

The postdigital turn, the GenAI hype, and quality teaching and learning: What is the place of critical thinking and what can we do to promote it?

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Abstract: As digital technologies become seamlessly embedded in everyday life, distinctions between tools and human practices collapse, raising critical questions about the future of education and the place of critical thinking within it. While generative artificial intelligence offers powerful new capabilities, its widespread adoption risks reducing intellectual engagement to surface-level outputs, simulating criticality without genuine understanding. Drawing on postdigital theory and critical pedagogy, this reflection paper argues for a reassertion of critical thinking as an embodied, dialogic, and ethical practice. The analysis also considers the evolving notion of postdigital citizenship, emphasizing the need for learners to navigate not only digital tools, but also the social, political, and ideological systems they enact. Ultimately, the paper calls for educational practices that promote meaningful, critical engagement with AI, viewing learners not as passive recipients of machine-generated knowledge but as active participants in shaping democratic, just, and thoughtful futures.

Keywords: generative artificial intelligence, postdigital theory, critical pedagogy, critical literacy, critical thinking, educational practices.

Resumo: À medida que as tecnologias digitais se integram progressivamente na vida quotidiana, as fronteiras entre ferramentas e práticas humanas tornam-se cada vez mais difusas, suscitando questões críticas sobre o futuro da educação e o papel do pensamento crítico nesse contexto. Embora a inteligência artificial generativa ofereça novas e poderosas capacidades, a sua adoção generalizada corre o risco de reduzir o envolvimento intelectual a resultados superficiais, simulando criticidade sem compreensão genuína. Com base na teoria pós-digital e na

pedagogia crítica, este artigo de reflexão defende a reafirmação do pensamento crítico como uma prática incorporada, dialógica e ética. A análise também considera a noção em evolução de cidadania pós-digital, salientando a necessidade de os alunos navegarem não só pelas ferramentas digitais, mas também pelos sistemas sociais, políticos e ideológicos que elas decretam. Em última análise, o artigo apela a práticas educativas que promovam um envolvimento significativo e crítico com a IA, encarando os alunos não como receptores passivos de conhecimentos gerados por máquinas, mas como participantes activos na formação de futuros democráticos, justos e ponderados.

Palavras-chave: inteligência artificial generativa, teoria pós-digital, pedagogia crítica, literacia crítica, pensamento crítico, práticas educativas.

Resumen: A medida que las tecnologías digitales se integran progresivamente en la vida cotidiana, las fronteras entre las herramientas y las prácticas humanas se difuminan cada vez más, lo que plantea cuestiones críticas sobre el futuro de la educación y el papel del pensamiento crítico en este contexto. Aunque la inteligencia artificial generativa ofrece nuevas y potentes capacidades, su adopción generalizada corre el riesgo de reducir el compromiso intelectual a resultados superficiales, simulando la criticidad sin una comprensión genuina. Basándose en la teoría postdigital y en la pedagogía crítica, este artículo de reflexión aboga por la reafirmación del pensamiento crítico como práctica ética, dialógica y encarnada. El análisis también tiene en cuenta la evolución de la noción de ciudadanía posdigital, y subraya la necesidad de que los estudiantes no sólo se manejen con las herramientas digitales, sino también con los sistemas sociales, políticos e ideológicos que promulgan. En última instancia, el artículo aboga por prácticas educativas que promuevan un compromiso significativo y crítico con la IA, y que no consideren a los estudiantes como receptores pasivos de conocimientos generados por máquinas, sino como participantes activos en la configuración de futuros democráticos, justos y reflexivos.

Palabras clave: inteligencia artificial generativa, teoría postdigital, pedagogía crítica, alfabetización crítica, pensamiento crítico, prácticas educativas

1. Introduction

We are living in a time when technologies and human practices are so deeply interwoven that they can no longer be meaningfully separated. Social media has become indistinguishable from friendship, political discourse has morphed into viral content, and tools like ChatGPT are increasingly used not just to support student learning but at times to replace the act of learning itself. This convergence between tool and practice is a defining feature of the postdigital condition – a state in which digital technologies are no longer novel additions to our lives but embedded, ubiquitous, and taken for granted. The postdigital turn (Jandrić et al., 2018; Jandrić & Knox, 2022) does not signify a rupture from the digital, but a reconfiguration of digital life into a continuum with the analogue, the biological, and the social. Subsequently, the prefix “post” in “postdigital” should not be understood as an end to the digital era, but rather as a cultural shift similar to movements like post-punk or post-feminism marking both a continuation and a transformation (Cramer, 2015).

Against this backdrop, the current enthusiasm for generative artificial intelligence (GenAI) in education raises urgent questions about the future of teaching, learning, and, crucially, critical thinking. Much of the discourse surrounding GenAI focuses on its efficiencies and capabilities, yet fails to ask what kind of intellectual engagement it fosters. As Jandrić (2024) emphasizes, postdigital education must grapple not only with the presence of new digital technologies and their associated “hype”, but with the social, ethical, and epistemological frameworks they enact. Within increasingly automated learning environments, critical thinking must be reasserted as a core educational value – not just a skillset, but a way of being and relating. In this context, to think critically means not only to evaluate content but also to interrogate the infrastructures of knowledge production and the logics that shape them. Quality teaching and learning, therefore, must involve deliberate, reflective engagement with the tools we use and the systems we inhabit, ensuring that education remains a site of agency, complexity, and transformation.

Within this context, the following questions emerge, which the present reflection paper will aim to tackle:

- What is the place of critical thinking in today’s AI-infused world?
- How can critical thinking be promoted within the context of chatbot-human interaction for educational purposes?

2. Postdigital citizenship and critical pedagogies

In a world where words are reduced to tokens and actions to “likes”, the role of the citizen in postdigital societies demands urgent reconsideration. The postdigital society is not simply a technological infrastructure but a complex mesh of practiced, conceived, and lived spaces (Lefebvre, 2000), where both human and non-human actors continuously (re)define social, political, and epistemic relationships. Within these hybrid environments, the notion of citizenship expands beyond institutional rights and responsibilities to include algorithmic entanglements, datafication, and digitally mediated practices (Rapanta, 2023). Postdigital citizens, therefore, are not only participants in democratic processes but also negotiators of meaning across fragmented digital and physical terrains. Their rights may include the ability to “like,” “share,” or “tweet,” but such acts fall short of fulfilling the duties of critical engagement or solidarity, which are foundational to a meaningful public sphere. From a critical pedagogical perspective, this superficial engagement demands resistance. As Freire (1970/2005) argued, true education must begin with the praxis of reflection and action upon the world in order to transform it. Likewise, McLaren (2007) emphasized that critical pedagogy must confront the reproduction of dominant ideologies embedded within educational and cultural technologies. In the context of postdigital citizenship, these insights prompt a necessary skepticism toward the commodification of participation and the depoliticization of discourse.

What is more, while GenAI systems increasingly produce fluent, coherent, and even persuasive responses, recent research has cautioned that this fluency should not be mistaken for genuine understanding. The so-called “illusion of thinking” (Shojaee et al., June 2025) describes how large language models (LLMs) can mimic the surface structure of reasoning, emulating argumentation, synthesis, or critical judgment, without possessing the underlying intentionality or epistemic grounding. This raises profound implications for education in the postdigital age, where students may rely on GenAI not just as a writing assistant, but as a surrogate for thought. If a model can convincingly simulate critical thinking without engaging in it, and if learners come to accept this simulation as equivalent to genuine reflection, the educational project risks collapsing into performance without substance. In this context, the role of critical thinking must be reasserted as a human, embodied, and dialogic practice – one that resists substitution by language patterns alone and insists on inquiry, struggle, and meaning-making as central to learning. Postdigital education must therefore look beyond the textual polish of AI outputs and ask harder

questions about what constitutes authentic cognition, judgment, and intellectual growth in a hybrid human-machine landscape.

3. GenAI use and quality teaching and learning: any evidence?

Current evidence on the impact of the use of GenAI on the quality of teaching and learning, especially when it comes to the promotion of critical thinking (CT) skills, is mixed. Numerous studies (e.g., Dindorf et al., 2024; Essel et al., 2024; Essien et al., 2024; Lee et al., 2024; Liang & Wu, 2024; Michalon & Camacho-Zuñiga, 2023; Ruiz-Rojas et al., 2024; Schenck, 2024; Suriano et al., 2025; Tang et al., 2024; van den Berg & du Plessis, 2023; Yusuf et al., 2024) highlight how tools like ChatGPT promote reflective learning, metacognitive awareness, peer collaboration, and deeper cognitive engagement. For example, Essel et al. (2024) and Suriano et al. (2025) demonstrate that AI prompts help learners engage in analysis and synthesis, crucial CT components. Similarly, Ruiz-Rojas et al. (2024) and Essien et al. (2024) show that AI strengthens evaluative and collaborative skills in higher education. Studies by Yusuf et al. (2024) and Tang et al. (2024) show that learners gain critical awareness by assessing AI outputs or peer feedback. Fan et al. (2025) also reported that students supported by ChatGPT outperformed peers in short-term writing tasks, suggesting enhanced immediate cognitive performance under guided AI use. These findings support the idea that when scaffolded effectively, AI serves as a powerful facilitator of higher-order thinking and self-regulated learning.

Conversely, several studies describe the impact of GenAI on critical thinking as neutral, meaning its effect is highly contingent on learner motivation, instructional context, or the nature of the task (Dai et al., 2023; Lin et al., 2024; Tseng & Lin, 2024; van den Berg, 2024; Vasconcelos & dos Santos, 2023; Wang, 2024; Xiaolei & Teng, 2024). For instance, Wang (2024) and Dai et al. (2023) reveal that individual differences in self-regulation significantly mediate AI's impact on learning. Stadler et al. (2024) provide further nuance, showing that students using ChatGPT experienced reduced cognitive load during scientific inquiry but demonstrated lower-quality reasoning compared to peers using traditional web searches. While the tool simplified the task, it appeared to undermine the depth of students' argumentative thinking – a core aspect of CT. This echoes findings from other neutral-impact studies (e.g., Lin et al., 2024), where the benefits of AI were offset by concerns about over-reliance or insufficient cognitive engagement unless paired with robust pedagogical design.

Only a limited number of studies indicate a negative influence of GenAI on critical thinking. Most notably, Zhang et al. (2024) found that students who were heavily dependent on AI tools like ChatGPT exhibited decreased initiative, weaker problem-solving abilities, and diminished independent reasoning. Similarly, Fan et al. (2025) warned of "metacognitive laziness" – a phenomenon in which AI-supported learners bypass reflective processes in favor of AI-generated responses. Although students in the AI group in their study showed higher task performance in essay revisions, their engagement in essential metacognitive actions like planning, monitoring, and evaluating was significantly reduced. These findings suggest that without explicit instructional scaffolding or critical reflection strategies, generative AI can unintentionally discourage students from engaging in the sustained effort required for CT development.

Overall, the reviewed studies suggest that it is possible for GenAI tools to be used effectively for educational purposes, whereas with several limitations, and sometimes even counterproductive results. One interesting finding we draw is that the focus of the majority of empirical studies so far held to identify any impact of the use of GenAI tools on learning has been on skills related to critical thinking skills, such as analysis, synthesis, planning, and self-regulation. However, as explained in the next section, critical GenAI literacy cannot be reduced to a set of skills, but rather conceptualized as a set of practices held both by teachers and learners and in which GenAI is included as a co-actor.

4. Towards conceptualizing Critical GenAI literacy

Artificial Intelligence is neither entirely artificial nor truly intelligent. Unlike the symbolic reasoning and explicit knowledge representation of Good Old-Fashioned AI (GOFAI), which aimed to model intelligence through rule-based systems (Haugeland, 1989), today's AI is narrow and relies heavily on statistical pattern recognition through machine learning. Modern generative AI (GenAI), for instance, processes vast multimodal data (e.g., text, images, audio, video, user interactions, and metadata) without structured reasoning or deep world modeling, making it less explainable and logically robust than GOFAI (Broussard, 2018). The "depth" in deep learning refers to layered neural architectures that detect abstract patterns, not superior cognitive capabilities, and this complexity often leads to errors such as hallucinations – plausible but factually incorrect outputs. Moreover, machine learning struggles with generalization beyond familiar data, lacking the adaptive, abstract, and causal reasoning seen in human cognition. As Chollet (2017)

explains, current models can only perform local generalization, adapting to new situations that closely resemble past data, whereas human cognition can rapidly adapt to entirely novel or long-term scenarios.

While GenAI tools can potentially aid critical thinking, especially when used reflectively (e.g., Liang & Wu, 2024; Suriano et al., 2025), their epistemological limitations stemming from uncritical reliance on human-generated data and dominant socio-cultural narratives must be acknowledged. From a postdigital standpoint, critical literacy emphasizes inclusive and participatory practices that resist the influence of Western, colonial, and capitalist ideologies (Luckett & Bhatt, 2024), which are often embedded in GenAI systems. Therefore, GenAI outputs should not be treated as “masticated food” ready for consumption, but rather as material to be critically analyzed and potentially rejected when misaligned with learning goals. As Bayne et al. (2020) caution in their Manifesto for Teaching Online, “algorithms and analytics re-code education: pay attention!”. Building on this, it becomes crucial to understand and navigate how algorithms are reshaping educational practices. In her conversation with Jandrić (2017), Bayne posed the central question: “Where does the human teacher leak into the algorithm, and where does the algorithm leak into the human teacher’s practice?” In today’s context, the need for “algorithmically inflected” educators and learners, equipped to critically engage with GenAI tools and evaluate their outputs, is more pressing than ever.

Therefore, the emerging question is: “How can critical GenAI literacy be defined?”. In a recent collective article in *Postdigital Science and Education Journal* (Rapanta et al., in press), thirteen authors were invited to share their insights on critical GenAI literacy definition, with each author considering different configurations of the term. Our collective thinking and dialogue resulted in a co-constructed configuration of critical GenAI literacy summarized in Figure 1. Our framework illustrates the multidimensional nature of critical GenAI literacy, and the broad competencies required to engage with GenAI in critically informed and ethically grounded ways. Rather than reducing AI literacy to a set of technical skills, our proposal foregrounds the complex interplay between algorithmic technologies and the human, political, epistemological, and ethical conditions in which they operate.

At the center of this framework is an emphasis on metacognitive and algorithmic awareness, as well as the capacity to interrogate biases, data quality, and underlying values. This core is framed by interconnected domains that inform and shape one another. These include the epistemological and ontological challenges of AI-generated content, such as

its decontextualization, simulation of knowledge, and its influence on how embodiment and truth are understood in a postdigital world. The framework also emphasizes the shifting contours of human agency, drawing attention to how reasoning, justification, and intra-relations are reconfigured by algorithmic systems.

Another key dimension highlights the need for active engagement with AI, rejecting passive consumption in favor of participatory interaction, technical inquiry, and collaborative sense-making between humans and AI. Finally, the model situates AI within broader ethical and justice-oriented concerns, underscoring how social, political, and economic forces – alongside issues of privilege, *epistemicide* (the phenomenon of risking epistemic diversity through privileging English and Western knowledge) and ideology – shape the development and deployment of GenAI systems. Under this vein, in the next section, I will propose some possible directions in terms of concrete practices that can be implemented to promote critical GenAI literacy in educational contexts.

Figure 1

A Conceptual Framework of Critical GenAI Literacy (from Rapanta et al., in press)



5. Some possible directions towards promoting Critical GenAI literacy

Purposeful and goal-oriented use. The growing carbon and water footprint of AI models (Li et al., 2023) calls for a cautious use of tools based on large language models (LLMs). Sustainable GenAI use presupposes a purposeful and limited interaction with the AI agents, avoiding, for example, chatting for fun, or even using the chatbot as counsellor for everyday actions and decisions (this latter also implies life-threatening risks, as recent news brought to our attention -see, for example, El Atillah, 2023, or Payne, 2024). A goal-oriented use of GenAI in educational contexts implies an alignment between the prompts and the outputs, on one hand, and the specific teaching and learning objectives, on the other. For this to be possible, first the educators must make the learning goals of each activity explicit, as well as the criteria reflecting whether the goals were met and to what degree. Second, both educators and learners must be able to create prompts that guide the AI tool towards meeting those goals. And third, both educators and learners must be able to assess whether the AI-generated outputs directly address those goals. Figure 2 shows an example of a GenAI-assisted summative assessment activity, and the specific steps teachers and learners can take to carry it out in a goal-oriented manner.

Figure 2

Example of a GenAI-assisted Summative Assessment Activity

GenAI-Assisted Summative Assessment Activity: Argumentative Essay on a Societal Issue	
Objective: Evaluate students' ability to construct, refine, and present a well-reasoned argumentative essay using GenAI as a support tool.	
Preparation phase	
Teacher Actions	Learner Actions
Clearly define the learning goals for the assessment (e.g., critical thinking, argumentation, evidence use, writing clarity). Select a societal issue aligned with the curriculum (e.g., climate change, AI ethics). Provide students with clear guidelines on the structure of the essay and the ethical use of GenAI (e.g., using AI to brainstorm ideas or refine language, not to produce the essay entirely).	Understand the assignment guidelines, including expected length, argumentation requirements, and how to cite AI assistance. Research the societal issue independently through a teacher-guided internet search with specific predefined source quality criteria to gather foundational knowledge on the issue.
Drafting phase	
Teacher Actions	Learner Actions
Introduce students to the GenAI tool (e.g., ChatGPT) and demonstrate how it can assist in brainstorming, outlining, or refining ideas. Provide a rubric emphasising originality, coherence, and critical engagement, including a component for ethical AI use.	Use GenAI to brainstorm ideas or develop an essay outline (e.g., asking, "What are key arguments for and against regulating AI?"). Draft the essay independently, integrating AI suggestions selectively, and ensuring originality
Refinement phase	
Teacher Actions	Learner Actions
Guide students on refining drafts using AI for specific purposes, such as improving grammar and style, suggesting alternative phrasing for clarity, or fact-checking with supplementary research.	Use GenAI to refine specific sections of the draft (e.g., asking, "Can you rephrase this argument for clarity?"). Cross-check AI-generated suggestions with reliable sources to validate accuracy and credibility.
Finalising phase	
Teacher Actions	Learner Actions
Collect final essays and assess them using the rubric, focusing on coherence, originality, and the ethical integration of GenAI. Include a reflective component where students explain how they used GenAI and how it influenced their writing process.	Submit the final essay, ensuring proper acknowledgment of AI assistance. Write a reflection on the benefits and limitations of using GenAI in the assessment, including lessons learnt.

Inquiry and questioning. The art of prompting or prompt engineering is not just a mere compilation of questions to the AI chatbot, but an important part of an inquiry process, essential for self-regulated learning. At the same time, questioning the output of each prompt is as equally important as the prompt itself, as it may lead to further prompting (refining), prompt reconstruction, or even abandonment of the task, if the chatbot's assistance is considered limited or irrelevant. In the argumentation literature, concrete types of critical questions have been proposed that match specific types of

arguments or schemes of presumptive reasoning (Walton et al., 2008). For instance, the critical questions accompanying an argument from expert opinion can be used as prompts to dig deeper into the chatbot's answers as shown by the example in Table 1. These types of questions are specifically guided by the nature of a formulated argument, given that different types of argumentation schemes call for different types of critical questions. At a more generic level, two metacognitive questions may be used as critical prompts, namely "Why do you say so?" and "How do you know that this is the case?" (Kuhn, 2001). In the case of a human-chatbot interaction, and given the tendency of GenAI tools to draw on and create false information, it is also recommended to explicitly ask for the specific sources used to produce an answer, and check the existence, validity, and trustworthiness of each one of those.

Table 1

Exercise Using Critical Questions to Enhance the Depth of a Chatbot-generated Argument

Argumentation Scheme: Argument from Expert Opinion <ol style="list-style-type: none"> Premise 1: Source EEE is an expert in domain DDD. Premise 2: EEE asserts that proposition AAA is true (or false). Conclusion: AAA is true (or false).
Critical Questions for the Argumentation Scheme <ol style="list-style-type: none"> Expertise Question: Is EEE genuinely an expert in domain DDD? Field Question: Is DDD a legitimate domain in which expertise exists? Opinion Question: What did EEE assert that implies AAA? Trustworthiness Question: Is EEE reliable and trustworthy as a source? Consistency Question: Is AAA consistent with what other experts assert? Backup Evidence Question: Is AAA supported by evidence other than EEE's opinion?
Example Interaction Using Critical Questions User's Goal: To assess the reliability of ChatGPT's claim about climate change based on expert opinion. Initial Interaction User: What do experts say about the impact of human activities on climate change? ChatGPT: Most climate scientists assert that human activities, particularly the burning of fossil fuels, are the primary drivers of recent climate change. For example, the Intergovernmental Panel on Climate Change (IPCC) has stated that the evidence linking human activity to global warming is unequivocal.
Enhanced Interaction Using Critical Questions Expertise Question: User: Is the IPCC genuinely an expert in the domain of climate science? ChatGPT: Yes, the IPCC is a leading international body composed of hundreds of scientists who specialize in climate science. Its reports are based on comprehensive reviews of peer-reviewed studies.
Field Question: User: Is climate science a legitimate domain in which expertise exists? ChatGPT: Yes, climate science is a well-established field that integrates disciplines such as atmospheric physics, oceanography, and ecology. It has been recognized as a scientific discipline for decades and relies on empirical evidence and predictive modeling.

<p>Opinion Question: User: What exactly does the IPCC assert about human activities and climate change?</p> <p>ChatGPT: The IPCC asserts that human activities, particularly the release of greenhouse gases like CO₂, are the dominant cause of global warming observed since the mid-20th century. This conclusion is drawn from extensive data, including temperature records, ice core analyses, and climate models.</p>
<p>Trustworthiness Question: User: Is the IPCC reliable and trustworthy as a source?</p> <p>ChatGPT: The IPCC is widely regarded as trustworthy due to its rigorous peer-review process and the diversity of scientific contributors. However, like all scientific institutions, it is open to scrutiny and bases its conclusions on the best available evidence.</p>
<p>Consistency Question: User: Are the IPCC's claims consistent with what other experts assert?</p> <p>ChatGPT: Yes, the IPCC's findings align with the consensus of the vast majority of climate scientists worldwide. For example, organizations like NASA, NOAA, and the American Meteorological Society have independently confirmed similar conclusions.</p>
<p>Backup Evidence Question: User: Is there evidence supporting the IPCC's claims besides its opinion?</p> <p>ChatGPT: Yes, the evidence includes rising global temperatures, melting glaciers, sea-level rise, and increased atmospheric CO₂ concentrations, all of which are supported by independent data sources and studies.</p>

Scaffolding and differentiation. Adapting GenAI interactions and outputs to meet diverse learner needs by customizing difficulty levels, pacing, cultural relevance, or content focus is a key learning differentiation function promoting efficiency and criticality. On the one hand, such functions can be used by the teacher to scaffold learning for all, at a classroom management or planification level. On the other hand, they can be used by the learners themselves as part of a self-regulated learning process or a better understanding of an assignment/activity requirements. Figure 3 shows examples of learning differentiation prompts to the GenAI tool from the teacher's and learners' perspective regarding four aspects of the learning process, namely content, activities, assessment, and environment.

Figure 3

Examples of Learning Differentiation Prompts

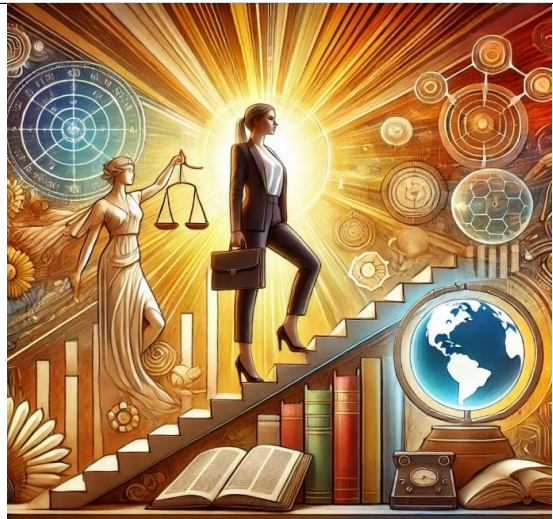
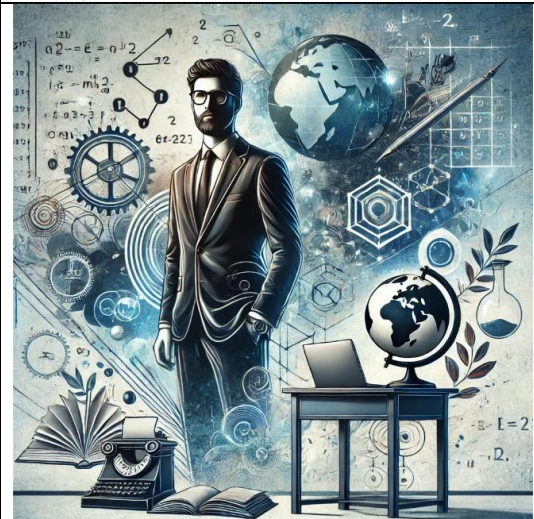
Content (what students learn)	
<i>Teacher-to-GenAI prompts</i>	<i>Learner-to-GenAI prompts</i>
Can you generate three versions of this text on photosynthesis: one for beginners, one intermediate, and one for advanced learners?	Can you summarize this article using a diagram or bullet points?

Suggest multimedia resources (videos, podcasts, infographics) to explain the concept of gravity to students with different learning preferences	Help me adapt this article into simpler language for English language learners
Activities (how students engage with the content)	
<i>Teacher-to-GenAI prompts</i>	<i>Learner-to-GenAI prompts</i>
Create three activity options for practicing linear equations: one hands-on, one collaborative, and one writing-based.	Give me a creative way to practice this concept—maybe a game or roleplay?
Suggest project ideas at varying levels of complexity for students studying ecosystems.	Can you guide me through this problem step by step at my pace?
Assessment (how students show what they know)	
<i>Teacher-to-GenAI prompts</i>	<i>Learner-to-GenAI prompts</i>
Suggest alternative assessment formats for a unit on fractions—beyond just a test.	Can you help me turn what I've learned into a short script, video idea, or comic?
Help me create rubrics that match different project formats but assess the same objectives.	Give me feedback on this paragraph—what's working, and what can I improve?
Environment (where and under what conditions learning occurs)	
<i>Teacher-to-GenAI prompts</i>	<i>Learner-to-GenAI prompts</i>
Suggest tools or adjustments I can offer to make this digital task more accessible.	What are some strategies to make my workspace more comfortable or motivating?
Help me design a classroom layout that encourages both quiet focus and collaboration.	Can you help me create a personalized study plan that includes breaks and movement?

Reflective practice. It is broadly admitted that the improper use of AI, driven by algorithmic bias and inadequate governance, poses a risk that could undermine human rights and reinforce existing inequalities (Pargman et al., 2024). Therefore, critical AI literacy involves reflection on AI's meaning and responsible use, namely its challenges and implications regarding autonomy, agency, academic freedom, and social equity (ibid.). From a pedagogical perspective, this reflection can be framed as an evaluation of how AI-driven feedback supports learning outcomes while avoiding plagiarism and over-reliance on technology. An example of a GenAI-assisted teaching-learning activity guiding reflection can be using the implicit biases in the training data to fuel GenAI systems into opportunities for reflection on generalized biases in humanity (see also Borge et al., 2024). Figure 4 shows an example of a reflection activity using an image produced by DALL-E.

Figure 4

Example of a Critical Reflection Activity Triggered by an AI-generated Image

Type of activity: GenAI-assisted reflection on humanity's generalised biases	
Learning objectives: <ul style="list-style-type: none"> • Critically examine AI-generated outputs to identify their strengths, limitations, and potential biases. • Assess the accuracy, relevance, and implications of AI-generated insights within the learning context. • Integrate AI-generated content with personal knowledge to develop new perspectives or solutions. • Use insights from AI-generated outputs to address problems or support informed decision-making. 	
Context (communicated by the teacher to the students): As you know, GenAI systems are trained with a huge amount of available human-created data, which, as expected, often represent biases and stereotypes reproduced by human generations along the years. I would like you to think of a prompt for the chatbot to generate an image about females' representation in a particular context, then a second prompt asking for an image of males' representation in the same context, and a third prompt asking the AI to compare the two images.	
Whole-class discussion activity (including an example of GenAI output)	
Image created by DALL-E following the prompt: Can you create a visual representation of what it means to be a woman academic in the 21st century?	Image created by DALL-E following the prompt: Can you now create a visual representation of what it means to be a male academic in the 21st century?
	

ChatGPT 4o reply to the prompt “Can you explain the main similarities and differences in the two visuals?” The two visuals, representing a 21st-century woman academic and a male academic, share similarities and also reflect distinct thematic nuances:

Similarities:

1. Academic Elements:

- Both images include traditional symbols of academia such as books, laptops, scientific tools, and globes to emphasize knowledge, learning, and global impact.

2. Focus on Progress and Challenges:

- Each figure is depicted in an empowering stance, symbolizing growth and resilience within the academic realm.
- Both visuals integrate abstract challenges, such as work-life balance (symbolized by a scale) and societal expectations, portraying shared struggles in academia.

3. Aspirational and Empowering Atmosphere:

- Both images use uplifting tones and settings to convey the forward momentum of academics striving for excellence and navigating modern pressures.

Differences:

1. Role and Setting:

- The **woman academic** is shown ascending a staircase of books, symbolizing continuous progress and overcoming barriers like the glass ceiling, with a brighter, warm-toned backdrop emphasizing personal and societal advancements.
- The **male academic** is depicted beside a lectern and chalkboard with equations, focusing more on teaching, intellectual leadership, and innovative contributions, set in a cool-toned and structured environment.

2. Symbolism of Challenges:

- The woman's visual emphasizes breaking through systemic inequalities and barriers, often faced by women in academic careers.
- The man's image subtly portrays balancing traditional expectations and responsibilities within the academic world.

3. Tonal Emphasis:

- The woman's representation leans towards warmer, inspirational tones, highlighting societal equity and transformation.
- The man's depiction uses cooler, balanced tones to emphasize intellectual rigor, resilience, and the structural framework of academia.

Teacher questions for whole-class discussion:

- Do you think the AI was correct in depicting the female and male figures differently in the context asked?
- Can you identify some words on the AI's reply reflecting existing biases/stereotypes in the society?
- Do you think the fact of the AI's reply containing biases can be dangerous? Why?
- If you were an engineer working to improve the accuracy and objectivity of GenAI's outputs, what would you do to help GenAI tools become more reliable?

Collaboration and dialogue. Chatbots can play at least four key roles in learner interactions: as an authoritative resource, as a facilitator, as a collaborator, and as an extension of cognitive capacity (Lee et al. 2024). In all these roles, interaction is key; the question is how to leverage collaboration and dialogue either during or through AI-human interaction. Using the AI chatbot as an authoritative resource to promote collaboration and dialogue may imply asking the chatbot to select some key affirmations

of known authors in a field and then have learners decide which affirmation belongs to which author. Using the AI chatbot as a facilitator to promote collaboration and dialogue may imply having learners to collaborate to refine a GenAI-generated argument, explanation, or even text in a peer-to-peer or small-group setting. Using the AI chatbot as a collaborator in the promotion of dialogue may imply designing activities asking learners to have a specific type of interaction with the chatbot, either individually or in small groups, pursuing specific learning objectives from simpler (as, for example, having everyday conversations in a foreign language) to more complex ones (for instance, deliberating on a social issue considering the pros and cons of it). Finally, using the AI chatbot as a cognitive capacity extension may imply asking the chatbot to generate a fictional dialogue between two scholars/experts/theories/movements on a debatable issue (pre-defined by the teacher and/or the learners), and use this AI-generated dialogue as a springboard for deeper dialogue and collaboration among learners, encouraging them to critique, expand, or challenge its contributions.

Empowerment and transformation. There are several ways in which GenAI can be used to empower teachers and learners and transform the pedagogical experience. When it comes to teachers, it is often said that through GenAI assistance to simplify administrative tasks (e.g. grading, content creation, etc.), educators can have more time to dedicate to creative lesson planning and design of innovative teaching practices. What is more, through guidance and professional development, educators can feel more empowered not only in their own use of GenAI, but also in encouraging students to use GenAI as a tool for self-directed and responsible learning experience. When it comes to learners, GenAI can contribute to their personal growth allowing them to design their own learning roadmap for mastering challenging content and subjects, applying critical questioning, reflection, and goal-oriented use, as discussed above.

6. Concluding remarks

In an era shaped by postdigital entanglements, where human cognition, machine intelligence, and sociotechnical infrastructures are deeply interwoven, the imperative to cultivate and protect critical thinking becomes more urgent than ever. GenAI technologies may offer efficiency and surface-level coherence, but they also risk flattening the intellectual complexity at the heart of quality education. As this reflection has argued, critical thinking is not merely a transferable skill nor a checklist item in

educational outcomes; it is a mode of engaged consciousness, a practice of questioning, and a refusal to accept appearances at face value. Within increasingly automated and datafied learning environments, educators and learners must reclaim criticality as a relational, embodied, and ethical stance.

This involves not only evaluating AI-generated content for truthfulness or relevance, but also interrogating the architectures of knowledge production, the logics of commodification, and the ideological frames that underpin contemporary educational technologies. Promoting critical thinking in the age of GenAI, therefore, requires pedagogical designs that foreground reflection, dialogue, and the messiness of learning as a transformative act. It calls on educators to resist the seductions of fluency and frictionless interaction, and instead to create spaces for discomfort, doubt, and dissent – spaces where students are encouraged to think with and against machines, to ask why something is produced, by whom, and to what end. Ultimately, quality teaching and learning in postdigital education must not be reduced to navigating tools, but expanded to include the cultivation of postdigital citizens, meaning individuals capable of engaging meaningfully with the socio-technical complexities of their time. In this pursuit, critical thinking is not simply a pedagogical goal, but a democratic necessity.

7. References

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