical exercises, and team-building tasks, students enhanced their self-awareness, empathy, and interpersonal communication. This was followed by the introduction of the workshop's core topic via storytelling, drama games, or interaction with mobile AI tools. The use of portable devices enabled students to interact with Artificial Intelligence platforms such as Character.AI, ChatGPT, MagicSchool.AI, and HeyGen.AI in creative ways composing dialogues, simulating dilemmas, developing fictional characters, or solving contextual problems. At the same time, drama-based techniques such as hot seating, frozen and dynamic images, improvised dialogues, conscience alley, telephone conversations, brainstorming, and Forum Theatre were seamlessly integrated. This interdisciplinary approach, bridging technological and performative modes of learning, empowered students to co-construct knowledge through action and imagination. Each workshop concluded with a reflective segment, during which students articulated their thoughts, emotions, questions, and connections arising from the experience. This phase deepened their metacognitive awareness and amplified every participant's voice, thereby promoting inclusion and equity (Ranzau & Horowitz, 2017).

The dynamic alternation between action and reflection, technology and embodied experience, language and imagination, contributed to the cultivation of an open, participatory, and transformative learning environment. The combined use of drama pedagogy and AI through mobile devices highlighted the pedagogical potential of mobile learning practices within contemporary, collaborative, and inclusive education.

4 Results

4.1 Quantitative analysis

During the final stage of the research, which involved the dissemination and analysis of results, the researchers first processed and categorized the quantitative data obtained from the students' questionnaires. All statistical analyses were performed using the open-source statistical software Jamovi (version 2.6.44) and the R programming language developed by Ihaka and Gentleman (1996). To assess whether the data followed a normal distribution, the Shapiro Wilk test was employed, as the sample size was small ($n < 50$). Following this, the non-parametric Mann Whitney U test was used to examine whether there were statistically significant differences in students' critical thinking performance between the control and experimental groups, comparing the results before and after the intervention (pre- and post-tests). Figure 1 presents the distribution of the overall scores for both the control and experimental groups based on the pre-test results, prior to the implementation of the twelve instructional interventions combining Artificial Intelligence tools and drama-based techniques. The distributions indicate that the overall scores of both groups exhibited similar characteristics at the outset of the study.

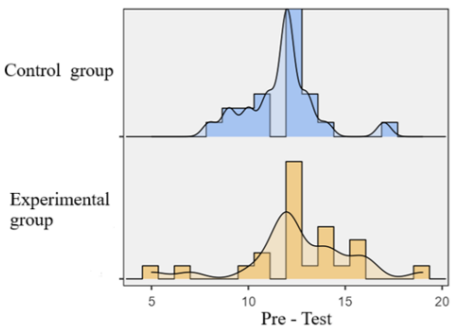

Figure 1 Distribution of responses by group based on overall scores in the pre-test

Additionally, the boxplot in Figure 2 illustrates that the medians of the two groups were nearly identical, while a few individual outliers were observed in both the control and experimental

groups. The similarity in central tendencies and value ranges suggests that the two groups were statistically comparable prior to the intervention.

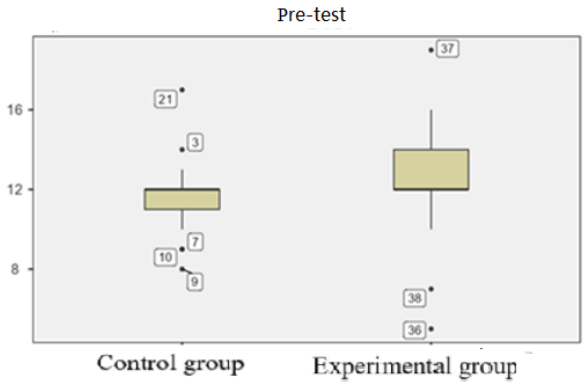

Figure 2 Boxplot of overall scores in the pre-test for both the control and experimental groups, prior to the intervention

The normality test indicated that the sample did not follow a normal distribution ($p = 0.018 < 0.05$); therefore, the non-parametric Mann–Whitney U test was applied to compare the performance of the two groups. The results of the Mann–Whitney U test revealed no statistically significant difference in the overall performance scores between the control group ($M = 11.682$, $SD = 1.887$) and the experimental group ($M = 12.625$, $SD = 2.901$), with $U = 192$ and $p = 0.052 > 0.05$ (see Table 1). Consequently, the performance of the two groups in the pre-test phase can be considered comparable, indicating that the groups were on similar levels before the implementation of the instructional intervention.

Table 1 Results of the normality test and Mann-Whitney U test for both groups based on overall performance in the pre-tests

	Control Group (N = 22)	Experimental Group (N = 24)	Statistical Tests
Mean Score	11.682	12.625	
Median Score	12.000	12.000	
Standard Deviation	1.887	2.901	
Standard Error	0.402	0.592	
Normality Test (Shapiro-Wilk)			p = 0.018
Mann-Whitney U Test			U = 192 p = 0.052

According to the distribution of overall performance scores in the post-tests, following the implementation of the twelve instructional interventions that combined Artificial Intelligence tools and drama-based techniques, the control group's overall scores appear to be shifted toward lower levels compared to those of the experimental group (Figure 3). Similarly, the boxplot in Figure 4 shows that the experimental group demonstrates a higher median and lower variability compared to the control group, which exhibits greater dispersion and a higher number of outliers. These data support the notable improvement in the performance of the experimental group following the instructional interventions.

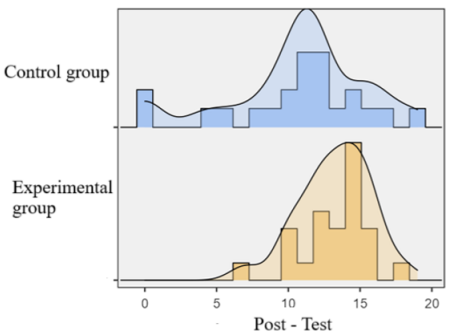

Figure 3 Distribution of responses by group based on overall scores in the post-test

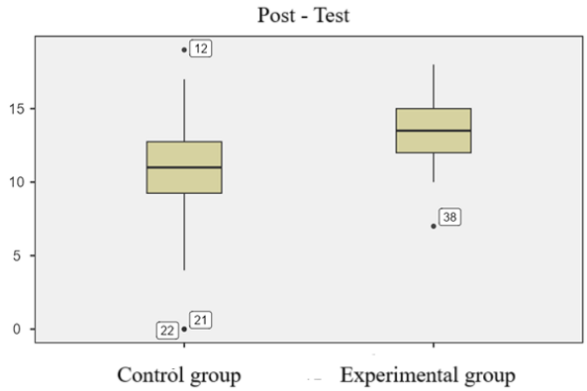

Figure 4 Boxplot of overall scores in the post-test for both the control and experimental groups following the intervention

The normality test revealed that the data did not follow a normal distribution ($p = 0.023 < 0.05$); therefore, the non-parametric Mann–Whitney U test was applied to compare the performance of the two groups. The results indicated a statistically significant difference in overall performance scores between the control group ($M = 10.636$, $SD = 4.846$) and the experimental group ($M = 13.208$, $SD = 2.484$), with $U = 168$ and $p = 0.017 < 0.05$ (see Table 2). These findings suggest that the instructional interventions implemented in the experimental group had a significant positive impact on students' overall post-test performance.

Table 2 Results of the normality test and Mann-Whitney U test for both groups based on overall performance in the post-tests

	Control Group (N = 22)	Experimental Group (N = 24)	Statistical Tests
Mean Score	10.636	13.208	
Median Score	11.000	13.500	
Standard Deviation	4.846	2.484	
Standard Error	1.033	0.507	
Normality Test (Shapiro-Wilk)			p = 0.023
Mann-Whitney U Test			U = 168 p = 0.017

4.2 Qualitative analysis of findings

The analysis of the qualitative data was conducted using the Thematic Analysis approach, following the process outlined by Clarke and Braun (2017). Through this method, patterns were identified within the qualitative data, which were then coded, organized into thematic categories, and further examined for relationships and connections. Subsequently, the themes were reviewed, refined, and interpreted (Braun & Clarke, 2013). Throughout the intervention, students used portable devices, primarily laptops and tablets, to interact with a range of AI-powered tools. These included text-generating applications such as ChatGPT, which supported scenario exploration and character development; as well as visual generators that allowed learners to create symbolic representations and stimulate discussion. The integration of these tools, alongside drama-based strategies, enriched the learning process by combining cognitive and affective dimensions. Students were encouraged to assume active roles, both digitally and physically, engaging in creative problem-solving and reflective dialogue.

Specifically, the combined use of AI and drama techniques helped students meet key learning objectives while navigating a variety of contemporary issues. They gradually developed the capacity to identify critical components within each scenario, such as underlying dilemmas, character viewpoints, and emotional undertones. This interpretative engagement fostered both empathy and careful attention to narrative detail. Spontaneous remarks like "I discovered something!" and "Let's look into this" reflected a growing metacognitive awareness and a clear activation of critical thinking. In several activities, the teaching team intentionally introduced misleading or conflicting information, either via AI-generated texts or through improvised role-play scenarios. These interventions led students to question the reliability of information and reflect on the nature of truth. Phrases such as "What if they're not telling the truth?" and

"Let's investigate it" illustrate the learners' inclination toward source evaluation and independent verification. These moments were particularly significant for developing analytical vigilance. Moreover, the integration of students' personal experiences into class discussions, facilitated by open ended drama activities, contributed to their ability to recognize motivations, decode emotional cues, and better understand the actions of fictional characters. This process supported both emotional literacy and the generalization of critical concepts beyond the immediate lesson context. Through collaborative analysis of symbols, events, and dialogue embedded in each learning episode, students demonstrated the ability to construct and deconstruct meaning, formulate arguments, and critically reflect on their own positions. The inclusive, dialogic nature of both the digital and embodied practices allowed students of diverse backgrounds and abilities to express themselves meaningfully and engage equitably in classroom interaction.

Following the analysis of the qualitative data, a triangulation process was conducted to synthesize findings across both data strands. This integrative approach strengthened the validity of the results and informed the final conclusions of the study.

5 Discussion

This study demonstrated the dynamic potential of combining AI and drama to significantly enhance critical thinking in sixth grade students. Our interdisciplinary approach, which integrated AI tools with experiential drama techniques, resulted in notable improvements in students' engagement and their ability to articulate, evaluate, and defend ideas. The experimental group exhibited statistically significant gains in comparison to the control group, suggesting that the constructivist learning environment fostered through the combination of embodied and digital learning modalities empowered students to become active agents in the learning process.

Throughout the intervention, students used portable devices, including classroom laptops and tablets, to access a variety of AI powered educational tools that supported both creative exploration and reflective learning. Among these, ChatGPT was used for generating dialogue and scenario prompts, helping students test interpretations and challenge assumptions (Hakiki et al., 2023). Character.AI, a platform enabling interactive engagement with virtual personas, allowed students to rehearse dialogues, pose questions, and explore diverse viewpoints in real time. This helped them develop empathy, evaluate motives, and consider alternative narrative trajectories. Additionally, students used Heygen AI, a tool that generates realistic digital characters capable of delivering spoken content based on input text. Particularly noteworthy was the use of Canva.AI, a visual content creation tool that supported students in designing posters, presentations, and stage backdrops for their dramatized projects. Canva was employed to enhance creative expression, foster collaborative production, and facilitate the understanding of abstract concepts through visual representation. Its user friendly and accessible interface enabled all students to participate actively, regardless of their technical proficiency or language competence, thereby reinforcing the inclusive aims of the intervention.

The drama techniques employed included Hot Seating, Improvised Dialogues, Dynamic Images, and Frozen Images methods that promote students' physical and emotional engagement in the learning process. These embodied practices encouraged learners to adopt alternative perspectives, express emotions, and explore complex social issues within a safe and expressive environment. Through such approaches, students were able to reflect critically, empathise with multiple viewpoints, and navigate ethical dilemmas while developing their communicative, cognitive, and interpersonal skills.

For young learners, such tools proved especially effective in making abstract content more tangible, promoting language development, and supporting inclusive participation regardless of literacy level or linguistic background (Darwin et al., 2023). The multimodal nature of these digital resources aligned naturally with drama pedagogy's emphasis on sensory, linguistic, and emotional expression. Combined with role-play, improvisation, and group storytelling, the AI tools helped students construct and deconstruct meaning, explore ethical dilemmas, and reflect on their own assumptions. The integration of text-based and audiovisual AI not only extended students' engagement but also fostered the ability to analyze information from different perspectives, a cornerstone of critical thinking.

Despite the encouraging findings, this study presents certain limitations that should be acknowledged. First, the sample size was relatively small (46 students), which constrains the generalisability of the results to broader populations. While the data are indicative and insightful regarding the potential of the intervention, further research with larger and more diverse samples is needed to validate these outcomes. Second, the successful implementation of

the selected tools presupposes that the teacher is sufficiently familiar with both the technological and theatrical components. This condition may not be universally met across all educational settings. Therefore, teacher training emerges as a critical factor for ensuring the pedagogically effective use of AI and drama-based techniques in the classroom. Third, the specific school setting and cultural context in which the intervention took place may have influenced students' engagement and responses. Variables such as local social norms, prior exposure to digital technologies, and learners' familiarity with drama practices could mediate the effectiveness of the approach in other contexts. Finally, the duration of the intervention was limited, which did not allow for the assessment of long-term impacts on students' metacognitive development or the sustained application of critical thinking skills. Future studies could explore the long-range effects of such integrative interventions, possibly extending them over time and across various curricular domains to assess their broader educational value.

These findings align with prior research. Oates & Johnson (2025) found that using ChatGPT to analyze AI-generated text enriched students' argumentative and reflective skills. Similarly, Stampfl et al. (2024) reported that role-play scenarios assisted by ChatGPT strengthened participants' critical thinking. Zafar et al. (2025) revealed that 68% of secondary students perceived ChatGPT as useful for developing critical thinking, especially when used regularly. Structured use of ChatGPT in primary classrooms also showed positive effects on critical evaluation and self-reflection. Taken together, these results support our hypothesis that combining AI and drama creates a rich, constructivist and inclusive learning environment in which students are not passive recipients of content but co-creators of meaning. The integration of familiar, accessible digital tools through portable devices further enhances the flexibility and responsiveness of the learning process, enabling differentiation and equitable engagement.

6 Conclusion

The findings of this study provide robust and compelling evidence in response to the research question. Both quantitative and qualitative analyses revealed significant and consistent outcomes, demonstrating that the integration of AI tools with drama-based pedagogy can meaningfully enhance students' critical thinking skills in primary education. Specifically, students in the experimental group showed measurable improvements in their ability to analyze, interpret, and evaluate information, while the control group exhibited no comparable progress. These results strongly suggest that a multimodal and interdisciplinary educational approach, one that combines the technological affordances of AI applications with the experiential, participatory methods of drama in education, promotes deeper engagement and facilitates the progressive development of higher-order thinking skills. The students' increased capacity for critical inquiry, argument construction, and reflective decision-making underscores the pedagogical value of such integrative practices. Throughout the intervention, learners engaged with AI powered applications using portable digital devices, such as laptops and tablets. These tools enabled flexible, differentiated, and accessible participation, allowing students to interact with content in ways tailored to their individual needs, interests, and abilities (Anastasiades et al., 2024). This approach aligned naturally with the principles of inclusive education, ensuring that learners with diverse linguistic, cognitive, or socio-emotional profiles could equally participate in and benefit from the learning process. Recent literature emphasizes the importance of AI in supporting inclusion through customizable feedback, adaptive scaffolding, and accessible multimodal input (Fitas, 2025).

Notably, platforms such as ChatGPT and Character.AI were employed to simulate real-time dialogue, stimulate inquiry, and facilitate exploration of multiple perspectives. These conversational interfaces promoted analytical and interpretive reasoning while also serving as linguistic mediators for students with varying levels of verbal fluency. In parallel, Heygen AI enabled the creation of dynamic, digital characters that brought dramatized narratives to life (Chang & Kidman, 2023). These tools provided multimodal access points into complex content, fostering emotional engagement, empathy, and symbolic understanding particularly valuable for students who may struggle with traditional text-based instruction. The synergy between AI driven interactivity and drama-based expression supported students' metacognitive development, transforming them from passive recipients of knowledge into co-constructors of meaning. Through improvisation, role-play, and collaborative storytelling, students were encouraged to examine ethical dilemmas, evaluate motives, express diverse viewpoints, and co-create responses to open ended problems. The integration of digital tools into these creative processes enabled real-time reflection and peer-to-peer dialogue, which are both central to inclusive and dialogic pedagogy (Papadakis, Kalogiannakis, & Zaranis, 2021; Walter, 2024).

Moreover, the embodied and imaginative aspects of drama provided a safe and inclusive space for students to explore their identities, experiences, and ideas without fear of judgment. This was especially important for learners who often feel marginalised in conventional instructional settings, including those with limited language proficiency, neurodiverse profiles, or lower confidence in academic subjects. Drama pedagogy, when combined with responsive AI tools, offered multiple entry points into learning, allowing all students to engage meaningfully and authentically in the co-construction of knowledge. Systematic reviews by Salas-Pilco, Xiao and Oshima (2022) and Melo-López et al. (2025) have emphasized the importance of integrating AI in inclusive, student centred learning environments that foster equity, participation, and learner agency. Taken together, these results affirm that combining AI and drama within digital classrooms does more than enhance individual cognitive skills it redefines the learning environment as a collaborative, inclusive, and imaginative space. This constructivist model, underpinned by ethical and inclusive pedagogical values, empowers students not only to access and interpret information but also to transform it creatively and critically in ways that are meaningful to them and relevant to the broader social context.

Future research should further examine the long-term impact of such interdisciplinary models, particularly focusing on which components of drama pedagogy and AI applications (prompting design, generative role-play, voice enabled agents) have the strongest influence on the cultivation of critical thinking. Moreover, the development of clear and ethical pedagogical frameworks for inclusive AI use in early education will be essential to ensure that all learners regardless of background, ability, or identity are fully supported in becoming reflective, informed, and empowered participants in their learning journeys.

Conflicts of interest

The authors declare that they have no conflict of interest.

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