

Generative AI and digital neocolonialism in global education: Towards an equitable framework

Matthew Nyaaba ^{1,2*} , Alyson Leigh Wright ¹ , Gyu Lim Choi ¹ 

¹Department of Educational Theory and Practice, University of Georgia, Athens, GA, USA

²AI4STEM Education Center, University of Georgia, Athens, GA, USA

*Corresponding Author: matthew.nyaaba@uga.edu

Citation: Nyaaba, M., Wright, A. L., & Choi, G. L. (2026). Generative AI and digital neocolonialism in global education: Towards an equitable framework. *Journal of Digital Educational Technology*, 6(1), ep2608. <https://doi.org/10.30935/jdet/17862>

ARTICLE INFO

Received: 05 Jun. 2024

Accepted: 22 Nov. 2025

ABSTRACT

As generative artificial intelligence (GenAI) becomes increasingly embedded in education systems worldwide, urgent questions arise concerning whose knowledge these technologies elevate and whose they marginalize. This study adopts a twofold critical-constructive approach to examine GenAI's role in reproducing epistemic hierarchies and to advance pathways toward more equitable use in education. Using a critical constructive qualitative design, we first conducted zero-shot prompt testing with ChatGPT-4 Turbo and Gemini 1.5 models across contexts in the Global North and Global South. The models' responses were documented in real time and analyzed through a critical interpretive lens to surface patterns associated with digital neocolonialism. The critical phase of the study identifies six interconnected dimensions through which GenAI sustains Western dominance in educational contexts: Western curriculum ideologies, cultural imperialism, pedagogical control, language marginalization, racial and ethnic underrepresentation, and access inequity. For instance, when Gemini was asked to identify the seasons in the United States and Ghana, it returned the same four-season framework for both contexts, reflecting Western climatological assumptions. Across other prompts, GenAI outputs relied on stereotypical imagery, assumed Western-centered instructional resources, limited Indigenous and local language support, and disproportionately represented Western racial identities. In addition, subscription-based pricing models create structural barriers, as educators and institutions in much of the Global South face disproportionate costs due to currency differences. Building directly on these findings, the constructive phase advances two mitigation pathways for equitable GenAI in education. The first pathway targets AI design, emphasizing liberatory design methods, foresight by design, and the decentralization of GenAI development to strengthen local participation and data sovereignty. The second operates at the pedagogical level, advancing a human-centric prompt engineering model that empowers educators to contextualize prompts, critically interrogate outputs, and exercise pedagogical agency. These pathways position GenAI not merely as a technological tool, but as a site of ethical, and culturally responsive education.

Keywords: generative AI, neocolonialism, digital neocolonialism, AI, bias, cultural biases, economic disparity, policy reform, human-centric AI

INTRODUCTION

The emergence of generative artificial intelligence (GenAI) technologies represents a significant advancement in the digital space, transforming how data is utilized and how content is generated (Ipek et al., 2023). GenAI encompasses a range of technological capabilities, producing complex outputs such as text, audio, images, and now, video, based on patterns learned from vast datasets (Lim et al., 2023). This ability positions GenAI as a tool of immense potential within various sectors, including education, where it is revolutionizing teaching, learning, assessment, and research (Latif et al., 2023; Zhai et al., 2025). GenAI is currently noted for enhancing personalized learning experiences, automating

scoring and grading, and aiding in lesson preparation. As educational institutions, from K-12 to higher education, continue to integrate GenAI into their practices, it becomes crucial to understand the foundational mechanisms, challenges, and biases associated with these technologies to harness their capabilities effectively (Ipek et al., 2023; Latif et al., 2023).

While the benefits of GenAI in education are substantial, numerous studies have identified accompanying challenges, particularly the inherent biases within GenAI systems (Arora et al., 2023). These biases largely stem from the fact that GenAI systems learn from existing data, thereby absorbing and replicating the biases present within that data (Lynch et al., 2023; van Niekerk et al., 2024). The presence of these biases

can potentially lead to skewed knowledge dissemination, favoring dominant cultural narratives, typically Western, while overlooking minority perspectives and non-Western narratives (Lynch et al., 2023). The consequences of this could foster traditional colonial ideologies, amplify existing educational disparities, and perpetuate digital neocolonialism.

Digital neocolonialism in the domain of GenAI specifically describes a scenario where control over GenAI technologies and the data they use is concentrated in the hands of a few, predominantly Western, corporations or countries (Adam, 2019; Menon, 2023; Sok & Heng, 2023). This concentration of control can impose a digital hegemony on less technologically advanced nations, echoing the power imbalances seen in traditional colonial relationships (Zembylas, 2023), where economic and cultural dominance was asserted by colonial powers over colonized regions. Acknowledging these biases and the potential for digital neocolonialism is crucial to ensure that GenAI in education serves global needs equitably (Zembylas, 2023). The study unfolded in two key phases. In the first, a critical phase, zero-shot prompt testing was conducted using ChatGPT-4 Turbo and Gemini 1.5 to examine how GenAI systems represent educational contexts across the Global North and South. Outputs were documented through real-time screenshots and analyzed interpretively to trace textual, visual, and structural indicators of digital neocolonialism. In the second, a constructive phase, findings from this analysis informed the creation of the *inclusive AI design framework* and *human-centric prompt engineering model*. We were guided by the following questions:

1. How do GenAI outputs reflect global and cultural biases within educational contexts?
2. How can cultural biases present in GenAI be mitigated for global education?

Positionality Statement

The authors of this study represent diverse cultural, academic, and professional backgrounds spanning Africa, Asia, and North America. All are early-career scholars with active research and teaching engagements in K-12 and higher education contexts, particularly in the areas of early childhood, elementary, middle, teacher education, and with research focus on AI in education, culturally responsive pedagogy, and educational equity. The first author led the overall study's design, critical analysis, and development of the conceptual frameworks, drawing on his experiences in the Global South. The second author contributed to the mitigation approaches, drawing from her teaching experiences and technological exposure to educational technologies in the Global North. The third author provided contextual validation and cultural interpretation, ensuring that the findings reflect perspectives across multiple regions. The authors continuously engaged in collaborative discussions, intercultural reflection, and iterative consensus-building to verify interpretations and minimize positional bias. This reflexive process helped the team remain critically aware of how their own experiences informed their interpretation of AI outputs, while ensuring that analyses were balanced, evidence-based, and globally contextualized.

LITERATURE REVIEW

Digital Neocolonialism

Digital neocolonialism refers to the perpetuation of historical colonial inequities through the use of digital technologies, illustrating the exploitation and control exerted by dominant nations or large technology companies over nondominant countries (Gravett, 2022). This dynamic has led to new global power imbalances, with large technology companies accumulating massive amounts of data for profit (Gerbrandy & Phoa, 2022). The neocolonial project in the digital age operates through platforms like social media and technologies, including GenAI, influencing democratic processes and perpetuating power imbalances (Zembylas, 2023).

Digital neocolonialism manifests in various ways, such as reinforcing inequalities, generalizing language and culture, controlling curriculum and content, and dominating the market and economy. For example, major corporations often control and exploit data, extracting significant value while providing little benefit to the individuals from whom the data is collected (Coleman, 2018; Stürmer et al., 2021). Additionally, the dependence of developing countries on technology infrastructure and platforms provided by foreign companies limits their ability to develop and control their digital ecosystems, hindering local industry development and innovation (Adam, 2019; Kwet, 2019; Langmia & Sani, 2023).

The global spread of dominant cultural norms through digital platforms can lead to cultural imperialism, marginalizing local cultures and languages (Enein, 2023). Digital cultural hegemony undermines the diversity and autonomy of indigenous communities, as traditional forms of expression and knowledge are overshadowed by multinational tech companies. Consequently, this may lead to the homogenization of GenAI content and limit unique local perspectives (Couldry & Mejias, 2019; Hammer & Park, 2021). This dominance affects education in developing countries, as seen in Adam's (2019) study on MOOCs and digital textbooks produced by institutions in the Global North serving learners in the Global South. Addressing digital neocolonialism is crucial for safeguarding sovereignty, privacy, and democratic values, especially in education, where GenAI is already in near full operation (van Niekerk et al., 2024).

GenAI in Education

GenAI is revolutionizing education on a global scale (Lim et al., 2023). Current research on the application of GenAI in education typically falls within the three domains of teaching and learning, assessment and research (Chiu, 2021; Ding et al., 2024; Nyaaba, 2024). Recent studies demonstrate that GenAI influences several educational domains, including personalized learning, adaptive learning, immediate feedback, lesson planning, automated assessment, and research (Latif et al., 2023).

GenAI can support personalized learning, but it may also lead to over-reliance and reduced critical thinking (Bai et al., 2023). Generally, GenAI motivates learners to develop reading and writing skills, although its impact on listening and speaking skills remains neutral (Ali et al., 2023). For instance,

Li et al. (2024) explored the perspectives of YouTube content creators on using GenAI in self-directed language learning (SDLL). Their findings indicate that GenAI is valuable for its availability, versatility, and transformative potential in enhancing SDLL, providing contextually relevant responses, and fostering meaningful learner interactions (Li et al., 2024). Additionally, research by Lee and Zhai (2024) revealed that pre-service teachers effectively integrated ChatGPT into science learning, scoring well on a modified TPACK-based rubric, particularly in 'instructional strategies & ChatGPT.' However, they demonstrated less proficiency in using ChatGPT's full potential, indicating the need for high-quality questioning, self-directed learning, individualized support, and formative assessment to enhance lesson planning (Choi et al., 2024; Lee & Kang, 2024).

Furthermore, studies indicate that GenAI has the potential to support educators in research activities; however, inaccuracies and biases, such as language limitations and a lack of context, remain prevalent (Nyaaba et al., 2024; Owoahene & Nyaaba, 2024). A key takeaway from these studies is that GenAI has the potential to transform education, but is accompanied by biases.

Consequently, students are at the forefront of GenAI usage. For example, Holland and Ciachir (2024) posited that students appreciated the immediacy and validation provided by GenAI, but concerns about equity and academic integrity emerged, particularly in group work where misuse of the tool could lead to academic misconduct affecting all members. Similarly, Rasul et al. (2023) identified academic integrity as a significant challenge in their examination of GenAI roles in higher education. They emphasized the need for clear institutional policies and transparency to mitigate these risks and ensure ethical GenAI usage. There is a strong suggestion for well-defined guidelines and policies to support the responsible and effective integration of GenAI in education (Holland & Ciachir, 2024; Rasul et al., 2023).

METHOD

We employed critical constructive qualitative design grounded in the framework of *digital colonialism* (Denzin et al., 2017; Kincheloe & McLaren, 2011). Guided by the *digital colonialism/imperialism framework* (Couldry & Mejias, 2019; Kwet, 2019), this method allowed us to critically interpret the GenAI outputs to expose how algorithmic systems replicate or resist global asymmetries in language, culture, and epistemic authority. This was then followed by a constructive proposal of mitigation frameworks designed to inform equitable and culturally responsive AI in education.

Study Context

This study was conducted between March and May 2024, during which two of the most advanced publicly accessible GenAI systems were employed, ChatGPT-4 (turbo, advanced mode) developed by OpenAI, and *Gemini 1.5* developed by Google DeepMind. At the time of data collection, the advanced mode of ChatGPT provided access to GPT-4 Turbo, an OpenAI's premium large-language-model variant known for its enhanced reasoning, extended context window, and faster

processing speed (OpenAI, 2024). In parallel, *Gemini 1.5*, which evolved from Bard (launched in March 2023 and rebranded in December 2023), also offered multimodal reasoning and cross-linguistic capabilities suitable for comparative testing (Google DeepMind, 2024). The concurrent use of these two state-of-the-art models allowed for a comparative examination of how leading GenAI systems represent cultural contexts and reproduce, or resist, digitally neocolonial tendencies.

Data Collection

The study employed a structured empirical documentation strategy to generate verifiable evidence of GenAI's cultural representations and underlying biases. Using a zero-shot prompting technique, queries were entered without prior examples or contextual guidance to isolate each model's inherent epistemic and cultural assumptions. This approach allowed the researchers to identify baseline patterns of bias without the influence of human framing or priming effects. A series of systematically designed prompts were administered across six thematic domains, knowledge representation, visual culture, pedagogy, access, language, and race.

Each query was tested under controlled conditions, and outputs were captured through real-time screenshots that preserved the complete prompt, metadata, platform, date, and location to ensure transparency and replicability. For example, prompts such as "*what seasons are there in a year?*" and "*generate an image of a human robot*" illustrate the types of queries used to assess GenAI's default assumptions about culture, geography, and representation. To ensure contextual robustness, identical prompts were tested across multiple cultural and geographic regions, such as Ghana and the USA, to determine whether responses varied by location. Findings revealed consistent Western-centric orientations across all contexts, underscoring the systemic nature of GenAI's cultural encoding.

Analytical Approach

The analysis of the GenAI outputs followed a critical interpretive approach, guided by the concept of digital neocolonialism (Gravett, 2022; Kwet, 2019). Each AI response and screenshot was examined for recurring patterns of cultural bias, representational imbalance, and linguistic exclusion that reflected the global power asymmetries described in the literature (Coleman, 2018; Couldry & Mejias, 2018). The process involved identifying textual and visual cues that reproduced colonial hierarchies, such as Western-centric imagery, English-dominant language use, and assumptions of Global North educational norms (Adam, 2019; Zembylas, 2023). These observed patterns were then interpreted through postcolonial and critical algorithmic lenses to determine how GenAI systems perpetuate or challenge digital imperialism and data dependency (Enein, 2023; Langmia & Sani, 2023; Stürmer et al., 2021). The theoretical insights from these studies informed the construction of the GenAI Neocolonialism.

The screenshot shows a Gemini AI interface. At the top, a message says "Gemini was just updated. See update". Below it, a question is asked: "What seasons are there in a year?". The AI response is: "There are four main seasons in a year: spring, summer, fall (also called autumn), and winter. These seasons are caused by the Earth's tilt as it revolves around the sun. The tilt means that different parts of the Earth receive more or less direct sunlight throughout the year, which affects the temperature and weather." Below this, a ChatGPT response is shown: "In a year, there are four distinct seasons: spring, summer, autumn (or fall), and winter. These seasons are characterized by significant changes in weather, ecology, and the amount of daylight due to the Earth's orbit around the Sun and its axial tilt relative to the ecliptic plane. The timing and characteristics of these seasons can vary significantly depending on one's geographical location." The ChatGPT response then provides a detailed list of the four seasons:

1. Spring: This season follows winter and precedes summer. Spring is often associated with a rebirth or renewal, as many plants begin to grow again and animals emerge from hibernation. The weather becomes milder, and the days start to become longer than the nights. In the Northern Hemisphere, spring typically occurs from March to May, while in the Southern Hemisphere, it occurs from September to November.
2. Summer: Summer is the warmest season of the year and follows spring. During summer, the days are longest and the nights are shortest, especially at the solstices, which are the seasonal extremes. Activities during summer often involve spending time outdoors and taking advantage of the warm weather. In the Northern Hemisphere, summer lasts from June to August, and in the Southern Hemisphere, from December to February.
3. Autumn (Fall): Autumn is the season during which the temperature starts to cool again, and the days begin to shorten. Leaves on many trees change color and fall to the ground, hence the name "fall" used in North America. It's a time of harvest for many crops. In the Northern Hemisphere, autumn occurs from September to November, and in the Southern Hemisphere, from March to May.
4. Winter: The coldest season of the year, winter follows autumn and precedes spring. This season is characterized by the shortest days, the longest nights, and often brings snowfall in colder climates. Winter is a time when many plants become dormant, and some animals hibernate to

Figure 1. GenAI reflecting Western content outputs (Authors' screenshot from Gemini/ChatGPT generated for this study, 2024)

FINDINGS (EMERGENT DIMENSIONS OF GenAI NEOCOLONIALISM)

This section presents empirical evidence of GenAI's neocolonial manifestations in educational contexts through GenAI outputs, which systematically document how algorithmic biases reproduce colonial power structures. The analysis culminates in the GenAI digital neocolonialism framework, which theorizes the mechanisms through which technological systems perpetuate global inequalities in education. Through six interconnected dimensions, we demonstrate how GenAI systems function as vehicles for the reproduction of Western hegemony, creating what Lynch et al. (2023) term "algorithmic colonialism" in educational spaces. The six dimensions are as follows:

Western Curriculum Ideologies

GenAI can develop educational content such as digital textbooks, learning modules, and automated tutoring systems. If these AI systems are primarily trained on datasets from economically dominant countries, there is a risk that the content they generate may not be culturally relevant or appropriate for students in different regions. This can lead to a form of cultural imperialism, where dominant cultures' viewpoints and knowledge systems overshadow local educational needs and values, marginalizing non-dominant cultures and languages, and reducing the diversity and richness of the educational experience for students worldwide.



Figure 2. An example of AI amplifying cultural bias: "wealthy African man and his house" vs. "wealthy European man and his house" (adopted from Ożegalska-Łukasik & Łukasik, 2023)

GenAI systems trained predominantly on data from Western contexts can inadvertently prioritize Western narratives, values, and ideologies (Bentley et al., 2024; Enein, 2023).

When these systems are used in educational content creation, the resulting materials may reflect a limited worldview, marginalizing non-Western perspectives and knowledge systems. For instance, we demonstrated the prioritization of Western knowledge by investigating the number of seasons in a year. Using the prompt "*what seasons are there in a year?*", both Gemini and ChatGPT responded with four main seasons (see **Figure 1**). This answer oversimplifies climate variations and inaccurately reflects the reality in many regions of the world. For example, West Africa, Southeast Asia, and Central America have two main seasons, and polar regions can have just one. This example illustrates how algorithmic biases can reflect Western cultures and inaccurately provide contextual and diverse information and beliefs. As a tool for personalized learning, this shows the dangers that GenAI could have on educational content creation and curriculum. Although the prompts may be generic, we expected the responses to at least contextualize the answers or cover a wider range of seasonal variations around the world. Such biases in GenAI can marginalize non-dominant contents and undermining the richness and diversity of the global educational experience.

Cultural Imperialism

GenAI systems might generate outputs that incorporate cultural references, examples, and case studies that might project other culture less attractive to Western cultures, as evidenced by Ożegalska-Łukasik and Łukasik's (2023) finding that GenAI presented a bias representation in images depicting a "wealthy African man and his house" versus those of a "wealthy European man and his house" (see **Figure 2**). **Figure 2** illustrates how the study found that GenAI tools misrepresented what a wealthy man and his house in Africa might look like, while more accurately depicting a "wealthy European man and his house." The images do not accurately represent a wealthy African man which can impact and distort students' perspectives and understandings of different cultural groups and accurate cultural contexts. A typical modern wealthy African man may live in a more sophisticated house with cars, while a traditional wealthy African man may



Figure 3. Showing cultural bias of transportation system between USA and Balochistan, a province of Pakistan (Authors' screenshot from ChatGPT generated for this study, 2024)

Example Lesson Plan: Introduction to Environmental Science

Objective:
Students will explore key concepts in environmental science, focusing on the impact of human activities on climate change.

Grade Level: High School (Grades 10-12)

Duration: 1 class period (50 minutes)

Materials Needed:

- ChatGPT or similar AI tool for delivering content and assessments
- PowerPoint slides prepared with key information
- Access to individual computers or tablets for each student

Standards Met:

- Analyzes the influence of human activities on the environment
- Engages critical thinking through individual assessments

Figure 4. Gen AI lesson plan illustrating pedagogical control (Authors' screenshot from Gemini generated for this study, 2024)

have a large traditional house with livestock, family, and workers.

To further explore this phenomenon, we tested the findings of Ożegalska-Łukasik and Łukasik (2023) using GPT-4 and Gemini by comparing portrayals of transportation in the USA and Balochistan. Our study supported their observations, exemplifying the initially identified cultural bias and highlighting additional discrepancies. The responses generated by the GenAI tools depicted a stark contrast, suggesting a more advanced portrayal of the transportation system in the USA compared to the current reality of transportation in Balochistan (see **Figure 3**). Biased output can negatively influence students' understanding of various cultures and contexts, reinforcing stereotypes and misrepresentations in educational content. This cultural bias in GenAI can alienate students from other cultural backgrounds and fail to engage them with examples that resonate with their own experiences and environments (Athanasopoulos et al., 2023; Zembylas, 2023). Such cultural imperialism can lead to the marginalization of non-Western perspectives in educational content and could diminish the learning experience for students from diverse backgrounds.

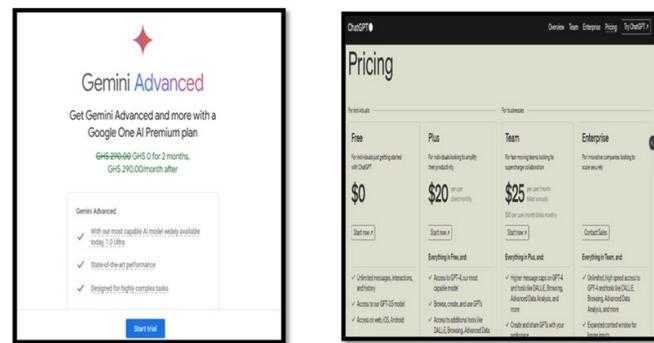


Figure 5. Digital divide through pricing of GenAI tools (Gemini, 2024; OpenAI, 2024)

Pedagogy Control

GenAI technologies may exacerbate dominant educational philosophy and pedagogy control from Western regions than non-western regions. This might be because these technologies are primarily developed in the Western regions and therefore can reinforce ideologies and teaching principles that may not represent local perspective (Kitsara, 2022; Lynch et al., 2023). This situation not only limits the diversity of thought in the evolution of GAI but also perpetuates a class divide within societies (Bentley et al., 2024). It begins by elucidating how colonialism distorts conventional art forms, often resulting in the erasure of indigenous cultures (Zhang & Cao, 2023). We demonstrated the pedagogy control by asking ChatGPT to prepare a lesson on the *introduction to environmental science* (see **Figure 4**). A well-organized lesson plan was generated but exhibited materials and teaching activities that are predominantly relevant and applicable in the Western regions, for instance, as part of the lesson, students were supposed to have access to individual computers and tablets which may not be available for students in most developing countries, especially those in public K-12 schools.

Digital Divide

The digital divide through pricing and monthly cost is another aspect that can perpetuate neocolonialism especially, getting access to the dancel versions of GenAI tools which are well-comprehensive with data and could provide users with vast features including audio and visual prompts. Gemini and GPT-4 cost over \$20.00 per month which may not fall within the budget of an average teacher, parent or students in most developing countries may be privileged GenAI access to Western regions over these regions. This factor will make it difficult for both parents and schools to afford for educational purposes. For instance, Nyaaba and Zhai (2024) study shows that teacher educators in developing countries are excited about using GenAI in their classroom practices but are much more concerned about the cost involved.

In addition, Enriquez et al. (2023) posited that the monetization of GenAI tools exacerbate divide, as wealthy families can afford advanced versions of these technologies (see **Figure 5**), providing their children with superior educational tools and opportunities while less affluent families may be relegated to inferior, free versions of these tools, potentially widening the achievement gap between socioeconomic classes (Enein, 2023). Additionally, the

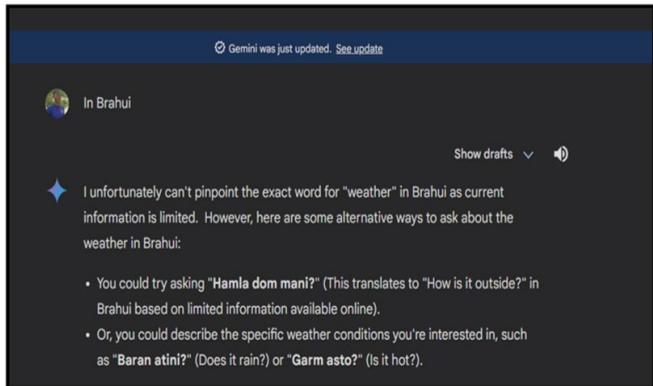


Figure 6. GenAI marginalizes indigenous and minority languages (Authors' screenshot from Gemini generated for this study, 2024)



Figure 7. GenAI exemplifying whiteness of output (Authors' screenshot from ChatGPT generated for this study, 2024)

restricted domain of GenAI might not be accessible to certain areas or localities. There are yet some communities who do not have access to technology including GenAI due to domain and internet restrictions (Ragnedda, 2020).

Language Marginalization

While GenAI has significantly advanced in incorporating and translating as many languages as possible, it remains evident that numerous indigenous languages are yet to be represented within these models (Ożegalska-Łukasik & Łukasik, 2023). This may inadvertently marginalize indigenous and minority languages, potentially accelerating language erosion and the dilution of cultural heritage among certain minoritized groups. More specifically, this focus can marginalize non-dominant languages and cultures, making educational content less accessible to speakers of indigenous or less widely spoken languages. To illustrate this bias, we prompted GenAI tools to provide an alternative term for "God is good" in Gurune (a language from Upper East, Ghana) (see **Figure 6**).

The response showed that GenAI is indeed limited in this language and could not find the term weather in Brahui language. This may impact on the ability of students to learn

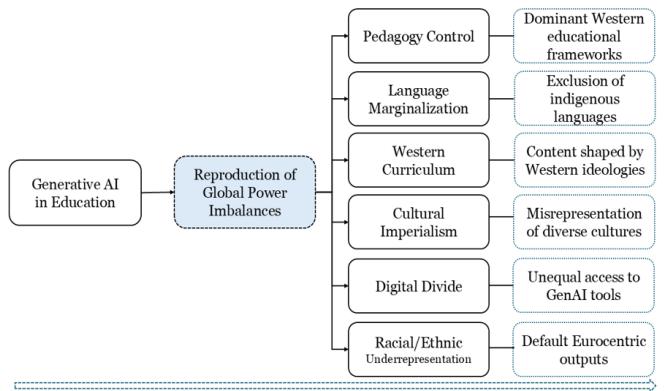


Figure 8. GenAI digital neocolonialism in education (Source: Authors, 2025)

in their mother tongue, which is crucial for young learners' understanding and cognitive development. Educators and students are thus urged to critically evaluate the implications of using GenAI on these languages and their corresponding cultures (Share et al., 2019).

Racial and Ethnic Underrepresentation

The racial dimensions of GenAI neocolonialism manifest through what Noble's (2019) terms *algorithms of oppression: how search engines reinforce racism* explores how search engines perpetuate racism, such as returning pornographic results for searches of "Latinas" and primarily displaying White men in professional roles, thus perpetuating racial stereotypes (Furuhasha, 2022; Rahman, 2020). This situation highlights the need for rectifying racial biases within search engine algorithms for fairer representations in education. We demonstrated racial biases in GenAI by requesting GenAI tools to generate an image of a "human robot," as shown in **Figure 7**. The output aligned with Cave and Dihal (2020)'s findings, which highlighted a white-centric bias in AI portrayals within Western culture (see **Figure 7**). This shows the need for more inclusive representations of GenAI technologies, particularly in educational contexts. While students may be relying on GenAI tools for drawing and image generation, these tools might be representing only a group of people.

GenAI Digital Neocolonialism Framework

The empirical evidence presented converges in our *GenAI and digital neocolonialism framework* (see **Figure 8**), which theorizes how these six merging dimensions operate through a central mechanism, the reproduction of global power imbalances in education. The framework positions "reproduction of global power imbalances" as the central mediating process, demonstrating how technological systems translate historical inequalities into algorithmic operations. Each dimension manifests through specific educational outcomes, dominant frameworks, excluded languages, Western ideologies, cultural misrepresentation, unequal access, and racial bias, that collectively constitute a comprehensive system of digital neocolonialism. We believe that the *GenAI and digital neocolonialism framework* provides a theoretical foundation for understanding these dynamics while pointing toward the necessity of transformative



Figure 9. Inclusive AI design framework (Source: Authors, 2025)

interventions that challenge the fundamental assumptions underlying GenAI development and implementation. Following this we proposed the mitigation framework to enhance democratization of GenAI for education in global and culturally responsive use.

Mitigation Frameworks

Through a critical examination of GenAI and its potential to perpetuate digital neocolonialism, this section delineates mitigation strategies operating at two distinct yet complementary levels (Brand, 2023): AI development and the pedagogical level of educational mitigations. The mitigation frameworks emerge from critical engagement with UNESCO's recommendation on ethics of artificial intelligence (UNESCO, 2021) and the AI convention by the Council of Europe (2022), which emphasize the imperative to align AI technologies with human rights while safeguarding cultural diversity. As UNESCO (2021) articulates, addressing ethical concerns must foster innovation that upholds fundamental freedoms, while the Council of Europe (2022) advocates for frameworks that protect cultural pluralism within digital technologies. These international instruments provide the normative foundation for the dual-pathway approach delineated below. The relationship between **Figure 9** and **Figure 10** reveals the complementary nature of systemic and pedagogical interventions. We proposed the *inclusive AI design framework* (**Figure 9**), which integrates the three critical approaches targeting AI developers and designers to disrupt neocolonial patterns at their source:

- (1) liberatory design methods (LDM) to center non-Western epistemologies,
- (2) foresight by design (FBD) to anticipate harm and ensure representational equity, and
- (3) decentralizing GenAI hubs to incorporate local voices and data sovereignty.

We proceeded to propose the *human-centric prompt engineering model* (**Figure 10**) which empowers educators (users) to navigate and resist biases within existing systems. These dual pathways create a mitigation strategy that operates across the entire GenAI ecosystem, from initial conception through classroom implementation.

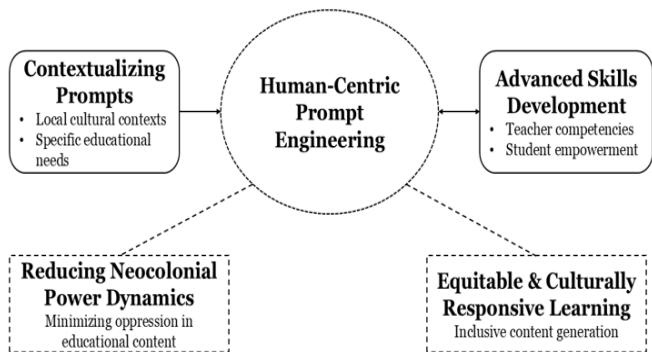


Figure 10. Human-centric prompt engineering framework (Source: Authors, 2025)

Inclusive AI Design Framework

Liberatory design methods

LDM ensure the inclusion of diverse perspectives and experiences. LDM empowers designers to embrace non-Western viewpoints and develop solutions by acknowledging “the intricacies of marginalized identities as a catalyst for positive innovation” (Harrington & Piper, 2018). Central to this approach is recognizing that technological solutions devised within one culture may not seamlessly translate to another. Liberatory design amplifies the voices of underrepresented and non-dominant communities by placing the creation of GenAI tools within the respective culture’s context. If adopted effectively, these strategies promise to democratize the benefits of GenAI technology and address the diverse needs of global educational communities, ultimately ensuring that students from all backgrounds feel represented and valued within these evolving technological spaces (Calzati, 2021).

Foresight by design

FBD is a proactive and human-centric approach to strategic planning and development, enabling developers and organizations to predict and mitigate the potential harm of GenAI while elevating diverse perspectives (Buehring & Liedtka, 2018; Dorton et al., 2023). FBD encourages a comprehensive consideration of trends, emerging technologies, social changes, and other factors that could influence the future trajectory of GenAI systems. Additionally, FBD involves a thorough assessment of the data used to train GenAI algorithms, including factors such as ethnicity, gender, socioeconomic status, and geographic location. By identifying potential biases in the training data, FBD can potentially preemptively address the perpetuation of power imbalances and oppressive outcomes through GenAI-driven decision-making and content generation.

Decentralizing GenAI hubs

Decentralizing GenAI hubs is an emerging approach to mitigating GenAI neocolonialism. GenAI's neocolonial nature creates a concentration of locations where technological innovation and development isolate the job market in Western tech hubs. Ultimately, this limits the perspectives contributing to GenAI technology development. Furthermore, opportunities to grow within the GenAI sector often require

relocation for education and labor. The growing need for more jobs related to GenAI should spark debate on decentralizing the hubs from dominating countries and creating more local design locations. Examples of this decentralization include Google's GenAI lab in Accra, Ghana, and IBM's research office in Nairobi, Kenya. By diversifying the locations of GenAI development, developers can be local to where opportunities and problems are identified. Local solutions and data will be more relevant by working with local voices and within the proximal context. For example, at Google's GenAI lab, developers are improving GenAI's natural language understanding by coding roughly 2,000 languages spoken in Africa. More opportunities exist for tech hubs within countries in Africa, Asia, and Latin America, where local voices, experiences, and histories create more accurate and culturally relevant solutions in sectors like healthcare and education technology.

The development of tools that utilize GAI has the potential to revitalize and reclaim non-dominant and indigenous languages and cultures. An example is Te Hiku Media, a nonprofit Māori radio station operated by Peter-Lucas Jones and Keoni Mahelona. Jones and Mehelona's vision is to revitalize the Māori language, Tte Rre, while still having control of the data rights. According to Hao (2019),

"They overcame resource limitations to develop their own language GAI tools, and created mechanisms to collect, manage, and protect the flow of Māori data so it won't be used without the community's consent, or worse, in ways that harm its people."

Together, they enlisted the local Māori community, 2,500 people, to provide verbal data to support the creation of a speech recognition model. The Māori project represents GAI development that utilizes FBD, LDM, and local context to develop a platform that serves both the people who created it as well as global users. This example of country-specific GAI use of localized GAI deployment is an approach to mitigating neocolonialism within GAI systems. GAI has become a topic for digital-territorial colonialism where retrieval and use of information are centered around Western culture (Mohamed et al., 2020). Through a colonial political economy lens, a common GAI market can be criticized since it helps maintain a dominant culture (Carmel & Paul, 2022).

Human-Centric Pedagogical Level Intervention

Vulnerable groups and non-dominant populations are often marginalized and overlooked in developing educational technology tools and sourcing data for GenAI (Gaskins, 2023). This poses significant risks, as algorithmic bias can become embedded within these technologies, as discussed in the preceding section. To mitigate these concerns, it is important to adopt a human-centric perspective when designing and deploying GenAI in any educational setting (Karakose et al., 2023). A human-centered approach considers the end-user and the contextual environment in which the tool is utilized, while also considering whether GenAI promotes diverse cultural norms and cultural pluralism (Fishman, 2004). We therefore proposed the *human-centric prompt engineering model*, which positions educators and learners at the center of GenAI use in education (see **Figure 10**). The framework begins

with contextualizing prompts to reflect local cultural settings and specific educational needs. This leads to advanced skills development, emphasizing teacher competencies and student empowerment in crafting and interpreting AI-generated content. These two primary components collectively contribute to reducing neocolonial power dynamics by minimizing forms of cultural and epistemic oppression embedded in educational materials, while also promoting equitable and culturally responsive learning through inclusive content generation (Issaka et al., 2022; Khazanchi & Khazanchi, 2024).

Effective promptings strategies

The transition from generic (such as zero-shot) to contextual prompting represents a critical skill for educators and students (Ekin, 2023). Recent investigations have established that contextualized prompting, incorporating local cultural contexts and specific educational needs, significantly enhances output relevance and inclusivity (Mollick & Mollick, 2023; Nyaaba & Zhai, 2025). As illustrated in **Figure 10**, this involves two key dimensions:

1. **Contextualizing prompts:** Embedding local cultural contexts and specific educational needs within query structures.
2. **Advanced skills development:** Building teacher competencies and student empowerment through systematic prompt engineering training.

IMPLICATIONS

In this study, we examine how the biases and ethical concerns of GenAI might perpetuate neocolonial power dynamics within education. GenAI tends to reflect Western ideologies by imposing Western values and norms on non-Western regions. This dynamic does not only risk cultural imperialism but also widens educational disparities between Western and Non-Western regions. While we encourage the use of GenAI in classroom settings to promote learning, we understand that these tools cannot be effective without educators first developing competency to facilitate them. In order to use GenAI for culturally relevant teaching, teachers need competency in GenAI prompting, as well as culturally relevant instructional strategies (Sanusi & Olaleye, 2022). Ladson-Billings (2014) posited that cultural competence is one of the factors for culturally relevant pedagogy. Educators are encouraged to strive to enhance their cultural competence through open discussions and implementing professional learnings (Sanusi & Olaleye, 2022).

We further suggest that educators harness their prompting skills in using these tools by directing prompts towards specific cultural contexts, especially as these tools are generically representing Western cultures. The dominance of Western bias within data sources can perpetuate misinformation and invade the classroom. For example, in a situation where ideologies and images only represent whites or Western culture, students from different cultures and races might not feel belonging in these technological spaces (Obermeyer et al., 2019). There should be a conscious effort to incorporate representation of culture, race, ethnicity, and knowledge.

While this theory has been more of a suggestion for the developers of GenAI tools, we extend this suggestions to educators as well to assist students to use GenAI to identify and analyze their cultural objects, to reveal their unique qualities (Chaves & Gerosa, 2021).

Students from historically marginalized or underrepresented cultural backgrounds must be empowered to critically examine their own cultural identities and develop analytical skills to recognize the pervasive influence of Eurocentric, neocolonial norms within educational systems (Ge et al., 2024). These suggestions depict two distinct approaches; encouraging pupils to use critical thinking skills to recognize covert colonial viewpoints in GenAI and making use of GAI to adapt to pupils' diverse cultural backgrounds (Emenike & Plowright, 2017). A practical example may be teachers employing these GenAI tools to create a platform for discussing biases, which can be subject to critique by students. By doing so, GenAI becomes an agent in the classroom teaching students to think critically about its responses (Nayir & Sari, 2026).

Moreover, the perpetuation of the neocolonial aspects of GenAI may not be limited to classroom practices in education. Recent studies have shown that educational researchers largely depend on GenAI for data and many aspects of research activities such as data analysis, literature reviews, and report writing (Nyaaba et al., 2024; Owoahene Acheampong & Nyaaba, 2024). While these tools are supportive in these proposals, we suggest that educational researchers incorporate human-centric, LDM and FBD to address the prevailing neocolonial aspects of these tools.

GenAI tools possess significant potential to positively impact education and serve as a means to bridge the digital divide (Bentley et al., 2024). However, it is imperative for the educational community to engage in a comprehensive reexamination of various aspects pertaining to GenAI, particularly those that contribute to power dynamics and marginalization. We therefore propose the integration of non-western data in GenAI tools through human-centric, LDM and FBD.

CONCLUSIONS

This study critically interrogated how GenAI reproduces colonial hierarchies within education while simultaneously revealing its potential as a transformative instrument for equity and inclusion. We identified six interrelated dimensions of digital neocolonialism, curriculum ideology, linguistic exclusion, racialized representation, cultural invisibility, pedagogical control, and access inequity. These findings illuminate how GenAI systems continue to privilege Global North epistemologies and socio-technical infrastructures, thereby reproducing epistemic hierarchies in educational spaces. Yet, moving beyond critique, this study advanced a constructive response through the *inclusive AI design framework* and *human-centric prompt engineering model*, which together reframe educators and learners as co-creators of equitable AI-mediated pedagogical practices. In these frameworks, we opined that algorithmic design and prompt engineering are deeply cultural and value-laden processes.

Therefore, equity in AI cannot be achieved through technical refinement alone but requires critical human agency, ethical reflexivity, and participatory inclusion across diverse educational contexts. Through contextualizing prompts, decentralizing AI development, and cultivating advanced teacher competencies, the frameworks proposed here promote a shift toward culturally responsive and inclusive AI in education.

Future Directions

Future studies should empirically evaluate the proposed frameworks across diverse educational and linguistic contexts to test their adaptability and impact on learning equity. Longitudinal and participatory design studies could explore how teachers and students co-develop prompt strategies that resist algorithmic bias while enhancing local relevance and representation. Moreover, research must investigate AI governance, data sovereignty, and model training ethics from Global South perspectives, emphasizing how indigenous and multilingual datasets can reshape the moral architecture of GenAI systems. Advancing this agenda will require interdisciplinary collaboration among educators, computer scientists, and policymakers to ensure that the future of AI in education is intelligent and also just, anchored in cultural humility, human dignity, and global epistemic balance.

Limitation

Although this study offers important insights into how GenAI systems reproduce and can potentially resist colonial hierarchies in education, several limitations must be acknowledged. First, the analysis was limited to two GenAI systems, ChatGPT-4 Turbo and Gemini 1.5, whose architecture, training data, and alignment processes are proprietary. Consequently, interpretations of bias and representation were derived from model outputs rather than from full transparency of internal algorithms or datasets. Second, while the study's zero-shot prompt testing provided a valuable means of comparing responses across Global North and South contexts, results are bounded by the specific prompts and contexts used. Alternative prompt formulations, languages, or domains could yield different outcomes. Third, as a qualitative design experiment, the findings emphasize depth over generalizability. Additionally, the interpretive coding of textual and visual outputs, though systematically conducted, remains influenced by researcher positionality and cultural standpoint. Future replications involving cross-cultural research teams could enhance interpretive validity and reduce subjectivity. Finally, the proposed *inclusive AI design framework* and *human-centric prompt engineering model* are conceptual and have yet to undergo extensive classroom-based validation. Empirical testing in diverse settings will be essential to refine these models, assess their pedagogical impact, and ensure their practical sustainability in addressing global AI inequities.

Author contributions: MN: conceptualization, methodology, data curation, writing – original draft, writing – review & editing, visualization; AW: conceptualization, methodology, writing – original draft, writing – review & editing; GL: methodology, writing – original draft, writing – review & editing. All authors approved the final version of the article.

Funding: No external funding is received for this article.

Ethics declaration: This study did not involve human participants, human data, or animals. The work relied solely on AI-generated screenshots and a conceptual framework developed from published literature. Therefore, formal ethical approval was not required. All sources used in the study have been properly acknowledged, and no ethical concerns arise from the materials employed.

AI statement: This study examines and analyses concepts that were generated by artificial intelligence, and these AI-generated materials are clearly acknowledged in the manuscript. For the authors' own scholarly work, no generative AI tool was used in the conceptualization, interpretation, or development of the study's ideas. Generative AI was employed only for grammar checking and minor language refinement during the writing process.

Declaration of interest: The authors declare no conflicts of interest related to this work.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

REFERENCES

Adam, T. (2019). Digital neocolonialism and massive open online courses (MOOCs): Colonial pasts and neoliberal futures. *Learning, Media and Technology*, 44(3), 365-380. <https://doi.org/10.1080/17439884.2019.1640740>

Alexander, R. J. (2001). Border crossings: Towards a comparative pedagogy. *Comparative Education*, 37(4), 507-523. <https://doi.org/10.1080/03050060120091292>

Ali, J. K. M., Shamsan, M. A. A., Hezam, T. A., & Mohammed, A. A. Q. (2023). Impact of ChatGPT on learning motivation: Teachers and students' voices. *Journal of English Studies in Arabia Felix*, 2(1), 41-49. <https://doi.org/10.56540/jesaf.v2i1.51>

Arora, A., Barrett, M., Lee, E., Oborn, E., & Prince, K. (2023). Risk and the future of AI: Algorithmic bias, data colonialism, and marginalization. *Information and Organization*, 33(3), Article 100478. <https://doi.org/10.1016/j.infoandorg.2023.100478>

Athanassopoulos, S., Manoli, P., Gouvi, M., Lavidas, K., & Komis, V. (2023). The use of ChatGPT as a learning tool to improve foreign language writing in a multilingual and multicultural classroom. *Advances in Mobile Learning Educational Research*, 3(2), 818-824. <https://doi.org/10.25082/AMLER.2023.02.009>

Bai, L., Wu, Y., Li, G., Zhang, W., Zhang, H., & Su, J. (2023). AI-enabled organoids: Construction, analysis, and application. *Bioactive Materials*, 31, 525-548. <https://doi.org/10.1016/j.bioactmat.2023.09.005>

Bentley, S. V., Naughtin, C. K., McGrath, M. J., Irons, J. L., & Cooper, P. S. (2024). The digital divide in action: How experiences of digital technology shape future relationships with artificial intelligence. *AI and Ethics*, 4, 901-915. <https://doi.org/10.1007/s43681-024-00452-3>

Brand, D. J. (2023). Ensuring the ethical development and use of AI in local governance. *Journal of Ethics & Legal Technologies*, 5, 95-109.

Buehring, J. H., & Liedtka, J. (2018). Embracing systematic futures thinking at the intersection of strategic planning, foresight and design. *Journal of Innovation Management*, 6, 134-152. https://doi.org/10.24840/2183-0606.006.003_0006

Calzati, S. (2021). Decolonising "data colonialism": Propositions for investigating the realpolitik of today's networked ecology. *Television & New Media*, 22(8), 914-929. <https://doi.org/10.1177/1527476420957267>

Carmel, E., & Paul, R. (2022). Peace and prosperity for the digital age? The colonial political economy of European AI governance. *IEEE Technology and Society Magazine*, 41, 94-104. <https://doi.org/10.1109/mts.2022.3173340>

Cave, S., & Dihal, K. (2020). The whiteness of AI. *Philosophy & Technology*, 33(4), 685-703. <https://doi.org/10.1007/s13347-020-00415-6>

Chaves, A. P., & Gerosa, M. A. (2021). How should my chatbot interact? A survey on social characteristics in human-chatbot interaction design. *International Journal of Human-Computer Interaction*, 37(8), 729-758. <https://doi.org/10.1080/10447318.2020.1841438>

Chen, B., Zhang, Z., Langrené, N., & Zhu, S. (2023). Unleashing the potential of prompt engineering in large language models: A comprehensive review. *Patterns*, 6(6), Article 101260. <https://doi.org/10.1016/j.patter.2025.101260>

Choi, G. W., Kim, S. H., Lee, D., & Moon, J. (2024). Utilizing generative AI for instructional design: Exploring strengths, weaknesses, opportunities, and threats. *TechTrends*, 68, 832-844. <https://doi.org/10.1007/s11528-024-00967-w>

Chiu, T. K. F. (2021). A holistic approach to the design of artificial intelligence (AI) education for K-12 schools. *TechTrends*, 65, 796-807. <https://doi.org/10.1007/s11528-021-00637-1>

Coleman, D. (2018). Digital colonialism: The 21st-century scramble for Africa through the extraction and control of user data and the limitations of data protection laws. *Michigan Journal of Race & Law*, 24, Article 417. <https://doi.org/10.36643/mjrl.24.2.digital>

Couldry, N., & Mejias, U. A. (2018). Data colonialism: Rethinking big data's relation to the contemporary subject. *Television & New Media*, 20(4), 336-349. <https://doi.org/10.1177/1527476418796632>

Council of Europe. (2022). Council of Europe and artificial intelligence. *Council of Europe*. <https://www.coe.int/en/web/artificial-intelligence>

Daft, R. L., & Lewin, A. Y. (2008). Perspective-Rigor and relevance in organization studies: Idea migration and academic journal evolution. *Organization Science*, 19(2), 177-183. <https://doi.org/10.1287/orsc.1070.0346>

Denzin, N. K., Lincoln, Y. S., MacLure, M., Otterstad, A. M., Torrance, H., Cannella, G. S., Koro-Ljungberg, M., & McTier, T. (2017). Critical qualitative methodologies: Reconceptualizations and emergent construction. *International Review of Qualitative Research*, 10(4), 482-498. <https://doi.org/10.1525/irqr.2017.10.4.482>

Ding, A.-C. E., Shi, L., Yang, H., & Choi, I. (2024). Enhancing teacher AI literacy and integration through different types of cases in teacher professional development. *Computers and Education Open*, 6, Article 100178. <https://doi.org/10.1016/j.caeo.2024.100178>

Dong, X., Hong, Y., Chen, X., Li, W., Zhang, M., & Zhu, Q. (2018). Neural question generation with semantics of question type. In M. Zhang, V. Ng, D. Zhao, S. Li, & H. Zan (Eds.), *Natural language processing and Chinese computing. NLPCC 2018. Lecture notes in computer science*, vol. 11109 (pp. 213-223). Springer. https://doi.org/10.1007/978-3-319-99501-4_18

Dorton, S. L., Ministero, L. M., Alaybek, B., & Bryant, D. J. (2023). Foresight for ethical AI. *Frontiers in Artificial Intelligence*, 6. <https://doi.org/10.3389/frai.2023.1143907>

Ekin, S. (2023). *Prompt engineering for ChatGPT: A quick guide to techniques, tips, and best practices*. TechRxiv. <https://doi.org/10.36227/techrxiv.22683919.v1>

Emenike, N. W., & Plowright, D. (2017). Third culture indigenous kids: Neo-colonialism and student identities in Nigerian international schools. *Journal of Research in International Education*, 16(1), 3-17. <https://doi.org/10.1177/1475240917692757>

Enein, G. F. R. A. (2023). Post-colonialism and the digital age. *Journal of Namibian Studies: History, Politics and Culture*, 38, 262-277.

Enriquez, G., Gill, V., Campano, G., Flores, T. T., Jones, S., Leander, K. M., McKnight, L., & Price-Dennis, D. (2024). Generative AI and composing: An intergenerational conversation among literacy scholars. *English Teaching: Practice & Critique*, 23(1), 6-22. <https://doi.org/10.1108/ETPC-08-2023-0104>

Fishman, D. A. (2004). Mainstreaming ethnicity: Horace Kallen, the strategy of transcendence, and cultural pluralism. *Southern Journal of Communication*, 69(2), 157-172. <https://doi.org/10.1080/10417940409373286>

Furuhata, Y. (2022). *Climatic media: Transpacific experiments in atmospheric control*. Duke University Press. <https://doi.org/10.2307/j.ctv28hj18z>

Gaskins, N. (2023). Interrogating algorithmic bias: From speculative fiction to liberatory design. *TechTrends*, 67(4), 417-425. <https://doi.org/10.1007/s11528-022-00783-0>

Ge, X., Xu, C., Misaki, D., Markus, H. R., & Tsai, J. L. (2024). How culture shapes what people want from AI. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (pp. 1-15). ACM. <https://doi.org/10.1145/3613904.3642660>

Gerbrandy, A., & Phoa, P. (2022). The power of big tech corporations as modern bigness and a vocabulary for shaping competition law as counter-power. In M. Bennett, H. Brouwer, & R. Claassen (Eds.), *Wealth and power* (pp. 166-185). Routledge. <https://doi.org/10.4324/9781003173632-11>

Google. (2024). Gemini for students – get free Google AI Pro for a year. Retrieved March, 2024, from <https://gemini.google/students/>

Google. (2024, February 15). *Our next-generation model: Gemini 1.5*. The Keyword: Google Blog. <https://blog.google/technology/ai/google-gemini-next-generation-model-february-2024/>

Gravett, W. H. (2022). Digital neocolonialism: The Chinese surveillance state in Africa. *African Journal of International and Comparative Law*, 30(1), 39-58. <https://doi.org/10.3366/ajicl.2022.0393>

Hammer, R., & Park, T. M. (2021). The ghost in the algorithm: Racial colonial capitalism and the digital age. In A. I. R. White, & K. Q. King (Eds.), *Global historical sociology of race and racism* (Vol. 38, pp. 221-249). Emerald Publishing Limited. <https://doi.org/10.1108/s0198-871920210000038011>

Hao, K. (2019). The future of AI research is in Africa. *MIT Technology Review*. <https://www.technologyreview.com/2019/06/21/134820/ai-africa-machine-learning-ibm-google/>

Harrington, C. N., & Piper, A. M. (2018). Informing design through sociocultural values: Co-creation with low-income African-American older adults. In *Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare* (pp. 294-298). EAI. <https://doi.org/10.1145/3240925.3240966>

Holland, A., & Ciachir, C. (2024). A qualitative study of students' lived experience and perceptions of using ChatGPT: Immediacy, equity and integrity. *Interactive Learning Environments*, 33(1), 483-494. <https://doi.org/10.1080/10494820.2024.2350655>

Ipek Z.-H., Gözüm, A.-C.-I., Papadakis, St., & Kalogianakis, M. (2023). Educational applications of ChatGPT, an AI system: A systematic review research. *Educational Process*, 12(3), 26-55, <https://doi.org/10.22521/edupij.2023.123.2>

Issaka, C. A., Nyaaba, M., & Iddrisu, F. A. (2022). Attitudes and concerns of pre-service teachers about inclusive education enshrined in the new four-year basic education curriculum in Ghana. *European Journal of Education and Pedagogy*, 3(6), 89-94. <https://doi.org/10.24018/ejedu.2022.3.1.239>

Jin, D., & Cao, J. (2018). "Perspective"—A new approach to serve our light community. *Light: Science & Applications*, 7, Article 89. <https://doi.org/10.1038/s41377-018-0085-y>

Karakose, T., Demirkol, M., Aslan, N., Köse, H., & Yirci, R. (2023). A conversation with ChatGPT about the impact of the COVID-19 pandemic on education: Comparative review based on human-AI collaboration. *Educational Process*, 12(3), 7-25. <https://doi.org/10.22521/edupij.2023.123.1>

Khazanchi, R., & Khazanchi, P. (2024). Generative AI to improve special education teacher preparation for inclusive classrooms. In M. Searson, E. Langran, & J. Trumble (Eds.), *Exploring new horizons: Generative artificial intelligence and teacher education*. AACE.

Kincheloe, J. L., & McLaren, P. (2011). Rethinking critical theory and qualitative research. In K. Hayes, S. R. Steinberg, & K. Tobin (Eds.), *Key works in critical pedagogy* (pp. 285-326). SensePublishers. https://doi.org/10.1007/978-94-6091-397-6_23

Kitsara, I. (2022). Artificial intelligence and the digital divide: From an innovation perspective. In A. Bounfour (Ed.), *Platforms and artificial intelligence: The next generation of competences* (pp. 245-265). Springer. https://doi.org/10.1007/978-3-030-90192-9_12

Kwet, M. (2019). *Digital colonialism: South Africa's education transformation in the shadow of Silicon Valley* [PhD thesis, Rhodes University]. <http://hdl.handle.net/10962/93767>

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: A.K.A. the remix. *Harvard Educational Review*, 34(1), 74-84. <https://doi.org/10.17763/haer.84.1.p2rj131485484751>

Langmia, K., & Sani, M. H. (2023). Decolonizing the African mind in the digital space. In U. S. Akpan (Ed.), *African media space and globalization* (pp. 343-354). Palgrave Macmillan. https://doi.org/10.1007/978-3-031-35060-3_15

Latif, E., Mai, G., Nyaaba, M., Wu, X., Liu, N., Lu, G., Li, S., Liu, T., & Zhai, X. (2023). *Artificial general intelligence (AGI) for education*. arXiv. <https://doi.org/10.48550/arXiv.2304.12479>

Lee, G.-G., & Zhai, X. (2024). Using ChatGPT for science learning: A study on pre-service teachers' lesson planning. *IEEE Transactions on Learning Technologies*, 17, 1683-1700. <https://doi.org/10.1109/TLT.2024.3401457>

Lee, S. C., & Kang, K. (2024). The effect of 'integrated science logic & essay' class using generative AI on technological, pedagogical, and content knowledge (TPACK) of pre-service science teachers. *Journal of Curriculum Evaluation*, 27, 133-155. <https://doi.org/10.29221/jce.2024.27.1.133>

Li, B., Wang, C., Bonk, C. J., & Kou, X. (2024). Exploring inventions in self-directed language learning with generative AI: Implementations and perspectives of YouTube content creators. *TechTrends*, 68(4), 803-819. <https://doi.org/10.1007/s11528-024-00960-3>

Lim, W. M., Gunasekara, A., Pallant, J. L., Pallant, J. I., & Pechenkina, E. (2023). Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. *The International Journal of Management Education*, 21, Article 100790. <https://doi.org/10.1016/j.ijme.2023.100790>

Lynch, R., Young, J. C., Jowaisas, C., Sam, J., Boakye-Achampong, S., Garrido, M., & Rothschild, C. (2023). 'The tears don't give you funding': Data neocolonialism in development in the Global South. *Third World Quarterly*, 44(5), 911-929. <https://doi.org/10.1080/01436597.2023.2166482>

Menon, S. (2023). Postcolonial differentials in algorithmic bias: Challenging digital neo-colonialism in Africa. *SCRIPTed: A Journal of Law, Technology & Society*, 20, 383-399. <https://doi.org/10.2218/scrpt.20.2.2023.8980>

Mohamed, S., Png, M.-T., & Isaac, W. (2020). Decolonial AI: Decolonial theory as sociotechnical foresight for artificial intelligence. *Philosophy & Technology*, 33, 659-684. <https://doi.org/10.1007/s13347-020-00405-8>

Mollick, E. R., & Mollick, L. (2023). *Using AI to implement effective teaching strategies in classrooms: Five strategies, including prompts*. SSRN. <https://doi.org/10.2139/ssrn.4391243>

Nayir, F., & Sarı, T. (2026). Algorithmic bias in generative AI: Implications for critical pedagogy, inclusivity, and equity in education. In A. Bozkurt (Ed.), *Rethinking education and agency in the age of human-generative AI interaction* (pp. 149-182). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3373-1195-1.ch005>

Noble, S. U. (2018). *Algorithms of oppression: How search engines reinforce racism*. New York University Press.

Nyaaba, M. (2023). *Comparing human and AI's (GPT-4 and Gemini) understanding of the nature of science*. SSRN. <https://doi.org/10.2139/ssrn.4661602>

Nyaaba, M., & Zhai, X. (2024). Generative AI professional development needs for teacher educators. *Journal of AI*, 8(1), 1-13. <https://doi.org/10.61969/jai.1385915>

Nyaaba, M., & Zhai, X. (2025). Developing a theory-grounded AI tool for the generation of culturally responsive lesson plans. *Computers and Education: Artificial Intelligence*, 9, Article 100474. <https://doi.org/10.1016/j.caai.2025.100474>

Nyaaba, M., Kyeremeh, P., Majialuwe, E. K., Owusu-Fordjour, C., & Asebiga, E. (2024). Generative AI in academic research: A descriptive study on awareness, gender usage, and views among pre-service teachers. *Journal of AI*, 8(1), 45-60. <https://doi.org/10.61969/jai.1400867>

Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science*, 366(6464), 447-453. <https://doi.org/10.1126/science.aax2342>

OpenAI. (2024). *ChatGPT pricing: Free, Plus, Pro, Business & Enterprise*. Retrieved March, 2024, from <https://chatgpt.com/pricing>

Owoahene Acheampong, K., & Nyaaba, M. (2024). *Review of qualitative research in the era of generative artificial intelligence*. SSRN. <https://doi.org/10.2139/ssrn.4686920>

Ożegalska-Łukasik, N., & Łukasik, S. (2023). Culturally responsive artificial intelligence—Problems, challenges and solutions. *Intercultural Relations*, 7(2(14)), 106-119. <https://doi.org/10.12797/RM.02.2023.14.07>

Ragnedda, M. (2020). New digital inequalities: Algorithms divide. In M. Ragnedda (Ed.), *Enhancing digital equity: Connecting the digital underclass* (pp. 61-83). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-49079-9_4

Rahman, A. (2020). *Postcolonialism and the digital age*. SAGE.

Rasul, T., Nair, S. R., Kalendra, D., Robin, M., Santini, F. D. O., Ladeira, W., Sun, M., Day, I., Rather, A., & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. *Journal of Applied Learning and Teaching*, 6(1). <https://doi.org/10.37074/jalt.2023.6.1.29>

Sanusi, I. T., & Olaleye, S. A. (2022). An insight into cultural competence and ethics in K-12 artificial intelligence education. In *Proceedings of the IEEE Global Engineering Education Conference* (pp. 790-794). IEEE. <https://doi.org/10.1109/educon52537.2022.9766818>

Sari, T., Nayir, F., & Bozkurt, A. (2024). Reimagining education: Bridging artificial intelligence, transhumanism, and critical pedagogy. *Journal of Educational Technology and Online Learning*, 7, 102-115. <https://doi.org/10.31681/jetol.1308022>

Share, J., Mamikonyan, T., & Lopez, E. (2019). Critical media literacy in teacher education, theory, and practice. In *Oxford research encyclopedia of education*. Oxford University Press. <https://doi.org/10.1093/acrefore/9780190264093.013.1404>

Sok, S., & Heng, K. (2023). *ChatGPT for education and research: A review of benefits and risks*. SSRN. <https://doi.org/10.2139/ssrn.4378735>

Stürmer, M., Nussbaumer, J., & Stöckli, P. (2021). *Security implications of digitalization: The dangers of data colonialism and the way towards sustainable and sovereign management of environmental data*. arXiv. <https://doi.org/10.48550/arXiv.2107.01662>

UNESCO. (2021). Recommendation on the ethics of artificial intelligence. UNESCO. <https://www.unesco.org/en/articles/recommendation-ethics-artificial-intelligence>

van Niekerk, D., Perez-Ortiz, M., Shawe-taylor, J., Orlic, D., Drobniak, I., Kay, J., Siegel, N., Evans, K., Moorosi, N., Eliassi-Rad, T., Tanczer, L. M., Holmes, W., Deisenroth, M. P., Straw, I., Fasli, M., Adams, R., Oliver, N., Mladenic, D., & Aneja, U. (2024). Challenging systematic prejudices: An investigation into bias against women and girls in large language models. UNESCO. https://ircai.org/wp-content/uploads/2024/03/IRCAI_UNESCO_Report_Challenging_Systematic_Prejudices_web_March2024.pdf

Zembylas, M. (2023). A decolonial approach to AI in higher education teaching and learning: Strategies for undoing the ethics of digital neocolonialism. *Learning, Media and Technology*, 48(1), 25-37. <https://doi.org/10.1080/17439884.2021.2010094>

Zhai, X., Nyaaba, M., & Ma, W. (2025). Can generative AI and ChatGPT outperform humans on cognitive-demanding problem-solving tasks in science? *Science & Education*, 34, 649-670. <https://doi.org/10.1007/s11191-024-00496-1>

Zhang, Y., & Cao, L. (2023). Exploring the potential presence of colonialism in the digital art field from a global perspective. *Advances in Education, Humanities and Social Science Research*, 8, 66-76. <https://doi.org/10.56028/aehssr.8.1.66.2023>