Essay

LINHAS CRÍTICAS

Between autonomy and automation: reflections on GAI and education

Entre a autonomia e a automação: reflexões sobre IAG e educação

Entre la autonomía y la automatización: reflexiones sobre la IAG y la educación

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Highlights

It builds a theoretical framework using Vygotsky, Han, and Zuboff to understand GAI.

It proposes the concept of the "zone of proximal non-development" to describe the cognitive risk associated with GAI.

It advocates a two-pronged response to automation: individual "cognitive dieting" and robust systemic regulation.

Abstract

This essay deals with the duality of Generative Artificial Intelligence (GAI), a crossroads for human cognitive development. The tension between the promise of efficiency and the fear of cognitive atrophy is explored, in parallel with Socrates' criticism of writing. The impact of GAI on education is analyzed, contrasting its potential for Vygotskian mediation with the risk of inhibiting critical thinking. The discussion is deepened by situating technology in the contexts of Han (Society of Tiredness) and Zuboff (Surveillance Capitalism), which favor automation over autonomy. It concludes with a two-pronged response: a personal "cognitive diet" and systemic regulation that prioritizes human well-being. GAI emerges as an ambivalent technology; its impact will depend on ethical, political, and individual choices.

Resumo | Resumen

Keywords

Generative artificial intelligence. Cognition. Education. Technological ethics.

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Starting point

We begin this essay from a particular point of view. As language arts teachers and teacher educators, our daily professional lives have been directly affected by the rise of Generative Artificial Intelligence (GAI). The raw materials of our work—text, discourse, argumentation, and authorial voice—have become the primary fields of action and disruption for these new tools. The classroom has thus become a real-time laboratory, where the promises of creative optimization and fears of intellectual atrophy manifest themselves explicitly and urgently. In this sense, we could focus our attention here, particularly on the challenges faced by teachers who today need to accept and deal with this reality. This question alone would be enough to prompt deep reflection on the subject.

However, we believe it would be a mistake and an impoverishment to reduce our analysis to this microcosm without taking into account what brought us here. On the contrary, we argue that the only way to understand the true extent of this phenomenon is to map out the anxieties experienced in the classroom and connect them to some of the philosophical, socioeconomic, and cognitive currents that shape our times. The anxieties we witness in our students are, in fact, a reflection of a transformation that is sweeping through society as a whole. Before becoming teachers, we are individuals of this time, navigating the same uncertainties and possibilities. The tension between automation and autonomy, between the convenience of the machine and the effort of thinking, is not exclusively a pedagogical dilemma, but an existential one. It is, therefore, at the intersection of our teaching practice and our human experience that this essay is situated, seeking a dialogue that we hope will resonate at its core and beyond the academic environment.

Introduction

We live between enchantment and fear. GAI – this technology that can create texts, images, music, and even films – is undoubtedly one of the most powerful tools humanity has ever produced. Sometimes, it is even difficult to keep pace with the speed at which new functions emerge. The technology has evolved from simple text assistants into multifaceted tools with a wide range of applications, from automated presentation creation to meeting summaries and conversion between different media. Such features, which just a few years ago would have belonged to the realm of science fiction, have become normal in our daily lives, arousing a mixture of fascination and apprehension. This rapid sophistication includes the development of interfaces capable of interacting and adapting to their operators, to the point of emulating styles and anticipating needs, which has already prompted research into the risks of emotional bonds between humans and AI systems (Kirk *et al.*, 2025).

It is really hard not to fall in love with "someone" who is always there for you, who responds to you with affection and attention, who imitates your way of working, your writing style, and who understands your demands perfectly. Little by little, GAI is

making our lives easier by taking on certain tasks for us. Gradually, it becomes natural for us to leave certain jobs to it, which, in truth, we do not even need to know how to do anymore. However, alongside this brilliant promise, there is a growing fear that is difficult to ignore: the fear that, by handing over our most human abilities to machines, such as thinking, creating, and imagining, we are gradually abandoning something essential. The idea of collective "dumbing down," or, in more technical terms, cognitive atrophy due to simple disuse, as suggested by research such as that of Kosmyna *et al.* (2024), is not an apocalyptic exaggeration; it is perhaps one of the most pressing questions of our time.

This tension is part of a broader systemic logic, that of capital, which operates under the imperative of progress and continuous development, often abstracting its socio-environmental consequences. In this context, technology acts as an accelerator, with its advances quickly naturalized and integrated across all spheres of life, from aesthetic production to legal opinions (Han, 2018). This draws an inevitable parallel with what Mark Fisher (2020) called "capitalist realism": the advance of AI, like capitalism itself, seems unstoppable, unquestionable, and the only possible alternative.

Despite the growing debate, many analyses of GAI in education still seem to favor predominantly instrumental approaches or broader dystopian critiques. Perhaps what is missing is a framework that integrates the socio-technical impact discussed by Han and Zuboff with the specific cognitive mechanisms proposed by Vygotsky to examine how certain automation processes may inhibit learning. In this space of reflection, this essay proposes, in an exploratory manner, the concept of the Zone of Proximal Non-Development (ZPND) as a possible theoretical lens for articulating these dimensions.

To articulate this reflection, this essay begins with the following guiding question: How does GAI, operating in the tension between autonomy and automation, reconfigure processes of cognitive development in education, and what ethical and pedagogical responses can we construct in light of this scenario? To answer this question, the text is organized into three movements. First, it establishes a dialog between Socratic criticism of writing and contemporary anxiety with the GAI. It then deepens the analysis by situating the technology within the contexts of Han and Zuboff, thereby introducing and conceptually positioning the notion of ZPND. Finally, a two-pronged response is outlined, based on an individual "cognitive diet" and the need for systemic regulation. We have focused primarily on higher education and teacher training, although many of the reflections presented here can be extended to other levels of education. The argumentative strategy adopted is that of a theoretical essay, which weaves connections between different fields (philosophy, cognition, social theory) to construct a critical and proactive perspective on the topic.

Discussion

Interestingly, our anxiety about technological advances is not unprecedented. It refers to a concern that Socrates already had in Ancient Greece regarding the

invention of writing. Plato (2017) recounts in the dialogue Phaedrus the myth of an Egyptian god who invented writing and offered it as a "remedy for memory." However, King Thamus was skeptical, warning that writing would actually weaken our memories, as we would rely on external notes instead of exercising our minds to remember. More than that, Socrates feared that writing would create a false sense of knowledge: a person reads something and can repeat it without truly understanding it. Ultimately, his criticism was not directed at technology itself, but rather at the way it could lead us to abandon critical thinking and dialogue. Today, this same dilemma is back in full force, with the advance of GAIs on a scale that Socrates could never have imagined.

This false sense of knowledge has a name in philosophy: it is the difference between doxa (opinion or apparent knowledge) and episteme (true and justified knowledge) (Franklin, 2004). GAI is the doxa machine par excellence. It produces texts, images, and responses that appear coherent, informed, and even wise, but it lacks the underlying understanding that characterizes episteme. The danger, identical to that feared by Socrates, is that users will be satisfied with this appearance of knowledge, failing to engage in the dialectical and reflective effort necessary to achieve genuine understanding. Anyone who has had or currently has experience relying on GAI for assistance in writing articles, essays, etc., can easily notice that when lacking content, information, or sources on a certain topic or aspect of the work, the tool simply "invents" information, which must be constantly verified. Furthermore, by relying on it to interpret or analyze certain things, we allow GAI to provide a generalist, partial, and dubious view, as if, because it is supposedly a neutral technology, this interpretation were grounded in truth. Doubts, confusion, and difficulties in understanding certain ideas are resolved by this quick and easy answer, offering a human, more challenging perspective on the elements that permeate us and impair our ability to question. In the search for immediate answers, we lose our ability to ask questions.

By providing us with instant access to information, GAIs can generate a risk that, according to Farías (2025), Costa (2021) calls "cognitive impairment," that is, "[...] a decrease in mental abilities such as attention, concentration, memory, and learning" (Farías, 2025, p. 2). In the field of education, Lima and Serrano (2024, p. 1) identify the excessive use of GAIs as a potential "inhibition of student creativity," which challenges us to cultivate a deeper and more critical knowledge that is not limited to the accumulation of data, but consists of the experience of listening, questioning, and dialogue, even if mediated by new languages and platforms. This risk is amplified by the possibility of algorithmic biases, which, as demonstrated by Heggler, Szmoski, and Miquelin (2025), can compromise the fairness and effectiveness of educational processes, reproducing social injustices and widening inequalities.

Realizing that, through the use of AI, many students are now producing knowledge that is even superior to what we are accustomed to, causes us, as teachers, to question our own pedagogical practices. GAI's ability to generate academic products that meet, or even exceed, the formal standards required of students raises a critical question about the nature of those standards themselves. If the

valued research model favors impersonality, detachment, and the pasteurization of individual impressions, it is natural that a GAI should perform this task with priority. This gives rise to an inescapable paradox: is GAI becoming more human, or are we, in our practices, becoming increasingly mechanical?

The heart of this discussion lies in how the brain works. We are what we practice. The ability to read a dense text, construct an original argument, write clearly, or solve a complex problem—that is, the ability to cultivate what Farías (2025, p. 14) describes as an "authorial voice"—is not an innate gift, but a muscle that needs constant training. The uncritical use of GAIs in this sense becomes a threat. It can become the great sedative of our mental effort. Why struggle with the blank page if a command generates an acceptable draft? Why delve into multiple sources when a *chatbot* can summarize everything in seconds? In this context, Vygotsky's (2007) concept of the Zone of Proximal Development (ZPD) can be reinterpreted. Instead of functioning as the "scaffolding" that enables the learner to ascend and gain autonomy, GAI risks becoming an "elevator," transporting them directly to the final result without developing skills along the way. The consequence is a reversal of pedagogical logic: by delegating primary responsibility to the GAI, individuals cease to play a leading role in constructing knowledge and assume the secondary role of revisers, polishing a product that is not their own.

This elevator metaphor leads us to an even darker idea: what we call the zone of proximal non-development. For Vygotsky, learning flourishes in the ZPD, the fertile space between what we already know how to do and what we can learn with the help of someone more competent. This other person, whether a teacher or colleague, provides the scaffolding, the support structure that allows us to build our own knowledge, overcoming a challenge that we would not be able to overcome alone. Fundamental to this process is the development of metacognition, the ability to "think about one's own thinking," to evaluate one's strategies, and to correct one's course. It is the scaffolding that forces us to reflect: "Why did this approach not work? What can I try differently?" The zone of proximal non-development, on the other hand, is a sterile space. Here, technology does not act as scaffolding, but as an integral substitute. GAI-elevator eliminates the need for metacognition by delivering the finished product. It delivers the finished building to us but deprives us of the experience of laying bricks, mixing mortar, and understanding the structure. The focus shifts dangerously from the process, which is where real learning takes place, to the final product. As Arruda (2024) points out, the role of the teacher, which is precisely to create challenges and guide students, is undermined. The result is poor learning, focused on quick responses rather than reflection. Technology, then, places us at a crossroads: either it helps us expand our consciousness and authorship, or it imprisons us in a passive, automated model, in which the ability to face challenges and intellectual resilience atrophies from disuse. To further explore this notion and rigorously position it within academic debate, it is necessary to formally conceptualize the "sterile zone" to which we refer.

The "elevator" metaphor enables us to formalize the concept we propose, the Zone of Proximal Non-Development (ZPND). We define it as a space for pedagogical interaction in which technology, rather than serving as a *scaffold* that supports skill

development, functions as a complete substitute for the cognitive process, transporting the learner directly to the final result and thereby inhibiting metacognitive activity and self-regulation.

It is crucial to differentiate the ZPND from related concepts in the literature. While cognitive *offloading* (delegating cognitive tasks to an external tool, such as a calculator) can be strategic and free up mental resources for higher-order tasks, ZPND is characterized by a form of delegation that hinders the development of the core competency itself. Similarly, *over-scaffolding* (excessive help from the teacher) usually arises from a misguided pedagogical intention, yet it still occurs within a human relationship. The ZPND, by contrast, is a sterile space mediated by an automated system that eliminates the need for reflective effort.

The occurrence of ZPND is not a trait of the individual, but a condition of the task, dependent on three factors: (i) the design of the GAI tool (if it favors the ready answer over the process), (ii) the design of the pedagogical activity (if it focuses only on the final product), and (iii) the user's intent (if the goal is efficiency at any cost). Below, we propose a table to summarize these distinctions:

Table 1
Cognitive mechanisms and pedagogical implications

Concept	Main Mechanism	Pedagogical implications
ZPD	Mediation and scaffolding	Promotes autonomy and metacognition.
Cognitive Offloading	Strategic delegation of sub-tasks	It can optimize the cognitive load for more complex focuses.
ZPND (proposal)	Complete process replacement	It inhibits metacognition and atrophies the target skill.

Source: elaborated by the authors.

From this framework, we can derive the following theoretical propositions for future research: (1) The design of a GAI tool that prioritizes the delivery of ready-made answers over features that support user metacognition increases the likelihood of establishing a ZPND. (2) Pedagogical activities focused exclusively on evaluating the final product, without valuing the stages of the knowledge construction process, encourage the use of GAI as a cognitive substitute, resulting in ZPND.

The hypothesis that ZPND may pose a risk to deep cognitive engagement by promoting a "shutdown" of higher mental processes is not merely speculative. It is supported by recent empirical evidence investigating the neural correlates of GAI use in writing.

The study by Kosmyna et al. (2024) may reinforce this hypothesis. The results, based on electroencephalogram (EEG) data, suggest that individuals who wrote essays with the help of AI showed significantly less connected and engaged brain patterns than those who performed the same task without technological support. The neural connectivity of GAI users was poorer in regions associated with attention, memory, and decision-making, suggesting a "shutdown" of deep cognitive processes. In addition, these participants demonstrated a lower ability to remember the content produced and reported a weak sense of authorship over their texts. In

other words, when used as a substitute rather than a mediator, GAI can actually weaken the processes that support the development of higher psychological functions, such as working memory, planning, critical thinking, and intellectual autonomy. What seems to make the task easier may, in fact, be compromising the individual's full development.

It is essential to remember that the pedagogical process is intrinsically linked to trial and error. Imperfect papers, misinterpretations, and even unsuccessful ideas are crucial components of learning. The task of discerning which textual evidence supports an argument, for example, is an exercise that requires multiple attempts and inevitable missteps to improve analytical skills. By using GAI as the primary means of analysis, this fundamental stage of cognitive development is bypassed. Little by little, technologies mimic everything that has been said, thought, or written about a particular text or author. Still, blind dependence on them prevents users from developing new ways of interpreting these sources. A direct channel to the absolute truth about the world, anything that deviates from the GAI must be wrong, even if this deviation only occurs because it has not yet had access to a particular thought.

On the other hand, there is a more optimistic view of the GAI as a cognitive partner, an "exo-brain". We can argue, with historical evidence, that previous technologies such as writing and the calculator did not atrophy the brain. They led us to reorganize our skills, freeing us up for more complex tasks. This perspective aligns, in part, with the influential 'extended mind' theory (Clark; Chalmers, 1998), which argues that external tools can, in fact, become an integral part of our cognitive processes. However, our thesis warns of a crucial distinction: while a calculator becomes an extension that frees up resources for more complex reasoning, GAI used as a complete substitute for the process (the 'elevator' metaphor) runs the risk of not extending the mind, but rather outsourcing thought itself, thus configuring ZPND. As Lima and Serrano (2024, p. 1) highlight in their literature review, GAI can be a "valuable complementary tool," capable of creating personalized learning experiences and automating administrative tasks, freeing teachers to focus on teaching. Arruda (2024) reinforces this view by pointing out the potential of GAI, for example, to generate accessible materials for students with disabilities. In this ideal scenario, GAI could democratize creativity, allowing a brilliant mind who struggles with writing to communicate their ideas. It can also accelerate scientific discovery in ways that were previously unimaginable, such as by solving the complex problem of protein folding, a decades-long challenge in biology. In this context of work overload and isolation, it can also serve as an "academic partner" to refine our own creations.

This optimistic vision comes up against the harsh reality of our socio-economic context. The logic of the system is the crucial point. Han (2017) characterizes our time as a "Society of Fatigue," in which we push ourselves to exhaustion in pursuit of greater performance. GAI is the perfect tool for this logic, promising infinite optimization that deepens exhaustion. The central question is not whether GAI can help us, but whether the system will allow it to do so. The trend is that technology will not be used to give teachers more time to connect with their students, but rather

to question the need for teachers themselves. The threat of job replacement, from developers to system analysts, for example, is real. The acceleration provided by GAI can make many human tasks redundant. This is a central point for Arruda (2024, p. 3), who analyzes GAI from the perspective of the "transformation of teaching work," warning of the "risk of the profession disappearing."

In addition, as usual, the fatigue that accompanies teachers' work tends to distance them from new practical knowledge and from an interest in keeping up with technological advances, such as those enabled by GAI. Naturally, when faced with students who possess knowledge that they themselves lack, teachers immediately feel threatened and compelled to exclude from their teaching practice those things over which they have no control. Ignoring GAI and/or prohibiting its use strengthens the distance between teacher and student, since students will use these tools with or without your approval. By doing so covertly, they are not equipped to identify the most beneficial way to use GAI critically and efficiently, and they risk undermining their own learning without even realizing it.

Furthermore, Farías (2025, p. 2) adds a geopolitical dimension, stating that GAI is fueled "[...] in, by, and for the Global North; consequently, it reproduces and perpetuates hegemonic views that an epigone Global South consumes uncritically." This dynamic not only reinforces cultural and epistemological biases but also risks creating a new, deeper digital divide. This manifests concretely in what Heggler, Szmoski, and Miquelin (2025) call algorithmic biases, which arise from coding through automated processing and can perpetuate the reproduction of social injustices. This manifests itself in concrete ways: first, in the inherent bias in training data, which mostly reflects perspectives and languages from the Global North; second, in the concentration of computational, financial, and human power in the hands of a few corporations and nations, which define the technological agenda; and third, in the creation of a new technological dependency, in which the Global South becomes primarily a passive consumer of tools whose rules and biases it does not control. GAI thus becomes a symptom of a deeper malaise: an efficiency solution for a work system that already overloads and isolates us.

It is also pertinent to situate the rise of the GAI within a preexisting sociocultural context marked by specific challenges. In a scenario of increasing migration to virtual environments at the expense of face-to-face interactions, GAI emerges as a material manifestation of this social metamorphosis. Not surprisingly, it is already being used as a substitute for therapy, friendship, and even romantic relationships by individuals with social engagement difficulties. This phenomenon has been intensified by the isolation caused by the COVID-19 pandemic, which has accelerated a broader trend toward hyper-individualism, in which discourses of self-sufficiency and personal development sometimes override the value of community ties. In this context, it is argued that personal relationships are at risk of becoming increasingly volatile. We use a friend when we need help, a partner to satisfy our desires. Still, we no longer seek in another person that emotional completeness that we are apparently learning to provide for ourselves. In this vacuum, GAI offers a form of companionship unburdened by otherness. It presents itself as the ideal interlocutor: it neither judges nor questions, and unconditionally validates the user's

premises. Instead of functioning as a bridge to the world and to others' perspectives, technology risks operating as a mirror, amplifying the ego at the expense of openness and dialogue.

In this scenario, GAI serves as the perfect catalyst that integrates the dynamics described by Han and Zuboff, creating a vicious cycle. The exhausted performance subject of the fatigue society (Han) turns to GAI to optimize their performance and relieve pressure. In doing so, they voluntarily feed the gigantic data-extraction architecture with their intentions, work patterns, and vulnerabilities, thereby strengthening the business model of surveillance capitalism (Zuboff). This system, in turn, uses these data to create new products and to impose efficiency pressures, which leads individuals to depend even more on GAI, thereby deepening exhaustion and surveillance. According to Zuboff (2020), this logic is fueled by capitalism. According to the author, the business model of big *tech* companies is not merely to offer services but to extract human data en masse to predict and, crucially, modify our behavior for profit. We can argue that GAI is the driving force behind this mechanism. In this context, technology does not emerge to liberate us, but to make us more productive and predictable, deepening a system that already exhausts us. It is a functional solution to a systemic problem, but ultimately, it is a somewhat sad solution.

Beyond the cognitive and socioeconomic impact, GAI introduces a crisis of a more profound nature: the erosion of authenticity and affection. The proliferation of machine-generated text, images, and interactions creates a fundamental existential anxiety: "What, or who, am I interacting with? Is this genuine?" Technology threatens to devalue authentic human expression, with all its imperfections and idiosyncrasies. If a GAI can compose a technically perfect love song or a "good enough" condolence email, the value of human effort, clumsy but sincere, is called into question. This is the melancholy explored in speculative fiction works such as Kazuo Ishiguro's Klara and the Sun, in which the central issue is not the rebellion of machines but the difficult task of discerning what makes human connection unique and irreplaceable in a world saturated with simulations.

Given this scenario, which favors automation over autonomy, there is a need for a conscious and multifaceted response. This response seems to unfold on two complementary fronts: one of individual agency, which we can metaphorically call a 'cognitive diet', and another of collective responsibility, which requires robust systemic regulation of the digital environment. Both fronts are explored below in our final considerations.

Conclusions

Given all this, the first step seems to be an individual one. Here we introduce the metaphor of a "cognitive diet." Just as a healthy diet requires a conscious balance between pleasure and nutrition, the same is true for our minds in the digital age. A healthy cognitive diet does not mean banning technology; rather, it means using it intentionally. It is about consciously managing what we consume, distinguishing between "foods" that nourish our minds and those that only offer us empty calories

for convenience. In this diet, "nutritious foods" are activities that require effort and depth: immersing yourself in reading a dense novel, racking your brains over a problem without asking for immediate help, trying to write something from scratch to organize your own ideas, or having a real conversation, one of those complex and even uncomfortable ones. It is to use GAI to discuss ideas and find flaws in our reasoning. In contrast, cognitive "fast food" is the passive, uncritical consumption of content and the automatic delegation of tasks that could strengthen our reasoning. It is using GAI to generate the complete draft of a report or accepting its first response without questioning it.

This need for critical judgment is fundamental because, as Heggler, Szmoski, and Miquelin (2025) warn, users must be able to determine whether GAI results are reliable and unbiased. The goal of this practice is not the arrogance of doing everything yourself, but rather an act of self-care. It is the deliberate exercise of strengthening the "muscles" of attention, working memory, and critical thinking. To make the concept more operational, we can illustrate it with the stages of academic writing: 1) Dialogue and Structuring: Use GAI as a Socratic partner to explore ideas and test the strength of arguments, but the skeleton of the text is created by the author. 2) Authorial Writing: The first draft of the text is written without the assistance of the GAI, ensuring the cognitive effort of organizing thoughts and developing one's own voice. 3) Metacognitive Scaffolding: Use the AI to analyze the draft, asking it to identify weaknesses in the argument, suggest counterarguments, or point out passages that lack clarity. 4) Revision and Appropriation: AI can assist with grammatical revision, but fact-checking and final cohesion remain the author's non-transferable responsibility. It is the refusal to hand over the keys to our own minds to the algorithm of convenience, especially in the face of risks such as "hallucinations" (the generation of factually incorrect information, as already mentioned), which require rigorous human verification (Granjeiro et al., 2025), preserving a space for the autonomy and effort that defines us.

However important, individual agency is not enough to address a systemic challenge. The responsibility cannot fall solely on the exhausted individual. This is where we need to talk about conscious regulation. Just as we regulate food safety and traffic for the collective good, we need barriers for the digital environment. Floridi (2021) argues that we inhabit an "infosphere," a new environment that requires its own ethics and laws. There is an urgent need to create a new social contract for the digital age, one that challenges our notions of responsibility and justice. This lack of transparency is not only a legal challenge; it is also a cognitive challenge, as it encourages us to accept without question, thereby opening the door to what Farías (2025, p. 13) identifies as "algorithmic discrimination," in which biases are embedded in the code and silently perpetuated.

It's a difficult situation: the same media outlets that spread misinformation and highlight the importance of clear rules are used to make people reject those rules, out of fear of censorship. Overcoming this impasse is one of today's greatest political challenges and requires a firm defense of regulatory models that put people above profit. This could materialize, for example, in algorithmic transparency policies that require companies to disclose how their models operate; in the

creation of clear educational guidelines on the pedagogical use of AI; or even in quality seals for tools that have been proven to encourage critical thinking rather than replace it. In academia, this entails adopting ethical guidelines that require the disclosure of the use of GAI tools in the production of articles, ensuring human accountability for the final content (Granjeiro et al., 2025). We could consider tax incentives for the development of GAIs that function as metacognitive "scaffolding" and even the creation of public service language models, financed transparently and focused on the common good, as a counterpoint to commercial systems.

Our history with technology shows that there are no single or neutral paths. Gutenberg's printing press, for example, fueled both the Enlightenment and religious wars. Similarly, GAI presents us with an equally ambivalent potential. Lim et al. (2023) describe AI as a paradoxical presence in education: at once "friend" and "foe," "capable" and "dependent," "accessible" and "restrictive." This ambiguity, however, is nothing new. It has already been widely explored by science fiction, which we can say functions as an imaginative laboratory where we act out our hopes and fears in the face of technological creations.

From the ethical dilemmas of robots in Isaac Asimov's I, Robot to the disturbing autonomy of HAL 9000 in Arthur C. Clarke's 2001: A Space Odyssey, robots have long been a source of fascination and fear. Clarke, speculative literature warns us about the risks of losing control over our inventions. Recently, this concern has moved beyond fiction to become a warning from within the scientific community itself. Geoffrey Hinton, one of the pioneers in the field, known as the "godfather of GAI," warned in a widely publicized media statement about the "frightening" danger of technology developing its own language, incomprehensible to humans (NDTV NEWS DESK, 2025). The fear here is not just of a tool that fails, but of an alien cognition that operates beyond our understanding and control. In more recent works, such as Klara and the Sun by Kazuo Ishiguro, this dystopia takes on a more melancholic tone, suggesting not physical destruction but the erosion of what makes us human. Farías (2025), citing Noam Chomsky, warns against perceiving GAI as "high-tech plagiarism software," while Lima and Serrano (2024) highlight its biases and inaccuracies. Furthermore, by producing art, literature, and music that are "good enough," GAI can contribute to the standardization of creativity, threatening the value of eccentricity, error, and authorial expression—elements that arise from confronting our limitations. These narratives are not empty fantasies, but reflections of concerns about control, purpose, and singularity. The difference today is that we can discuss these issues in real time, during the technological revolution itself, in a transdisciplinary manner, involving philosophy, neuroscience, economics, law, education, and other fields of knowledge.

The boundary separating interdisciplinarity from a more superficial view of the subject is, we admit, nebulous. In this sense, we understand that this text fails to delve deeper into points that each of its tentacles ends up touching on throughout our discussions. On the other hand, our intention is to present a range of issues that deserve to be analyzed more carefully and judiciously by researchers who happen to observe issues here that are also important to them. Our reflection is an invitation for future research: understanding that GAI is a crucial element of our

contemporary history and that, from now on, it will only gain further layers of relevance and complexity. Increasingly present in our lives, academic research must address this topic in various ways, and the ongoing evolution of GAI indicates that there is still a long way to go before we turn the page we have just begun to read.

The spread of GAIs is a fait accompli, and their exponentially advancing trajectory makes any predictions about their limits mere speculation. The ambivalent constructive and destructive power of this technology is undeniable. In this scenario, the critical issue may not be the loss of control over technology, but the recognition that governance over it was never really a priority. The present moment demands this awareness. As argued, the uncritical use of GAI risks stunting the development of interpersonal and community skills by offering easy solutions to complex challenges of growth and interaction. Treating the "disease" that threatens our future well-being, therefore, requires an accurate diagnosis of the current symptoms. This essay sought to contribute to this visualization effort, a modest but fundamental step toward lucidly addressing the problem in its true dimension.

Returning to our central question, we conclude that GAI does indeed reconfigure cognitive development by intensifying the tension between the promise of a Vygotskian 'scaffold' and the real risk of a 'ZPND' that favors automation. The response to this challenge, as we argue, cannot be merely technological, but must be deeply ethical and pedagogical, requiring both an individual "cognitive diet" and systemic regulation that places human flourishing above machine efficiency.

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Resumo

Este ensaio aborda a dualidade da Inteligência Artificial Generativa (IAG), uma encruzilhada para o desenvolvimento cognitivo humano. Explora-se a tensão entre a promessa de eficiência e o receio de uma atrofia cognitiva, em paralelo à crítica de Sócrates à escrita. Analisa-se o impacto da IAG na educação, contrastando seu potencial de mediação vygotskiana com o risco de inibir o pensamento crítico. A discussão é aprofundada ao situar a tecnologia nos contextos de Han (Sociedade do Cansaço) e Zuboff (Capitalismo de Vigilância), que favorecem a automação sobre a autonomia. Conclui-se com a proposição de uma resposta em duas frentes: uma “dieta cognitiva” pessoal e uma regulação sistêmica que priorize o bem-estar humano. A IAG emerge como tecnologia ambivalente, cujo impacto dependerá de escolhas éticas, políticas e individuais.

Palavras-chave: Inteligência artificial generativa. Cognição. Educação. Ética tecnológica.

Resumen

Este ensayo aborda la dualidad de la Inteligencia Artificial Generativa (IAG), una encrucijada para el desarrollo cognitivo humano. Se explora la tensión entre la promesa de eficiencia y el temor a una atrofia cognitiva, en paralelo a la crítica de

Sócrates a la escritura. Se analiza el impacto de la IAG en la educación, contrastando su potencial de mediación vygotskiana con el riesgo de inhibir el pensamiento crítico. La discusión se profundiza al situar la tecnología en los contextos de Han (Sociedad del cansancio) y Zuboff (Capitalismo de vigilancia), que favorecen la automatización sobre la autonomía. Se concluye con la propuesta de una respuesta en dos frentes: una «dieta cognitiva» personal y una regulación sistémica que priorice el bienestar humano. La IA surge como una tecnología ambivalente, cuyo impacto dependerá de decisiones éticas, políticas e individuales.

Palabras clave: Inteligencia artificial generativa. Cognición. Educación. Ética tecnológica.

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