Chapter 1 / Capítulo 1

Superintelligence Series
ISSN 3046-4463
Volume 2 – Thinking in Machine Code: Dialogues between technology, knowledge, and culture
ISBN of the complete work: 978-9915-9851-0-7
ISBN of this volume: 978-9915-9851-2-1
DOI of the chapter: https://doi.org/10.62486/978-9915-9851-0-7_202515

©2025 The authors. This is an open access article distributed under the terms of the Creative Commons Attribution (CC BY) 4.0 License.

ORIGINAL

Thinking like a machine: an introduction to the new educational horizon

Pensar en clave de máquina: una introducción al nuevo horizonte educativo

Carolina Herrera López[1]

[1]Universidad Metropolitana de Educación, Ciencia y Tecnología (UMECIT). Provincia de Panamá, Panamá.

ABSTRACT

The emergence of artificial intelligence (AI) has transformed the boundaries of cognition, learning, and cultural production, establishing a hybrid ecosystem where human and machine intelligences coexist. This chapter explores the epistemological, pedagogical, and ethical implications of this shift, focusing on how AI redefines education not merely as a technical innovation but as a cultural and political phenomenon. It argues that the integration of AI into educational settings entails a paradigm shift—from the linear transmission of knowledge to distributed cognition mediated by algorithms. Through an interdisciplinary analysis, the author examines the risks and opportunities associated with this transformation, including algorithmic bias, dependence on automation, and the need for new literacies in critical and ethical AI use. Emphasis is placed on the Latin American context, where technological adoption intersects with structural inequalities and digital colonialism, but also with creative and emancipatory pedagogical traditions. Ultimately, the chapter proposes that "thinking in machine code" should not be understood as surrendering human judgment, but as cultivating the capacity to think with machines—critically, collaboratively, and humanely—toward an education grounded in justice, reflection, and collective intelligence.

Keywords: Artificial Intelligence; Education; Critical Literacy; Algorithmic Ethics; Digital Colonialism; Hybrid Cognition.

RESUMEN

La aparición de la inteligencia artificial (IA) ha transformado los límites de la cognición, el aprendizaje y la producción cultural, estableciendo un ecosistema híbrido en el que coexisten la inteligencia humana y la inteligencia artificial. Este capítulo explora las implicaciones epistemológicas, pedagógicas y éticas de este cambio, centrándose en cómo la IA redefine la educación no solo como una innovación técnica, sino como un fenómeno cultural y político. Sostiene que la integración de la IA en los entornos educativos implica un cambio de paradigma: de la transmisión lineal de conocimientos a la cognición distribuida mediada por algoritmos. A través de un análisis interdisciplinario, el autor examina los riesgos y oportunidades asociados a esta transformación, incluyendo el sesgo algorítmico, la dependencia de la automatización y la necesidad de nuevas alfabetizaciones en el uso crítico y ético de la IA. Se hace hincapié en el contexto latinoamericano, donde la adopción tecnológica se cruza con las desigualdades estructurales y el colonialismo digital, pero también con tradiciones pedagógicas creativas y emancipadoras. En última instancia, el capítulo propone que «pensar en código máquina» no debe entenderse como renunciar al juicio humano, sino como cultivar la capacidad de pensar con las máquinas —de forma crítica, colaborativa y humana— hacia una educación basada en la justicia, la reflexión y la inteligencia colectiva.

Palabras clave: Inteligencia Artificial; Educación; Alfabetización Crítica; Ética Algorítmica; Colonialismo Digital; Cognición Híbrida.

INTRODUCTION

In our time, intelligence is no longer an exclusively human attribute but has become a cognitive ecosystem shared between people and machines. This transformation, which may initially appear technical, reveals a much deeper change: artificial intelligence (hereinafter AI) has gone from being a scientific advance to becoming a cultural, cognitive, and educational phenomenon. This shift affects our social practices, the ways we produce knowledge, and the institutional structures that manage and disseminate it.

AI has left the laboratory behind and become part of everyday life. Generative models, conversational assistants, and recommendation systems have quietly inserted themselves into the daily flows of communication, research, and learning.[1,2] It no longer merely assists our decisions: it now anticipates, shapes, and even, on occasion, replaces them. This technological omnipresence gives rise to a new historical condition: we coexist with systems capable of emulating, amplifying, and, in certain areas, surpassing traditionally human tasks such as analyzing data, writing texts, diagnosing diseases, or designing strategies.

Beyond its functional power, AI produces cultural and symbolic effects. Its presence has become normalized in social life, giving rise to a certain technical mythification: machines are perceived as neutral, authoritative, or even wise entities. This raises ethical tensions around transparency, trust, and equity in access to knowledge.[3,4,5] In the field of education, this dual dimension—technical and symbolic—is manifested both in the promises of personalization and curricular adaptability and in the questions that arise: Who controls the data? How are learning criteria defined? What values do these systems respond to?[6,7]

The previous section referred to the emergence of a new era of intelligence, where human and algorithmic capabilities coexist in the same cultural ecosystem. In this context, AI does not only process information: it participates in the circulation of meaning and intervenes in the symbolic and emotional production of our societies. Affective chatbots redefine notions of empathy and companionship; recommendation systems shape tastes and mold public opinion; educational algorithms mediate the relationship between students, teachers, and knowledge.[4,8]

In the face of this transformation, the key questions shift from "what can technology do?" to "what does it mean to think, learn, and teach in an environment where machines also learn?" This shift directly challenges universities. It is no longer just a matter of training competent professionals, but of cultivating critical citizens capable of understanding, questioning, and co-creating technological intelligences.[9,10] In this context, digital and ethical literacy becomes transversal to the entire educational process.

However, this transition to a hybrid cognitive ecology is not happening uniformly. Latin America and the Caribbean occupy an ambivalent position on this new map of multiple intelligences. The region stands out for its capacity for pedagogical innovation, with universities experimenting with the use of AI in teacher training, academic management, and educational research.[7,11] But at the same time, it faces deep structural gaps: infrastructure limitations, technological dependence, and digital colonialism logics that affect its epistemic autonomy.[12,13]

This last point ties in with a relevant criticism: that of algorithmic colonialism. The models and platforms designed in the global North not only impose technologies, but also metaphors, values, and architectures that often do not dialogue with Latin American realities. To stop being mere users of these technologies, it is essential that countries in the region generate their own ethical frameworks, data, and epistemological horizons: an AI with a Latin American accent, committed to cognitive justice and social responsibility.[13,14]

Returning to this critical dimension, it is necessary to understand that AI is not limited to a set of tools: it constitutes a new ecology of knowledge that reorganizes the relationships between learning, knowledge, and power.[15] By introducing technical mediations—models, algorithms, platforms—it redistributes epistemic hierarchies: it determines who teaches, who evaluates, and what is validated as knowledge. The challenge, then, is not only technical, but deeply political and cultural: to ensure that these new intelligences expand—rather than limit—the autonomy of thought and the diversity of learning.

This scenario poses a monumental challenge for Latin American universities, but also a historic opportunity: to reconfigure their social function around responsible research, critical literacy, and ethical mediation between human and artificial intelligences. Training individuals capable of using, interpreting, and questioning the algorithms that mediate reality becomes imperative for any humanistic educational project in a world of thinking machines.

Thinking in terms of machines does not mean renouncing the humanity of thought. On the contrary, it means recognizing that intelligence—in all its expressions—has become a shared, hybrid, and relational force. This is the age of intelligences: a time when learning also means learning to coexist with other ways of thinking.

The aim of this chapter is to offer a panoramic and foundational overview of the contemporary phenomenon of AI as a transformative force in education, understood not only in its technological dimension, but also in its cultural, cognitive, and ethical dimensions. It aims to place the reader in the historical and conceptual context of the emergence of this technology, explore its transition from a technical tool to an agent that reconfigures thought and institutions of knowledge, and raise the key questions that will guide the rest of the book:

- What does it mean to think and learn in a world where machines also think?
- How is the social function of the university being redefined?
- What role can Latin America play in this new ecosystem of multiple intelligences?

Thus, the chapter opens with the intention of understanding our present as the age of intelligences and inaugurating a framework for critical and humanistic reflection on the coexistence of human thought and algorithmic thought.

DEVELOPMENT

From human intelligence to machine intelligence

The history of AI can be read as a long conversation between humans and machines about what it means to think. From Alan Turing's famous question—"Can machines think?"—to contemporary generative models such as ChatGPT, Geminis, Claude, Grok, among others, there has been a decisive shift: from behavioral imitation to cognitive collaboration. What was once a behavioral test ("making a machine appear to think") has become a reflection on how technical systems participate in the production of meaning, knowledge, and action.

This evolution is not only technical, but also conceptual. Current language and deep learning models are no longer limited to executing instructions: they learn from data, produce representations, and engage in dialogue with users in semantic and affective registers. Consequently, the notion of "intelligence" is no longer an individual or biological property, but has become a practice distributed among humans and systems. In fields such as biomedicine, education, and scientific management, algorithms have gone from being experimental tools to becoming cognitive support agents that directly influence decision-making.[16,17]

The previous section introduced the concept of a time of intelligences, where the human and the algorithmic coexist in the same cognitive ecosystem. This scenario invites us to review how our conception of thought has evolved from an exclusively human perspective to a more distributed and collaborative one.

The history of AI can be read as a long conversation between humans and machines about

the meaning of thinking. From Alan Turing's famous question—"Can machines think?"—to contemporary generative models such as ChatGPT, Gemini, Claude, and Grok, a fundamental shift has taken place: from behavioral imitation to cognitive collaboration. What was once conceived as a behavioral test—making a machine simulate thought—has given way to a more profound reflection on how technical systems participate in the production of meaning, knowledge, and action.

This change is not only technical, but conceptual. Current language and deep learning models are no longer limited to executing instructions: they learn from data, construct representations, and engage in dialogue with users in semantic, affective, and contextual registers. Intelligence, then, is no longer understood as an individual or biological property, but has become a practice distributed between humans and systems. In fields such as biomedicine, education, and scientific management, algorithms have evolved from simple tools to become cognitive support agents that directly influence decision-making processes.[16,17]

Thinking in terms of machines: two analytical meanings

The expression "thinking in terms of machines" can be understood in at least two complementary senses:

The first, imitative in nature, associates thinking with the execution of algorithmic processes. It involves adopting rules, sequences, and optimization models as a cognitive pattern. From this perspective, thinking like a machine is equivalent to formalizing mental tasks in computable terms, replicating the structural logic of technical systems. This view, inherited from the classical approach to AI, privileges efficiency, repetition, and predictability, but also tends to reduce intelligence to calculation and to externalize the human values of judgment and deliberation.[18,19]

The second meaning, hermeneutic or dialogical in nature, proposes a more critical approach: thinking in terms of machines means reading and interpreting the language of technical systems, understanding their architectures, biases, and forms of representation—vectors, weights, probabilistic inferences—and translating that knowledge for the benefit of human cognition. In this reading, AI does not replace thinking, but rather expands it. It requires technical and epistemological literacy and promotes conscious use of systems as interlocutors, not as replacements.[20,21]

The difference between the two meanings is not simply operational, but also ethical and political. While the former points to the automation of judgment, the latter strengthens cognitive autonomy. Imitating algorithmic logic can increase efficiency; understanding it, on the other hand, preserves the ability to decide judiciously and resist technical opacity.

Is there such a thing as "machine intelligence"?

This question reflects a central tension in contemporary debate. To speak of machine intelligence is to attribute cognitive agency to systems that lack consciousness, intention, or corporeality. Even so, the expression is useful as a heuristic category to describe hybrid cognitive processes, the result of cooperation between humans and machines, provided that we avoid falling into metaphysical or anthropomorphic uses.[22,23]

In this sense, rather than referring to autonomous intelligence, we are talking about collaborative intelligence: an assembly of human capabilities and technical systems that expands our perceptual, analytical, and expressive possibilities. Machines do not think on their own: they think with us, and in doing so, they reconfigure the limits of what we understand as thought.

Algorithms operate as imperfect mirrors of the human mind. They reproduce, amplify, and, in some cases, reinvent the biases present in the data and in the intentions of those who design them.[24,25] Far from being neutral, these systems encode normative frameworks and cultural

categories that reflect historical inequalities. And they do not just replicate existing realities: they also produce new structures of perception and behavior.

When algorithms intervene in social processes—by recommending, rating, or predicting—they generate feedback loops. The decisions they make affect future data, reinforcing collective trends and habits.[16] This dynamic underscores the urgency of critical literacy for both users and designers, enabling them to audit systems and prevent them from becoming invisible architectures of power.

Risks, opportunities, and the role of education

This intertwining of human thought and technical automation creates a field of symmetrical risks and opportunities. Among the opportunities are the expansion of distributed cognitive capabilities—from medical diagnosis to personalized learning—and the democratization of access to knowledge through natural language tools.[26] These technologies can enrich creativity, foster inclusion, and promote interdisciplinary work, provided they are accompanied by clear ethical frameworks and critical education.

However, the risks are equally significant: loss of reflective thinking, excessive dependence, widening inequalities, and moral irresponsibility when decisions are delegated to opaque systems.[27,28] Added to this is a more recent phenomenon: machine affectivity, that is, the projection of emotional bonds onto conversational systems, which challenges our traditional categories of empathy and companionship.[29]

Managing this new scenario requires public policies on technological governance, robust interdisciplinary education, and informed social participation processes. It is not enough to teach the use of tools: it is necessary to train critical interpreters, capable of reading the language of systems, recognizing their limits, and imagining emancipatory uses.[20,21]

Critical coexistence between intelligences

"Thinking in terms of machines" is, ultimately, a polysemic and strategic concept. It can refer both to the reproduction of algorithmic procedures and to conscious dialogue with them. Its meaning will depend on the place from which the thinking is exercised: subordinate or collaborative.

Higher education has a crucial role to play here. Its challenge is to institutionalize critical literacy, establish democratic regulatory frameworks, and foster digital cultures that position AI as a cognitive ally, not a substitute for human thought.

Thinking with machines without renouncing the humanity of thought: that is the true intellectual challenge of the 21st century.

A paradigm shift in education

The incorporation of AI into educational environments is not simply a technical innovation; it implies a paradigm shift in the ways of teaching, learning, and constructing knowledge. For the first time in modern history, the education system operates in a context where knowledge no longer resides exclusively with the teacher, but circulates in hybrid ecosystems that combine human and machine intelligence. This shift impacts both pedagogical practices and the epistemological structures that underpin our understanding of learning.

Are we prepared for an education system where knowledge is distributed?

This new scenario—in which knowledge is constructed collectively between humans and intelligent systems—raises a crucial question: are education systems prepared for this transformation?

Empirical evidence and recent policies reveal uneven preparedness. There are successful experiences in the use of AI that report benefits in personalization, efficiency, and access.

However, its systematic adoption requires solid pedagogical frameworks, clear governance structures, and teacher training that is still in development.[30,31,32]

In many contexts, the integration of AI continues to be guided by purely instrumental criteria, without epistemological or ethical accompaniment. Three key conditions are required for adequate institutional preparation:

- Pedagogical and organizational articulation: policies that integrate AI into the curriculum, assessment, and institutional management.
- Continuing teacher training and technological literacy.
- Assessment standards and technological auditing that guarantee transparency and equity.

Without these elements, AI could end up replacing pedagogical mediation rather than expanding it. Twenty-first-century education must be oriented toward a model of augmented intelligence, in which technology enhances the agency of the teacher, rather than replacing it.[33,34]

When intelligent systems take on tutoring, assessment, or cognitive support functions, learning is redefined. It is no longer an exclusively human or linear process, but a co-construction distributed between humans and algorithms.[35,36] Generative systems and intelligent tutors can personalize trajectories, offer immediate feedback, and adapt to the student's pace.

However, this capacity transforms the relationships between memory, comprehension, and metacognition: students learn both to think and to delegate thinking. In this context, the role of the teacher is profoundly reconfigured: they go from being transmitters of information to mediators of meaning, responsible for ensuring the epistemological and ethical quality of learning.[37] AI does not eliminate teaching, but rather reconceptualizes it as a technical and reflective dialogue, where human judgment remains indispensable.

Augmented pedagogy: redesigning teaching

Based on the above, it is clear that the transition from transmissive pedagogy to augmented pedagogy requires a redesign of educational architectures.

The specialized literature identifies at least four lines of transformation:[33,34,38]

a. Human-AI collaboration: instructional models that integrate augmented intelligence and active learning.

b. Authentic assessment: open-ended tasks that value creativity, critical judgment, and ethical problem solving.

c. Participatory and equitable design: incorporation of multiple perspectives and principles of algorithmic justice.

d. Digital and epistemological literacies: teaching how to interpret, audit, and question knowledge produced by automated systems.

The goal is not to pursue automated efficiency, but to build a pedagogy of assisted reflection, where systems amplify human capabilities without supplanting them.

Several studies show that, when critically integrated, AI can stimulate critical thinking: contrasting hypotheses, evaluating sources, and iterative review.[39,40] However, in contexts without teacher mediation, systems tend to standardize responses and weaken cognitive autonomy.[41,42]

This phenomenon, known as reliance behavior, describes the tendency of students to uncritically accept the answers generated by AI.[43] Therefore, the impact of these technologies does not depend solely on their technical capabilities, but also on the pedagogical design and critical literacy that accompanies their use.

Distributed cognition and algorithmic biases

AI not only expands human cognition: it also reproduces and amplifies pre-existing biases.[20,24] Algorithms reflect the design decisions and data that feed them; their outputs are therefore loaded with social, cultural, and economic histories.

In education, these biases can impact admission processes, assessment, or automated feedback. Without oversight, algorithmic pedagogy runs the risk of legitimizing inequalities, turning biases into new criteria for normality.

A critical pedagogy in the face of this reality must include:

- Training in data ethics and governance.
- Critical evaluation of model training sources and processes.
- Mandatory human supervision of system-mediated educational decisions.

From this perspective, machine learning requires multiple cognitive literacies. The literature identifies six essential competencies.[30,37,44]

a. AI literacy: understanding how models work, their limitations, and biases.

b. Epistemological thinking: evaluating sources, processes, and criteria for knowledge validation.

c. Technical-semantic communication: interacting with systems critically and effectively (prompt engineering).

d. Data literacy: interpreting metrics, inferences, and application contexts.

e. Technological ethics: incorporating principles of responsibility, privacy, and digital justice.

f. Metacognition: developing awareness of one's own relationship with technology and preventing algorithmic dependency.

These competencies must be integrated across the curriculum as foundational knowledge, not as ancillary content.

Opportunities, risks, and policies for augmented pedagogy

As shown, AI offers unprecedented opportunities: personalization, accessibility, immediate feedback, immersive learning scenarios, and assisted creativity.[31,35] But it also involves structural risks: technological dependence, weakening of critical judgment, deepening inequalities, and erosion of teacher responsibility.[41,45]

The most consistent recommendations point in the same direction:[30,33,41]

a. Systematic and continuous teacher training in AI.

b. Institutional frameworks that integrate pedagogy, governance, and technological operation.

c. Authentic and inclusive assessments.

d. Technical auditing and model transparency.

e. Longitudinal research on cognitive and social impacts.

These policies do not seek to reinforce a technocratic model, but rather to consolidate a critical and augmented pedagogy, in which AI expands human capabilities without colonizing the educational meaning.

AI transforms both pedagogical practice and the cognitive structure of learning. If knowledge no longer belongs to a single subject—neither the teacher, nor the book, nor the system—then the task of education is to redefine the authority of knowledge as a practice shared between humans and machines.

The goal is not to prohibit or idealize technology, but to institutionalize a reflective educational culture that uses AI as a critical mirror of thought. Training students to collaborate

with automated systems, diagnose biases, ask meaningful questions, and act ethically will be the cornerstone of the pedagogy of the future.

This section concludes by recognizing that the new paradigm is not only technological, but also epistemic. Educating in terms of machines means teaching students to think with machines without ceasing to think for ourselves.

Between fascination and resistance: discourses on artificial intelligence

The previous sections addressed the pedagogical, cognitive, and epistemological transformations that AI brings to contemporary education. At this point, it is necessary to explore its symbolic and cultural dimension, as AI has ceased to be a mere technical tool and has become a global narrative that structures our ways of imagining the future, intelligence, and humanity.

Far from being limited to technical reports or specialized papers, AI circulates in the media, education, politics, and popular culture, generating collective imaginaries. In this tension between promise and threat, two complementary forces are articulated: fascination and resistance. Both shape the insertion of AI into contemporary symbolic, economic, and epistemological regimes

Fascination is fueled by media spectacle and the image of efficiency associated with each new model. Conversational interfaces, predictive systems, and large language models are presented as civilizational milestones, with the promise of solving complex problems in health, education, or economics. The media amplifies this perception of imminent progress, celebrating the ability of machines to "teach," "create," or "decide" with an enthusiasm that ranges from scientific amazement to technocratic faith.[46,47] This narrative constructs a story of progress that, rather than informing, persuades: adopting AI becomes synonymous with moving forward, while questioning it is associated with obsolete resistance.

However, this fascination coexists with critical resistance that points to the opacity of systems, the concentration of technological power, and the progressive loss of human agency. Warnings against "technological solutionism" remind us that no technology is neutral: all algorithmic architecture embodies political decisions, economic values, and control structures. So-called "black boxes" not only hinder technical scrutiny, but also shift social responsibility to private actors who monopolize data, infrastructure, and regulatory frameworks. Thus, the more visible the functional performance of AI becomes, the more invisible its material conditions, biases, and ethical costs become.

Myths, fears, and imaginaries

The myth of the "thinking machine" condenses both desires and fears. It is constructed from anthropomorphic metaphors—machines that "reason," "feel," or "create"—that distort the statistical nature of algorithmic systems. These narratives not only inflate expectations about their capabilities, but also generate moral panic: from the loss of human jobs to the replacement of creativity and teaching.[48]

In turn, these narratives feed a geopolitical imaginary, where AI appears as an instrument of surveillance and control, in the hands of corporations or states with the capacity to modulate behavior on a large scale.[49] In this sense, AI operates as a contemporary technomythology: a story that is simultaneously redemptive and apocalyptic, defining how we relate to technology. It is admired for its efficiency and precision, but also feared for its potential to monitor, exclude, or make decisions without accountability.

The media and large technology corporations have been key players in constructing this imaginary. Through campaigns, conferences, cultural products, and media events, they promote a narrative focused on innovation, speed, and the inevitability of change. This rhetoric legitimizes technological adoption as if it were a moral imperative, not a political choice.[47,50]

Behind this narrative lies a geography of power. The concentration of data, infrastructure, and models in the Global North reinforces an epistemological hegemony where a few universities and corporations define the "universal" standards of algorithmic development. This gives rise to what has been called algorithmic coloniality: a form of symbolic and technical imposition in which logics, languages, and categories are exported that do not always dialogue with the realities of the Global South.[49,51]

In the face of this technocentric hegemony, Latin America offers critical and alternative perspectives. With roots in traditions such as those of Freire and Quijano, approaches have emerged that link technology, digital sovereignty, and social justice. These proposals do not seek to reject AI, but rather to re-narrate it from other epistemologies, making technology a means for emancipation rather than dependence.[13,52]

Among the emerging strategies, the following stand out:

- The design of data sovereignty frameworks that prioritize local infrastructures and repositories;
- The integration of critical literacy in AI into university curricula, under approaches such as University 5.0.[9]
- And the promotion of interdisciplinary and intercultural research that includes indigenous, community, and local knowledge in the design and evaluation of intelligent systems.[53,54]

These proposals not only resist the dominant narrative, but also reconfigure the meaning of technology from the South, affirming that another intelligence—local, critical, and situated—is possible.

The notion of algorithmic coloniality allows us to understand how AI reproduces contemporary forms of extraction and inequality. Just as classical colonialism was based on the exploitation of bodies and territories, its digital counterpart operates through data extraction and the imposition of alien epistemic frameworks. Decisions about which categories to use, which data to train, or which results to prioritize are not technical: they are political choices that perpetuate global hierarchies of knowledge.

Empirical studies have documented the concrete effects of these inequalities: from errors in the classification of populations to racial biases in facial recognition or the exclusion of non-hegemonic languages.[51,55] Even the materiality of AI—its energy footprint, its data centers, its supply chains—reveals an extractive economy in which the Global South provides resources to feed models designed and controlled from the Global North.[56]

Strategies of resistance and re-narration

In the face of this concentration of power and meaning, **resistance involves re-telling**. And this re-narration must take place on three interconnected levels: cultural, political, and educational.

- On a cultural level, artistic, documentary, and media counter-narratives that highlight algorithmic failures, systemic biases, and local experiences are key to rehumanizing the debate.[57]
- At the political level, it is becoming urgent to move towards algorithmic transparency and social ownership of data as necessary conditions for democratizing access to technologies and reducing corporate dependence.[52]
- And in the educational sphere, critical literacy and interdisciplinary training become central tools for teachers and students to play an active role: not as passive consumers of technology, but as interpreters, auditors, and co-creators.[9,13]

These strategies not only respond to current challenges, but also project an emancipatory

horizon, where technology can be thought of from other normative, cultural, and political frameworks.

Because discourses on AI are not neutral: they produce possible worlds. Fascination and resistance are not opposed, but coexist as ways of narrating the same complex reality. In this dialectic, Latin America has a unique opportunity: not to repeat the history of technological dependence, but to propose new narratives that situate AI as an open, plural, and situated social construction.

Thinking in terms of machines, from this perspective, does not imply uncritically accepting the language of technology, but rather translating, interpreting, and transforming it. Each algorithm contains a worldview; each model makes decisions that affect lives. Only a technological democracy—based on participation, transparency, and cognitive justice—can turn fascination into understanding, and resistance into a concrete path to emancipation.

Towards a new literacy: learning to think with machines

The previous sections have reflected on the impacts of AI on teaching models, cognitive dynamics, and cultural frameworks. Continuing with this analysis, this segment focuses on an urgent task for contemporary education: rethinking what it means to learn to think with machines.

This process involves a profound change in the way we conceive of knowledge, teaching, and cognition. It means overcoming the metaphor of confrontation—humans versus machines—and moving toward an idea of cognitive collaboration, where AI is not a competitor but a co-agent in ecologies of shared thinking.

From this perspective, learning ceases to be a linear transfer of information and becomes a hybrid interaction. Human and/ al capacities such as intuition, ethical judgment, and cultural sense are articulated with algorithmic functions such as data processing, pattern detection, and automated content generation.[58,59]

This model of distributed intelligence requires rethinking competencies, teaching roles, and institutional infrastructures, while also demanding recognition of the ethical and political risks that AI entails: opacity, data extractivism, bias, surveillance, and concentration of technical power.[4,6,60]

"Thinking with machines" therefore implies a co-creation of knowledge, where systems offer speed, correlation, and prediction, and humans provide context, meaning, and values. This dialogue takes the form of iterative learning cycles: algorithms suggest hypotheses or solutions, and people interpret, adjust, or discuss them.[2,61,62]

However, this collaboration requires recognizing that machines also make mistakes, and they do so in systematic ways. Understanding the "grammar of error" in algorithms—its causes, biases, and structures—becomes an essential pedagogical skill.[4] Thus, thinking with machines is not about accepting their outputs, but learning to question them, integrating human capacities such as critical judgment, cultural interpretation, and divergent thinking.[58,63,64]

Cognitive and ethical competencies for the digital citizen

This new literacy is not solely technical: it requires the integration of cognitive, ethical, and civic knowledge.

On a cognitive level, the following are required:

- Algorithmic thinking and data literacy: understanding how models work, their biases, and limitations.
- Metacognition: the ability to monitor, reinterpret, and correct automated processes.
- Relational creativity: use of AI as a co-author, curator, or critical interlocutor.[60,61,67]

At the ethical and civic level:

- Awareness of privacy and data sovereignty.
- Judgment on fairness, inclusion, and algorithmic justice.
- Public accountability for automated decisions, with deliberative and critical capacity.[6,52,68]

These competencies require transdisciplinary training that connects the humanities, computer science, and critical pedagogy. It is not enough to "know how to use" AI: it is essential to interpret, evaluate, and regulate it.[6,58,69]

In this process, the role of the teacher is profoundly transformed. Rather than a transmitter of content, the teacher becomes a cognitive and ethical mediator, a translator between intelligences.

In this new role, teachers:[70,71]

- Designs activities that take advantage of human-machine complementarity.
- Facilitate the critical evaluation of algorithmic responses.
- Ethical, contextual, and reflective thinking about technology.

This mediation requires mixed training for teachers: basic technical proficiency, digital ethics skills, and a solid pedagogical foundation.[9,62,72] Co-teaching programs—which bring together AI specialists and humanities educators—are strategic. In addition, teachers must take an active role in educational auditing, ensuring transparency, equity, and traceability in the institutional use of these technologies.[10,63,73]

In this new context, teachers are not providers of answers, but guarantors of meaning: key figures in teaching how to think, even when machines also do so.[74,75]

Creativity: amplification or domestication by AI

AI can act as a tool for creative expansion or as a mechanism for cognitive domestication. Its impact depends on how it is integrated pedagogically.[76]

When used as an extension of human thought, AI allows for the expansion of repertoire through variations, simulations, and unusual recombinations.[58,63] But when used as a substitute, geared toward efficiency metrics or obtaining "optimal" results, it tends to homogenize production, impoverishing expressive diversity and reducing creative uncertainty.[77,78]

In response to this, pedagogy must incorporate deliberate de-automation strategies: counterfactual exercises, exploration of errors, aesthetic reinterpretations, and traceability between human and algorithmic contributions. Learning with AI also means resisting the reduction of creativity to the quantifiable and defending the human capacity to imagine the unforeseen.[4,79,80]

Higher education has a key role to play here. Preparing minds to collaborate critically with technology requires profound transformations on three levels:

a. Curriculum: cross-cutting integration of AI literacy (ethics, epistemology, digital rights) in all degree programs.[81,82]

b. Interdisciplinarity: creation of responsible AI laboratories, subjects co-taught by humanities and technology teachers.

c. Authentic assessment: criteria that distinguish between human and algorithmic contributions, valuing reflection and process.[14,83]

d. Institutional governance: clear policies on data protection, audits, and digital sovereignty.[12,52,84]

e. Critical academic culture: promotion of research, art, and experimentation at the limits of automation.[4,85,86]

These actions articulate technological literacy with a truly democratic education, oriented toward cognitive justice and ethical thinking.

Learning to think with machines is not about delegating thought, but about expanding our awareness of how we think, decide, and create. The AI literacy that higher education should promote is technical, critical, and political: it teaches us to use, understand, and question.

Beyond training expert users, it is about creating epistemic citizens: people capable of participating autonomously, responsibly, and creatively in the construction of digital knowledge.

Only then can AI become an ally in the expansion of human thought, rather than a force that replaces its complexity.

Thinking with machines is ultimately a way of learning to be more human in the age of shared intelligence.

CONCLUSIONS

This chapter has argued that thinking like a machine is not a technical gesture, but a pedagogical, philosophical, and cultural provocation. In the transition to an ecology of shared intelligences, education cannot limit itself to integrating new tools: it must rethink itself as a critical, situated, and relational practice.

The presence of systems that simulate, amplify, or displace human capacities forces us to reconfigure our ideas about knowledge, teaching, and humanity. It is no longer enough to transmit information or teach technical skills: it is about training individuals capable of inhabiting a hybrid intelligence without losing their agency, judgment, or sensitivity.

This historic moment challenges not only our educational institutions but also our fundamental categories. What does it mean to learn when machines also learn? What does it mean to teach when the teacher is no longer the sole source of knowledge? What does it mean to think when algorithms also produce meaning?

In this transition, Latin America has a decisive role to play. From its critical traditions and struggles for cognitive justice, the region can offer normative frameworks, epistemologies, and pedagogies that challenge the logic of technological subordination. A humanly intelligent education cannot be measured by its capacity for technical adaptation, but by its power to cultivate autonomy, critical thinking, and ethical commitment.

Rather than providing answers, this chapter leaves open the questions that will run through the rest of the book and invite the reader to join this urgent conversation:

- How do we redefine what it means to be human in an era of thinking machines?
- Can education continue to be a process of emancipation when tools think for us?
- What kind of intelligence do we want to develop: technical, critical, or compassionate?
- What educational legacy will this transition to hybrid intelligence leave behind?
- What ethical and philosophical horizon should guide Latin America in building a humanly intelligent education?

These questions do not seek closure, but rather an opening: that of an educational mindset capable of looking at technology without fetishism, and of shaping humanity in the midst of the mechanical.

Thinking with machines, yes. But thinking with humanity, and doing so from here, from our histories, our territories, and our questions.

BIBLIOGRAPHIC REFERENCES

1. Esteves-Fajardo Z, Gamboa M, Valdivieso M, Murillo J. Cómo impacta la inteligencia artificial en la educación. Reciamuc. 2024;8(1):62-70. https://doi.org/10.26820/reciamuc/8.(1).ene.2024.62-70

2. Canal M, Ardavin A, Díaz-Marcos L, Aguado-Tevar Ó. Aprendizaje generativo integral: un modelo para la educación superior ante los desafíos de la inteligencia artificial. European Public & Social Innovation Review. 2024;9:1-21. https://doi.org/10.31637/epsir-2024-1685

3. Gràcia X, Gil J. La inteligencia artificial en la educación: big data, cajas negras y solucionismo tecnológico. Relatec Revista Latinoamericana De Tecnología Educativa. 2022;21(1):129-145. https://doi.org/10.17398/1695-288x.21.1.129

4. Pasquinelli M, Cafassi E, Monti C, Peckaitis H, Zarauza G. Cómo una máquina aprende y falla – una gramática del error para la inteligencia artificial. Hipertextos. 2022;10(17):13-29. https://doi.org/10.24215/23143924e054

5. Gutiérrez J. Replika y la compañía de la inteligencia artificial emocional. Visual Review International Visual Culture Review. 2022;10(3):1-13. https://doi.org/10.37467/revvisual.v9.3606

6. Vivar J, García-Peñalvo F. Reflections on the ethics, potential, and challenges of artificial intelligence in the framework of quality education (sdg4). Comunicar. 2023;31(74):37-47. https://doi.org/10.3916/c74-2023-03

7. Vera D, Gutiérrez M, Chuquillan D, Carrión D. Avances tecnológicos para la inclusión: el rol de la inteligencia artificial en la diversificación del aprendizaje escolar. Revista Social Fronteriza. 2024;4(3):e43265. https://doi.org/10.59814/resofro.2024.4(3)265

8. Zavaleta J, Narvaez J. Inteligencia artificial bajo juicio. RJChornancap. 2024;1(2):89-96. https://doi.org/10.61542/rjch.52

9. Alvarez-Torres F, Sagahón F, Torres G. Universidad 5.0 el futuro de la universidad y la alfabetización en inteligencia artificial. Ties Revista De Tecnología E Innovación en Educación Superior. 2024;(10):100-111. https://doi.org/10.22201/dgtic.26832968e.2024.10.17

10. Mendoza K. Docentes como intelectuales: sus estratos y su función principal como intérprete y traductor. Ie Revista De Investigación Educativa De La Rediech. 2024;15:e2041. https://doi.org/10.33010/ie_rie_rediech.v15i0.2041

11. Guevara-Reyes R, Ruano-Lara E, Hidalgo-Torres J, Guevara-Serrano J. Exploración del uso de tecnologías de ia en la educación universitaria: caso unemi. Mqrinvestigar. 2024;8(4):2382-2397. https://doi.org/10.56048/mqr20225.8.4.2024.2382-2397

12. Tello A. Sobre el colonialismo digital. Inmediaciones De La Comunicación. 2023;18(2):89-110. https://doi.org/10.18861/ic.2023.18.2.3523

13. Martínez E, Acencio P, Totoy J, Jordán C. La descolonización en la universidad. la ecología de saberes como dispositivo de la desmonumentalización del saber. Pacha Revista De Estudios Contemporáneos Del Sur Global. 2023;4(11):e230117. https://doi.org/10.46652/pacha.v4i11.117

14. Cedeño E, Quintero A, Quiñónez O, Zamora M, Prado N. Análisis de tendencias y futuro de la inteligencia artificial en la educación superior: perspectivas y desafíos. Ciencia Latina Revista Científica Multidisciplinar. 2024;8(1):3061-3076. https://doi.org/10.37811/cl_rcm.v8i1.9637

15. Krylova SM, Krylova V, Nataliya M, Gerasymova E, Tabler T. Relaciones de saber y poder entre la inteligencia artificial y la condición humana: reflexiones desde la filosofía social contemporánea. Interacción y Perspectiva: Revista de Trabajo Social. 2024;14(2):360-370. https://dialnet.unirioja.es/servlet/articulo?codigo=9736805

16. Castelo G, Urda B, Carpintero I, Cirillo D, Valencia A. Inteligencia artifical en biomedicina. Ambiociencias. 2022;(20):7-21. https://doi.org/10.18002/ambioc.i20.7484

17. Israfilzade K, Sadili N. Beyond interaction: generative ai in conversational marketing - foundations, developments, and future directions. Journal of Life Economics. 2024;11(1):13-29. https://doi.org/10.15637/jlecon.2294

18. Rodrigues R, Lima M. Máquinas de pensar. 2022. https://doi.org/10.55371/978-65-5399-061-6

19. Cazar D. Más allá del test de turing: el papel humano en el futuro de la ciencia. Aci Avances en Ciencias E Ingenierías. 2025;17(1):1. https://doi.org/10.18272/aci.v17i1.3886

20. Román-Acosta D. Exploración filosófica de la epistemología de la inteligencia artificial: una revisión sistemática. EPISTEME. 2024;11(1):101-122. https://doi.org/10.61154/rue.v11i1.3388

21. Otero-Hermida P. Pensar la antropología en clave posthumanista. ACS. 2023;(47). https://doi.org/10.7203/acs.v0i47.27413

22. D'Amato K. Chatgpt: towards ai subjectivity. Ai & Society. 2024;40(3):1627-1641. https://doi.org/10.1007/s00146-024-01898-z

23. Tejada J. Transhumanismo y educación: reflexiones sobre la intervención biotecnológica en la práctica educativa. Edähi Boletín Científico De Ciencias Sociales Y Humanidades Del Icshu. 2024;12(24):57-66. https://doi.org/10.29057/icshu.v12i24.11713

24. Martins S, Díaz J, Gómez S. Tecnología, sociedad y cultura ¿una relación ética?. Revista Latinoamericana De Economía Y Sociedad Digital. 2022. https://doi.org/10.53857/zicx3421

25. Villaplana Á. Claudio gutiérrez: en los albores de la inteligencia artificial. Rev. Filosofía UCR. 2024;63(165):241-252. https://doi.org/10.15517/revfil.2024.58418

26. Ungaro A, Harari I, Amadeo A, Almán A. Pensar la accesibilidad en la educación universitaria: concepciones y perspectivas en diálogo con la experiencia. Trayectorias Universitarias. 2023;9(16):128. https://doi.org/10.24215/24690090e128

27. Otálvaro Ó. Industria y educación: un breviario de ideas. Revista De La Facultad De Trabajo Social. 2023;39(39):57-77. https://doi.org/10.18566/rfts.v39n39.a04

28. Rebolloso M, Jaime R, García K, Terrazas B. Justificación para la adquisición de una máquina de micropercusión en el área de ensamble de weir minerals: un enfoque basado en eficiencia y calidad. MDI. 2025;13(21):19-26. https://doi.org/10.29105/mdi.v13i21.329

29. Radrigán V. Enamorarse en clave robótica. primeros materiales para pensar el amor humano-máquina. Ciencias Sociales Y Educación. 2024;12(24):165-182. https://doi.

org/10.22395/csye.v12n24a8

30. Chan C. A comprehensive ai policy education framework for university teaching and learning. International Journal of Educational Technology in Higher Education. 2023;20(1). https://doi.org/10.1186/s41239-023-00408-3

31. Alammari A. Evaluating generative ai integration in saudi arabian education: a mixed-methods study. Peerj Computer Science. 2024;10:e1879. https://doi.org/10.7717/peerj-cs.1879

32. Slade J, Byers S, Becker-Blease K, Gurung R. Navigating the new frontier: recommendations to address the crisis and potential of ai in the classroom. Teaching of Psychology. 2024;52(3):254-261. https://doi.org/10.1177/00986283241276098

33. Kim J, Lee H, Cho Y. Learning design to support student-ai collaboration: perspectives of leading teachers for ai in education. Education and Information Technologies. 2022;27(5):6069-6104. https://doi.org/10.1007/s10639-021-10831-6

34. Berg G, Plessis D. Chatgpt and generative ai: possibilities for its contribution to lesson planning, critical thinking and openness in teacher education. Education Sciences. 2023;13(10):998. https://doi.org/10.3390/educsci13100998

35. Vasconcelos M, Santos R. Enhancing stem learning with chatgpt and bing chat as objects to think with: a case study. Eurasia Journal of Mathematics Science and Technology Education. 2023;19(7):em2296. https://doi.org/10.29333/ejmste/13313

36. Liu H. Applicability of chatgpt in online collaborative learning: evidence based on learning outcomes. iaceducation. 2024;1(1):33-43. https://doi.org/10.33422/iaceducation.v1i1.656

37. Ciampa K, Wolfe Z, Bronstein B. chatgpt in education: transforming digital literacy practices. Journal of Adolescent & Adult Literacy. 2023;67(3):186-195. https://doi.org/10.1002/jaal.1310

38. Miserandino M. Authentic and creative assessment in a world with ai. Teaching of Psychology. 2024;52(3):267-272. https://doi.org/10.1177/00986283241260370

39. Ruiz-Rojas L, Salvador-Ullauri L, Acosta-Vargas P. Collaborative working and critical thinking: adoption of generative artificial intelligence tools in higher education. Sustainability. 2024;16(13):5367. https://doi.org/10.3390/su16135367

40. Li F, Yan X, Su H, Shen R, Mao G. An assessment of human–ai interaction capability in the generative ai era: the influence of critical thinking. Journal of Intelligence. 2025;13(6):62. https://doi.org/10.3390/jintelligence13060062

41. Zhai C, Wibowo S, Li L. The effects of over-reliance on ai dialogue systems on students' cognitive abilities: a systematic review. Smart Learning Environments. 2024;11(1). https://doi.org/10.1186/s40561-024-00316-7

42. Çela E, Fonkam M, Potluri R. Risks of ai-assisted learning on student critical thinking. International Journal of Risk and Contingency Management. 2024;12(1):1-19. https://doi.org/10.4018/ijrcm.350185

43. Hou C, Zhu G, Sudarshan V. The role of critical thinking on undergraduates' reliance behaviours on generative ai in problem-solving. British Journal of Educational Technology. 2025;56(5):1919-1941. https://doi.org/10.1111/bjet.13613

44. Walter Y. Embracing the future of artificial intelligence in the classroom: the relevance of ai literacy, prompt engineering, and critical thinking in modern education. International Journal of Educational Technology in Higher Education. 2024;21(1). https://doi.org/10.1186/s41239-024-00448-3

45. Hyde S, Busby A, Bonner R. Tools or fools: are we educating managers or creating tool-dependent robots?. Organizational Behavior Teaching Review. 2024;48(4):708-734. https://doi.org/10.1177/10525629241230357

46. Roche C, Wall P, Lewis D. Ethics and diversity in artificial intelligence policies, strategies and initiatives. Ai and Ethics. 2022;3(4):1095-1115. https://doi.org/10.1007/s43681-022-00218-9

47. Potnis D, Tahamtan I, McDonald L. Negative consequences of information gatekeeping through algorithmic technologies: an annual review of information science and technology (arist) paper. Journal of the Association for Information Science and Technology. 2024;76(1):262-288. https://doi.org/10.1002/asi.24955

48. Peron A, Evangelista R. Beyond instrumentarianism: automated facial recognition systems in brazil and digital colonialism's violence. Science Technology and Society. 2024;29(4):535-554. https://doi.org/10.1177/09717218241281819

49. Gekker A, Kotliar D. The data center cannot hold: data colonialism and the "nimbus project". Aoir Selected Papers of Internet Research. 2023. https://doi.org/10.5210/spir.v2022i0.13004

50. Park K, Culloty E. Beyond performative transparency: lessons learned from the eu code of practice on disinformation. Aoir Selected Papers of Internet Research. 2023. https://doi.org/10.5210/spir.v2022i0.13067

51. Rodó M, Valderrama M. From copper mining to data extractivism? data worth making at chile's data observatory foundation. Environment and Planning D Society and Space. 2023;41(3):411-432. https://doi.org/10.1177/02637758231183719

52. Lehuedé S. An alternative planetary future? digital sovereignty frameworks and the decolonial option. Big Data & Society. 2024;11(1). https://doi.org/10.1177/20539517231221778

53. Gasparotto M. Fostering linguistic justice in digital spaces: using indigenous methods in the study of nlp. Emerging Media. 2024;3(1):13-22. https://doi.org/10.1177/27523543241305814

54. Cocq C. Open science in sámi research: researchers' dilemmas. Frontiers in Research Metrics and Analytics. 2023;8. https://doi.org/10.3389/frma.2023.1095169

55. Masso A, Chukwu M, Calzati S. (non)negotiable spaces of algorithmic governance: perceptions on the ubenwa health app as a 'relocated' solution. New Media & Society. 2022;24(4):845-865. https://doi.org/10.1177/14614448221079027

56. Bratton-Benfield I. Strategic visibility: architectures of data colonialism in las vegas. Journal of Visual Culture. 2023;22(1):47-63. https://doi.org/10.1177/14704129231161952

57. Lythberg B, Wolfgramm R, Refiti A, Blackwell A. Making relations: re-imagining ai through crafted and embodied knowledge systems in moana oceania. Big Data & Society. 2025;12(2). https://doi.org/10.1177/20539517251337097

58. Liu Y, Fu Z. Hybrid intelligence: design for sustainable multiverse via integrative cognitive creation model through human–computer collaboration. Applied Sciences. 2024;14(11):4662. https://doi.org/10.3390/app14114662

59. Zeng Y, Lu E, Sun K. Principles on symbiosis for natural life and living artificial intelligence. Ai and Ethics. 2023;5(1):81-86. https://doi.org/10.1007/s43681-023-00364-8

60. Zhao Q, Zhang M. The necessity of artificial intelligence universal education course in liberal arts. Journal of Educational Research and Policies. 2022;4(11). https://doi.org/10.53469/jerp.2022.04(11).31

61. Kwon J. A study on ethical awareness changes and education in artificial intelligence society. Revue D Intelligence Artificielle. 2023;37(2):341-345. https://doi.org/10.18280/ria.370212

62. Marcano B, Rodríguez H, Lopez L. Impacto de la inteligencia artificial en la mejora de la práctica docente. Actas IDI-UNICyT. 2024:461-466. https://doi.org/10.47300/actasidi-unicyt-2023-71

63. Dávila L. Conocimiento inteligente para los procesos decisionales en carreras de ingeniería. Brazilian Journal of Development. 2023;9(8):23437-23449. https://doi.org/10.34117/bjdv9n8-023

64. Santillán B, Sosa S, Mariño P, Duran V, Párraga A. Diseño e implementación del gamming impulsados por ia para mejorar el aprendizaje. Ciencia Latina Revista Científica Multidisciplinar. 2024;8(3):4051-4071. https://doi.org/10.37811/cl_rcm.v8i3.11611

65. Andrada P. Entrevista a carlos scolari: “el chatgpt es un animal que debemos domesticar”. Comunicación Y Medios. 2023;32(47). https://doi.org/10.5354/0719-1529.2023.70103

66. Andramuño J. Techmentor: app híbrida que permite la adaptación de la ia en estudiantes de 40 a 60 años en el instituto tecnológico superior sudamericano de guayaquil. Revista Conectividad. 2024;5(2):30-45. https://doi.org/10.37431/conectividad.v5i2.127

67. Bai L, Liu X, Su J. Chatgpt: the cognitive effects on learning and memory. Brain-x. 2023;1(3). https://doi.org/10.1002/brx2.30

68. Baruwa I. A conversation with chatgpt: philosophy, critical thinking, and higher education. 2024;9(1):1-12. https://doi.org/10.61969/jai.1498257

69. Berbenyuk A, Powell L, Zary N. Feasibility and educational value of clinical cases generated using large language models. 2024. https://doi.org/10.3233/shti240705

70. Caisabanda N, López J, Lascano D, Quispilema D. Inteligencia artificial aplicada a la educación. Ciencia Latina Revista Científica Multidisciplinar. 2024;8(4):12127-12156. https://doi.org/10.37811/cl_rcm.v8i5.13405

71. Cerame Á, Juaneda J, Estrella-Porter P, Puente L, Navarro J, García E, et al. ¿es capaz gpt-4 de aprobar el mir 2023? comparativa entre gpt-4 y chatgpt-3 en los exámenes mir 2022 y 2023. Revista Española De Educación Médica. 2024;5(2). https://doi.org/10.6018/edumed.604091

72. Fedoriv Y, Shuhai A, PIROZHENKO I. Linguo-cognitive markers in human vs ai text attribution: a case study of narrative and descriptive discourse. Humanities Science Current Issues. 2023;3(66):130-145. https://doi.org/10.24919/2308-4863/66-3-20

73. Grubaugh S, Levitt G. The future of elementary social studies: harnessing ai's potential through evidence-based practices. Technium Social Sciences Journal. 2024;58:87-93. https://doi.org/10.47577/tssj.v58i1.10991

74. Hutinel M. Máquina y acontecimiento: o de un performativo sin presente. Revista Palabra Y Razón. 2022;(21):10-36. https://doi.org/10.29035/pyr.21.10

75. Lee K, Park H. Development of convergence course of artificial intelligence and psychology applying team teaching method. International Journal on Advanced Science Engineering and Information Technology. 2024;14(5):1772-1778. https://doi.org/10.18517/ijaseit.14.5.11491

76. Núñez-Michuy C, Veloz-Segura V, Agualongo-Chela L, Bayas-Romero E. Integración de la inteligencia artificial en la educación para el desarrollo sostenible: oportunidades y desafíos. Magazine De Las Ciencias Revista De Investigación E Innovación. 2023;8(4):96-108. https://doi.org/10.33262/rmc.v8i4.2959

77. Ou S. Transforming education: the evolving role of artificial intelligence in the students academic performance. International Journal of Education and Humanities. 2024;13(2):163-173. https://doi.org/10.54097/cc1x7r95

78. Putnam E. On (not) becoming machine: countering algorithmic thinking through digital performance art. Frontiers in Communication. 2024;9. https://doi.org/10.3389/fcomm.2024.1352628

79. Quishpi-Quinte C, Lata-García J. Diseño de una máquina bobinadora semiautomática y evaluación del tiempo de ejecución de bobinados de transformadores y motores eléctricos. Mqrinvestigar. 2024;8(3):5646-5660. https://doi.org/10.56048/mqr20225.8.3.2024.5646-5660

80. Ramírez C, Herrero M, Canales F, Hernández A. Capítulo 8. el estudio de aplicación de taller de inteligencia artificial aplicada a niños de sexto de primaria: inteligencia artificial para niños. 2024:97-111. https://doi.org/10.46990/iquatro.2024.08.5.8

81. Sánchez-Holgado P, Calderón C, Blanco-Herrero D. Conocimiento y actitudes de la ciudadanía española sobre el big data y la inteligencia artificial. Revista Icono14. 2022;20(1). https://doi.org/10.7195/ri14.v21i1.1908

82. Scharff C, Cotoranu A, Brusseau J, Wautelet Y. Systematically incorporating equity into design thinking for ai education. Ai Magazine. 2025;46(2). https://doi.org/10.1002/aaai.70008

83. Siegle D. Using ai to foster creativity: removing the fear of the blank canvas. Gifted Child Today. 2025;48(3):227-230. https://doi.org/10.1177/10762175251330329

84. Sila C, William C, Yunus M, Rafiq K. Exploring students' perception of using chatgpt in higher education. International Journal of Academic Research in Business and Social Sciences. 2023;13(12). https://doi.org/10.6007/ijarbss/v13-i12/20250

85. Wijaya T, Yu Q, Cao Y, He Y, Leung F. Latent profile analysis of ai literacy and trust in mathematics teachers and their relations with ai dependency and 21st-century skills. Behavioral Sciences. 2024;14(11):1008. https://doi.org/10.3390/bs14111008

86. Zhang F. Rethinking the chinese room argument. Lecture Notes in Education Psychology and Public Media. 2023;27(1):229-236. https://doi.org/10.54254/2753-7048/27/20231195

FUNDING

None.

CONFLICT OF INTEREST

None.

AUTHOR CONTRIBUTION

Conceptualization: Carolina Herrera López.
Data curation: Carolina Herrera López.
Formal analysis: Carolina Herrera López.
Writing - original draft: Carolina Herrera López.
Writing - review and editing: Carolina Herrera López.