

THE SCHOOL IN THE FACE OF GENERATIVE ARTIFICIAL INTELLIGENCE: AUTHORSHIP, COGNITION, AND LEARNING IN THE FINAL YEARS OF ELEMENTARY EDUCATION AND IN HIGH SCHOOL

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Abstract

The spread of generative artificial intelligence has introduced new questions into everyday school life, particularly at stages of Basic Education in which students consolidate more complex forms of reading, writing, argumentation, problem-solving, and intellectual autonomy. This article analyzes the implications of using generative artificial intelligence in the Final Years of Elementary Education and in High School, focusing on authorship, the cognitive processes involved in learning, and the ways in which schools can incorporate these technologies without transferring to them intellectual functions essential to students' development. This is a qualitative, bibliographic, and theoretical-analytical study based on books, scientific articles, institutional documents, a doctoral dissertation, and recent studies on artificial intelligence, education, writing, cognition, and digital literacy. The analysis demonstrates that the educational effects of generative AI cannot be understood solely in terms of the presence or absence of the technology, as they depend on how it is used, its pedagogical purposes, students' age and development, and teacher mediation. The studies examined point to possibilities related to personalization, writing support, feedback generation, and the development of digital literacy, while also highlighting risks of dependence, cognitive offloading, weakened authorship, and the uncritical use of automatically generated content. It is concluded that the central issue for schools is neither to prohibit nor to normalize generative AI, but to establish pedagogical conditions that preserve students' intellectual participation and assign technology a role consistent with the educational objectives of Basic Education.

Keywords: Authorship, Basic Education, Cognition, Generative artificial intelligence, Learning.

INTRODUCTION

Generative artificial intelligence has entered everyday school life more rapidly than educational institutions have been able to establish pedagogical criteria for its use. Tools capable of producing texts, images, explanations, summaries, and solutions to various tasks have begun to participate in activities previously carried out predominantly by students themselves. This change, however, is not limited to the

presence of yet another technology in schools. When a system can formulate an argumentative response, reorganize ideas, or provide a ready-made summary, it becomes necessary to ask which intellectual operations remain the student's responsibility and which may be supported by technology. UNESCO (2023) observes that generative AI produces content by statistically identifying patterns in large datasets, without this amounting to an understanding of the objects and social relations underpinning language. For this reason, its responses cannot necessarily be regarded as reliable.

In the Final Years of Elementary Education and in High School, this issue takes on particular importance because reading, writing, argumentation, source evaluation, problem-solving, and intellectual autonomy are still being consolidated. Bueie, Skar, and Graham (2026) show that generative AI already participates in different stages of school writing, from idea generation to revision and editing, while warning of the risk of dependence that may reduce students' engagement in analytical and compositional processes. The discussion of authorship therefore extends beyond the problem of copying or plagiarism. From a broader perspective, Orlandi (2012) enables authorship to be understood as a position assumed by the subject in the production of meaning, while Santaella and Kaufman (2024) situate generative AI among the technologies that place pressure on notions historically associated with human creation and symbolic production. What is changing is not only the way a text is written, but the very relationship between subject, language, and intellectual production.

The cognitive dimension adds another layer to the problem. A tool that summarizes, explains, compares, and answers may provide support, but it may also prematurely take over intellectual operations that the student still needs to develop. Tao (2025) proposes that AI integration should be considered in light of stages of cognitive and socioemotional development, rejecting both indiscriminate prohibition and uncritical adoption. Farrokhnia et al. (2024), in analyzing the strengths, weaknesses, opportunities, and threats associated with ChatGPT in education, likewise demonstrate this ambivalence: personalized responses and rapid access to information coexist with limitations related to deep understanding, assessment of response quality, biases, and the development of higher-order thinking skills.

An interpretation focused solely on risks, however, would be equally inadequate. In a study involving 500 students from grades 7 through 12, Wu and Zhang (2025) found positive associations between generative AI applications, innovative capacity, and digital literacy, involving critical thinking, creative problem-solving, and adaptive learning. Kasneci et al. (2023) also recognize possibilities related to personalization, feedback, and material production, while emphasizing the need for critical thinking, information verification, and human oversight. In a systematic review of 71 empirical studies, Liu and Zhong (2025) further demonstrate that the outcomes of integrating AI into learning are strongly related to pedagogical design and underscore the importance of teacher scaffolding. This weakens any assumption that merely providing access to the tool would produce better learning outcomes.

This debate is also unfolding in schools already shaped by hyperconnectivity and the acceleration of digital practices. Silva (2025) identifies fragmented attention and immediacy as factors capable of interfering with concentration and depth of learning, while acknowledging the educational possibilities opened up by technologies. Generative AI intensifies this context because it does more than expand access to information: it participates in selecting, organizing, and formulating that information. The discussion also has an ethical dimension, since the educational use of these systems entails human decisions regarding responsibility, purpose, and limits. Santaella (2025) argues precisely that ethics should provide guidance in relation to generative AI, a perspective that shifts the focus from the tool's technical capabilities to the human decisions directing its use.

It is at this point that the problem guiding this article takes shape: how can schools integrate generative artificial intelligence into the Final Years of Elementary Education and High School without compromising authorship, cognitive development, and the effective construction of learning? This question avoids two common responses that offer little help in understanding the phenomenon: that the technology should simply be prohibited because it poses risks, and that its use is inevitable and should therefore be incorporated without substantial resistance. UNESCO (2023) summarizes this need by arguing that AI technologies should serve to expand human capabilities rather than replace them. In its

formulation, these tools should “extend or augment human intellectual capabilities and social skills, and not undermine, conflict with, or usurp them” (UNESCO, 2023, p. 38, our translation). The relevance of this study lies precisely in the need to shift the debate away from the mere presence of technology and toward the pedagogical conditions governing its use.

Considering this issue, the article’s general objective is to analyze the implications of generative artificial intelligence for the authorship, cognition, and learning of students in the Final Years of Elementary Education and in High School. More specifically, it seeks to discuss how the automated production of content affects the understanding of authorship in school settings; examine possible relationships between AI use, the delegation of cognitive effort, and the development of intellectual capabilities; identify educational possibilities highlighted in recent literature; and reflect on the role of schools and teachers in developing uses that keep students intellectually engaged in the learning process. The purpose is neither to establish an opposition between human learning and technology nor to attribute uniform effects to AI. The focus is on the conditions that distinguish a resource used as support from a tool that begins to perform precisely what the student needed to learn how to do.

Methodologically, this is a qualitative, bibliographic, and theoretical-analytical study. The corpus comprises books, scientific articles, institutional documents, and recent academic scholarship on generative artificial intelligence and education, with particular attention to studies addressing Basic Education, adolescence, writing, cognition, and digital literacy. The analysis prioritizes dialogue between perspectives that recognize the educational possibilities of AI and research that problematizes its effects on autonomy, authorship, and cognitive activity. The methodological process will be detailed in a separate section, including the procedures adopted to select, organize, and analyze the references.

In addition to this introduction, the article first presents the research methodology. The discussion is then organized into three interrelated movements. The first addresses authorship and school production in the context of the automated generation of texts and content. The second examines the relationships among cognition, intellectual effort, and learning in practices mediated by generative AI. The third shifts

the analysis to schools, discussing teacher mediation, AI literacy, and pedagogical criteria for its use in the Final Years of Elementary Education and in High School. The final considerations revisit the principal arguments to maintain that the contemporary educational challenge is not simply to decide whether to accept or reject generative AI, but to preserve, in its presence, what constitutes the educational purpose of schooling: creating conditions for students to learn to think, produce meaning, evaluate, decide, and assume authorship of their own intellectual development.

METHODOLOGY

The study adopts a qualitative, bibliographic, and theoretical-analytical approach, based on the understanding that issues related to generative artificial intelligence in Basic Education require the articulation of recent empirical studies, theoretical scholarship, and documents that make it possible to examine the phenomenon beyond its strictly technological aspects. The research process was guided by the article's central problem, concerning the implications of generative AI for authorship, cognition, and learning in the Final Years of Elementary Education and in High School.

The literature review prioritized works directly related to generative artificial intelligence in educational contexts, with particular attention to Basic Education, adolescence, school writing, cognitive development, digital literacy, authorship, and teacher mediation. Scientific articles, books, institutional documents, literature reviews, and academic studies available in scientific journals, academic publishers' portals, and institutional repositories were consulted. The corpus comprises studies published by various scientific journals and publishers, documents from UNESCO and the OECD, and academic works available in university repositories. The selection was supplemented by consulting references cited in the studies themselves, particularly when they contributed to the conceptual understanding of authorship, cognitive offloading, the pedagogical integration of technology, ethics, and education for the use of artificial intelligence.

The inclusion criteria prioritized works directly related to one or more of the dimensions under investigation; empirical studies involving students or teachers; reviews capable of synthesizing recent evidence; theoretical works relevant to understanding authorship, cognition, and pedagogical mediation; and institutional documents recognized in the fields of education and artificial intelligence. Most of the works were published between 2023 and 2026, a period corresponding to the expansion of publicly accessible generative AI and the growth of research into its educational uses. Earlier works were retained when necessary to support concepts that did not emerge with generative AI, such as authorship, technological mediation, and the delegation of cognitive activities. Predominantly commercial materials, texts without identifiable authorship or academic provenance, and publications whose discussions were limited to the technical operation of systems without a substantive relationship to the educational processes under analysis were excluded.

The corpus was read in a series of interconnected stages. An exploratory reading was initially conducted to identify the relevance of the works to the study's problem and objectives. The selected materials were then examined in full or through the sections directly related to the research topic, with records made of the main conceptual categories, empirical findings, convergences, divergences, and limitations identified by the authors. This procedure made it possible to organize the analysis into three areas: authorship and school production in the context of automated content generation; cognition, intellectual effort, and learning; and teacher mediation, AI literacy, and pedagogical criteria for its use in schools.

The analysis did not seek to arrange arguments for and against AI into opposing blocks, but rather to understand the conditions under which certain forms of use may contribute to learning and the circumstances in which they begin to replace intellectual operations relevant to students' development. The works were therefore placed in dialogue, with attention to points of convergence, divergence, and the limitations of their findings. Direct quotations were selected from the full texts of the works consulted and checked against the original pagination. Excerpts from English-language materials were translated into

Portuguese and identified as our translations. This methodological choice is consistent with the article's perspective: to analyze the presence of generative AI in schools without adopting in advance a position either celebrating or rejecting the technology, taking as a reference its concrete implications for educational processes.

AUTHORSHIP AND SCHOOL PRODUCTION IN THE CONTEXT OF AUTOMATED CONTENT GENERATION

The ability to generate a formally organized text within seconds changes a long-familiar situation in schools. For a long time, the work submitted by students provided teachers, albeit imperfectly, with indications of the process through which it had been produced. A text revealed lexical choices, hesitations, distinctive ways of organizing reasoning, inadequacies, revisions, and traces of the writer's repertoire. Generative AI partially disrupts this correspondence between the product presented and the intellectual process undertaken. A student may submit a linguistically sophisticated response without having developed, to the same extent, the reading, selection, organization, and compositional processes that the text appears to demonstrate.

This change places school authorship in a position that cannot be resolved merely by identifying who wrote each sentence. In Orlandi (2012), authorship is related to the position assumed by the subject in producing discourse and to responsibility for organizing meaning, a perspective that allows the discussion to move beyond material ownership of words. From this standpoint, being an author does not simply mean linguistically producing an utterance, but assuming a position toward what is said by articulating choices, relationships, and meanings. The issue becomes particularly complex when some of these operations can be performed by systems capable of producing coherent texts from relatively simple prompts.

Santaella and Kaufman (2024) broaden this problem by discussing how generative artificial intelligence challenges traditionally established boundaries between human capabilities and machine

production, particularly in the domains of language and symbolic creation. The presence of these technologies does not eliminate human authorship, but makes it less evident where the decisions that give a work direction, intention, and accountability are located. In the school environment, therefore, it is important to determine not only who produced a particular sequence of words, but also who defined the perspective adopted, selected and prioritized information, evaluated the content received, and is able to explain, defend, or rework what is presented as their own.

This tension ceases to be merely conceptual when examined in students' own practices. Bueie, Skar, and Graham (2026) show that generative tools already reach different stages of writing in High School and that their use is growing rapidly. In the authors' study, the proportion of students who reported using generative AI for school purposes rose from 43.7% in 2023 to 71.4% in 2024. Nevertheless, many participants expressed reservations about the benefits of these tools for writing and the reliability of the texts they produced. This finding is important because it precludes both the interpretation that students have simply transferred writing to machines and the assumption that increased use necessarily corresponds to uncritical acceptance.

Instead, the relationship is more contradictory: students are increasingly using the technology, but this does not mean that they place unrestricted trust in it or regard learning to write as unnecessary. The challenge for schools is precisely to understand this intermediate space. Between producing an entire text without assistance and asking a tool to produce it in full, there are different forms of interaction: seeking ideas, requesting explanations, testing possible organizational structures, asking for reformulations, comparing versions, revising arguments, or receiving suggestions. These actions are not pedagogically equivalent and should not be assessed as if they were. It is precisely the nature of this participation, both human and technological, that determines the extent to which AI supports the authorial process or assumes decisions that should remain the student's responsibility.

This distinction is particularly clear when Bueie, Skar, and Graham (2026) discuss the educational implications of their findings among students:

In 2024, seven out of ten High School students in this study indicated that they had used generative AI for school purposes. In the span of only one year, its use for these purposes had increased by 163%. Despite this rapid growth, only half of the students in 2024 indicated that generative AI had been discussed at school, and only two out of seven stated that their school had a policy concerning the use of this technology. Because students need to learn how to use generative AI in authorized, responsible, ethical, and safe ways both in and outside school, teachers, administrators, and school systems need to determine how these tools will be used in writing and establish guidelines accordingly, if they have not already done so. (Bueie; Skar; Graham, 2026, p. 623, our translation).

The passage highlights an important gap: students are incorporating the tool into their practices more quickly than schools are turning it into an object of pedagogical discussion. When schools fail to establish criteria, a lack of guidance does not mean a lack of use. Rather, it means that some decisions about when, why, and to what extent AI should be used are made individually by students, often without sufficient means to assess the consequences of these choices for their own learning. This finding is consistent with what Liu and Zhong (2025) identify in their analysis of studies on integrating generative AI into learning: the technology's potential depends heavily on the pedagogical strategies accompanying its use, while students' independent use does not always receive the support needed to transform technological interaction into learning. In this context, authorship ceases to be merely a matter of academic integrity and comes to require explicit instruction concerning the permissible degrees of technological participation in different activities.

There is a considerable difference, for example, between asking AI to generate questions that help develop an idea the student has already conceived and assigning it the task of formulating the thesis, arguments, and conclusion of a text. In the first case, the tool may function as an interlocutor; in the second, it may take the place of the compositional work itself. This boundary is not fixed, nor can it be defined solely by the number of words generated by the machine. A text partially produced using AI may involve intense intellectual activity on the student's part if it entails selection, evaluation, comparison with sources, rewriting, and justification of choices. Similarly, an apparently authorial work may result from successive requests to the tool in which the student merely accepts ready-made responses. The decisive factor is the quality of the intellectual participation maintained throughout the process.

This perspective helps explain why school writing serves a function that extends beyond producing a linguistically correct result. Students also learn to write by writing: by struggling to formulate an idea, noticing gaps in their own arguments, reorganizing a sequence that does not work, choosing among expressive possibilities, and revisiting what they had regarded as finished. In this sense, writing is simultaneously an object of learning and a means of learning other content. Bueie, Skar, and Graham (2026) warn that dependence on AI for school writing may reduce precisely the time devoted to analyzing and thinking about the information students should mobilize during production. The issue brings authorship and cognition together: when technology systematically eliminates stages of formulation, revision, and decision-making, it changes not only the material origin of the text, but also the intellectual process through which students learn to produce it.

The problem becomes even more evident when one considers that generative systems produce texts whose fluency may conceal weaknesses in content. UNESCO (2023) emphasizes that these systems operate on the basis of statistical regularities found in the data on which they were trained and may produce convincing responses without understanding what they state. Farrokhnia et al. (2024) add that although tools such as ChatGPT offer speed, personalization, and expanded access to information, limitations persist regarding response quality, bias, lack of deep understanding, and implications for higher-order thinking skills. Requiring students to examine, compare, and justify generated content therefore ceases to be an additional precaution and becomes part of education for authorship in digital environments. Accepting a text because it “seems correct” is very different from assuming intellectual responsibility for it.

This responsibility also changes teachers’ work. Concern with determining whether a particular text “was made by AI” tends to generate an unproductive competition between generative systems and detection tools. Kasneci et al. (2023) had already noted the growing difficulty of distinguishing responses produced by students from those produced by language models and argued that, in the long term, curricula and teaching practices should incorporate creative and well-founded uses of these systems rather

than rely exclusively on detection mechanisms. For schools, this entails shifting part of the assessment from the product to the process: preliminary versions, justifications, oral defenses of choices, research records, source comparisons, and rewrites may reveal far more about learning and authorship than an isolated analysis of the final text.

This shift also connects authorship with artificial intelligence literacy. UNESCO (2024) argues that student education should go beyond the instrumental use of tools to encompass a critical understanding of systems, ethical responsibility, and the ability to evaluate when and how to use AI. Its framework organizes these competencies around a human-centered perspective in which students should develop the ability to understand, use, and progressively create with AI without losing their capacity to judge its outputs. In this sense, declaring that a tool was used is only the first step. It is also important to understand what the tool did, which decisions remained the student's responsibility, and how the generated material was evaluated and transformed.

This does not mean abandoning written texts as evidence of learning, but recognizing that their interpretation needs to change. In activities in which generative AI is available, authorship also comes to involve transparency concerning use of the tool, the ability to assess its contribution, and sufficient command of the content to accept, reject, or transform what has been generated. A student author is not necessarily someone who never uses AI, but someone who remains responsible for the intellectual decisions involved in their work. The tool may offer possibilities; it should not silently take the place of the person who needs to learn how to choose among them.

For the Final Years of Elementary Education and High School, this distinction carries particular educational significance. These are stages during which students progressively expand their ability to formulate their own arguments, work with multiple sources, recognize different perspectives, and construct positions. AI may enrich this process when it introduces counterpoints, provides material for analysis, or makes different formulation possibilities visible. Conversely, it may impoverish the process when it systematically eliminates the need to confront uncertainty, produce an initial version, formulate a

hypothesis, or defend an argument. The discussion of authorship thus inevitably leads to the cognitive dimension: if writing, researching, and arguing are also ways of thinking, it becomes necessary to examine what happens to learning when some of this effort is transferred to the machine.

COGNITION, INTELLECTUAL EFFORT, AND LEARNING IN PRACTICES MEDIATED BY GENERATIVE AI

The discussion of generative artificial intelligence in schools cannot be limited to the quality of the responses produced by the tool. For learning, it is equally important to observe the path students follow to arrive at a response, interpretation, or solution. Reading a problem, selecting relevant information, retrieving prior knowledge, formulating hypotheses, testing alternatives, and revising a conclusion are operations that do not always appear in the final product but constitute an important part of the cognitive work involved in learning. When AI begins to perform some of these stages, the pedagogical question ceases to be only what the technology is capable of doing and comes to include what students cease to do when they use it. This distinction is particularly important because, as Liu and Zhong (2025) demonstrate, the educational outcomes associated with generative AI depend on the forms of pedagogical integration and the support offered to students. Tool use and learning therefore cannot simply be equated.

The concept of cognitive offloading helps explain this process. Risko and Gilbert (2016) use the term cognitive offloading to describe situations in which external resources are mobilized to reduce internal cognitive demands. This transfer is not inherently harmful. Notes, calculators, calendars, and search engines also make it possible to move certain operations to external supports. The distinctiveness of generative AI lies in the breadth of tasks it can undertake: in addition to storing or retrieving information, it can organize, relate, summarize, and present information in the form of seemingly finished answers. The ease with which different stages of a task can be transferred to the system therefore broadens an existing human practice, while changing its scale and nature.

It is precisely at this point that the distinction between support and substitution becomes less clear. Farrokhnia et al. (2024) recognize that generative tools can expand access to information, offer personalized responses, and support certain learning activities, but they also identify limitations related to deep understanding and possible implications for the development of higher-order thinking capabilities. The issue, therefore, is not to regard cognitive offloading as necessarily negative, but to identify which operations may be externalized without detriment and which need to remain the student's responsibility because they are part of the skill being developed. A tool that reduces operational effort may free up resources for more intellectually complex activities. The same tool, when used to produce the answer before students have developed the ability to formulate it themselves, may remove precisely the effort required for learning.

This distinction prevents an automatic association between ease and cognitive impoverishment. Not all effort produces learning, and not every reduction in effort represents a loss. The pedagogical issue lies in the nature of the operation being transferred, the student's prior knowledge, the stage of skill development, and the purpose of the activity. It is in this respect that Tao's contributions (2025) become particularly relevant, as she relates AI integration to different stages of cognitive development and the need to preserve progressively increasing levels of intellectual autonomy.

Tao (2025) brings this concern into the field of development by proposing different levels of AI integration according to students' ages. For adolescents, the author recognizes a greater capacity for self-regulation and the possibility of using tools in more sophisticated ways, without concluding, however, that mediation can be dispensed with. Addressing the age group that largely corresponds to High School, she states:

At the final stage, the model provides for regulated collaboration, in which students may use AI more extensively but must maintain a predominant level of independent participation and submit an AI use statement for each activity, detailing how and why the tool was used. The proposal acknowledges AI's legitimate role as a productivity resource but requires that the central intellectual contribution, the "human value added," remain dominant. (Tao, 2025, p. 7, our translation).

The idea of “regulated collaboration” is relevant to schools because it moves the debate away from binary thinking. It is not necessary to choose between completing every activity without any technological support and allowing AI to produce the work on the student’s behalf. There is an intermediate field in which the tool may be used, provided that the core reasoning continues to be developed by the learner. The difficulty lies precisely in identifying that core. In a research activity, for example, obtaining initial keyword suggestions does not produce the same cognitive effect as requesting a ready-made summary and using it without consulting the sources. Likewise, comparing one’s own answer with one generated by AI differs from resorting to the tool before even attempting to solve the question.

This distinction takes on particular importance in the Final Years of Elementary Education, when many skills are still being consolidated. Tao (2025) emphasizes that younger students’ executive functions and self-regulation mechanisms are still developing, requiring greater caution regarding forms of use that encourage dependence or automatic trust in generated responses. The principle can be extended to schoolwork in simple terms: the less firmly established a particular skill is, the greater the caution required when delegating it. A student who still struggles to construct an argumentative paragraph needs to experience the effort involved in selecting an idea, developing it, and connecting it to the text. If this operation is systematically handed over to AI, immediate efficiency may conceal the fact that learning has not occurred.

This does not mean turning difficulty into an absolute pedagogical value. Learning does not depend on keeping students permanently engaged in tasks they are unable to solve. Mediation exists precisely to offer support, cues, examples, and interventions that make possible what students cannot yet accomplish independently. In this respect, AI may perform valuable scaffolding functions: producing examples for comparison, formulating questions, offering alternative explanations, or providing initial feedback. Kasneci et al. (2023) identify possibilities of this kind in different fields and observe that language models can produce personalized materials, explanations, and questions designed to elicit critical thinking. Liu and Zhong (2025), in examining empirical studies on the integration of generative

AI into learning, reinforce the importance of the pedagogical strategies accompanying its use. Educational benefit therefore depends less on the amount of assistance offered by the tool than on whether that support enables students to progress toward more autonomous forms of action.

The findings of Wu and Zhang (2025) help prevent an excessively defensive interpretation. In their study of students from grades 7 through 12, the authors identified positive relationships among generative AI use, digital literacy, and innovative capacity. The result indicates that AI-mediated environments may foster critical thinking and creative problem-solving when organized for this purpose. The data themselves, however, do not justify the conclusion that frequent use automatically corresponds to greater learning. In subsequent analyses, the authors note that mere frequency of interaction may be insufficient to develop more sophisticated capabilities when it is not accompanied by depth and diversity in forms of use. This qualification is important: extensive use of a technology and extensive learning through it are different phenomena.

Silva (2025) adds another element by relating contemporary digital practices to fragmented attention and immediacy. Generative AI is entering schools within a culture marked by an expectation of speed, a circumstance that may make the possibility of eliminating laborious stages especially attractive. An immediate answer, however, is not always pedagogically desirable. There are situations in which searching, making mistakes, revising, and sustaining uncertainty for some time form part of the process through which knowledge is developed. The tool's speed may be advantageous when it reduces peripheral tasks, but it becomes problematic when it eliminates the cognitive time students need to construct relationships themselves.

The central issue, therefore, is not to preserve forms of work artificially simply because they existed before AI. Nor is it a matter of regarding every effortful activity as cognitively valuable. The challenge consists in distinguishing what can be delegated without detriment from what students need to experience for learning to take place. This distinction varies according to age, content, the skill involved, the degree of prior mastery, and the purpose of the activity. The same tool that helps one student progress

in a complex task may prevent another from building a basic skill when it is used to replace that student's first attempt at developing a response.

In this regard, schools will need to make the learning process more visible. Asking students how they reached a particular answer, requesting that they explain a choice, comparing versions, proposing that they rework something without assistance from the tool, or asking them to critically evaluate an AI-generated response are strategies that can make observable some of the intellectual work that the final product can no longer reveal on its own. Concern with cognition therefore does not lead to distancing education from technology, but to developing practices in which AI does not erase the learner's process. This movement restores the teacher to a decisive position, since determining when a tool expands intellectual activity and when it begins to replace it is, above all, a pedagogical decision.

TEACHER MEDIATION, AI LITERACY, AND PEDAGOGICAL CRITERIA FOR SCHOOLS

The presence of generative AI expands the range of decisions teachers must make. It is not enough to be familiar with a tool or show students how to produce effective prompts. Teachers must decide when its use is appropriate, which objectives it may advance, which skills need to remain independent, and how to determine whether the expected learning has occurred. This understanding is consistent with Holmes, Bialik, and Fadel (2019), for whom the discussion of artificial intelligence in education needs to be linked to pedagogical purposes and to the changes these technologies may bring about in teaching and learning processes, rather than only to their technical capabilities. Teacher mediation thus becomes less centered on controlling technology and more concerned with organizing the conditions under which it participates in schoolwork.

In discussing the growing presence of artificial intelligence in education, Selwyn (2019) questions perspectives that treat automation as the natural replacement of tasks performed by teachers. His criticism is particularly pertinent in the context of generative AI because educational decisions encompass contextual, relational, and developmental dimensions that cannot be reduced to generating a technically

adequate response. Teachers know the class's learning trajectory, identify difficulties that are not apparent from a written request, and recognize when students need support and when they need to confront a task with greater autonomy. These decisions form part of pedagogical work and cannot be transferred entirely to systems that operate through probabilistic patterns.

The central role of teachers also appears in the OECD Digital Education Outlook 2023. The document distinguishes mere digitalization from effective educational transformation, arguing that teachers' digital competencies, their ability to critically evaluate technological resources, and their authority to make pedagogical decisions about their use are fundamental conditions for integrating artificial intelligence responsibly. The OECD (2023) specifically highlights teacher agency and continuing professional development among the elements necessary for incorporating digital resources critically into the pedagogical repertoire.

This helps dispel another oversimplification: the idea that preparing teachers for AI would mean teaching them only how to operate platforms or produce effective prompts. Instrumental knowledge is necessary but insufficient. In examining educational uses of ChatGPT, Tlili et al. (2023) identified possible applications accompanied by problems involving response quality, academic integrity, privacy, misleading content, and manipulation. The authors therefore advocate safe and responsible adoption, which requires educators and institutions to understand not only what these tools do well, but also the risks associated with their use.

At the same time, mediation should not take the form of permanent surveillance. Centering the school's response on attempts to determine whether students have used AI tends to make the pedagogical relationship defensive and lacking in educational value. The difficulty of distinguishing human-authored texts from those produced by language models was already identified by Kasneci et al. (2023), who argue that changes in teaching practices and curricula constitute a more consistent response than reliance on detection mechanisms. The challenge is to make the use of AI visible, open to discussion, and intellectually justifiable.

This shift also requires teacher education. In presenting the practical implications of their research, Wu and Zhang (2025) assign a central role to teachers' professional development:

Systematic professional development for educators is essential to maximizing the potential of generative artificial intelligence in the classroom. Equipping teachers with the competencies required to use these tools effectively can ensure their alignment with pedagogical objectives. These initiatives should strengthen educators' own digital literacy and innovative capacity, enabling them to model these competencies for students as well. (Wu; Zhang, 2025, p. 17, our translation).

The education mentioned by the authors cannot be limited to operational mastery of platforms. Knowing how to formulate prompts, generate materials, or use particular resources constitutes only part of the issue. Teachers need to understand system limitations, the risks of fabricated information, bias, privacy concerns, and the differences between activities in which AI serves as support and those in which its intervention compromises the learning objective. Kasneci et al. (2023) likewise associate the educational integration of these models with the development of competencies among teachers and students to recognize limitations, verify information, and maintain human oversight. Tlili et al. (2023), in examining ChatGPT in educational settings, reach a similar conclusion by relating its possible uses to the need to consider academic integrity, privacy, information reliability, and responsible use. Teacher education for AI must therefore combine technical knowledge, pedagogical judgment, and critical capacity.

This perspective is also consistent with the OECD (2023), which identifies teacher education and agency as conditions necessary for digital transformation to move beyond the mere introduction of tools into educational institutions. In this case, teacher competence does not consist in following every technological novelty, but in having the ability to assess what a particular technology adds to a proposed activity, what it may compromise, and which interventions are needed to ensure that its use remains subordinate to educational purposes. It is precisely in this decision-making capacity that human mediation retains its centrality.

In this context, it becomes appropriate to speak of AI literacy. For students, this means more than learning how to obtain better answers. At a level appropriate to their stage of schooling, it entails understanding that generative systems do not possess knowledge or intention in the same terms as humans; that their responses may contain errors; that their outputs depend on the information provided and on patterns present in the training data; and that seemingly convincing content must be compared with other sources. UNESCO (2023) emphasizes precisely that fluent responses do not guarantee accuracy and that many errors may go unnoticed when users lack sufficient knowledge of the subject.

UNESCO's (2024) AI Competency Framework for Students broadens this understanding by proposing AI education guided by a human-centered perspective, ethics, knowledge of artificial intelligence techniques and applications, and the capacity for critical participation in its use. It is therefore not enough to teach students to interact with generative systems. They must develop the ability to understand their limitations, assess their responses, and recognize the implications of their own choices. This conception connects AI literacy with intellectual autonomy: the more powerful the tool becomes, the greater the user's capacity must be to decide when to trust, question, or reject what it offers.

This finding has an important pedagogical consequence: disciplinary knowledge does not lose relevance in the face of AI. In several respects, it becomes even more necessary. Students can critically evaluate a historical explanation, a scientific argument, or a literary analysis only if they possess frames of reference that enable them to recognize inadequacies. The idea that easy access to answers would reduce the need to learn content overlooks the fact that evaluating an answer requires knowledge. The greater AI's ability to produce plausible texts, the more important it becomes to educate students not to confuse plausibility with truth. This concern also aligns with Santaella's (2025) positioning of ethics as a guiding principle for decisions involving generative AI: responsibility lies not only in the system used, but also in how individuals and institutions decide to incorporate it into human practices.

Schools also need to establish different criteria for different tasks. In an activity intended to assess authorial writing, it may be legitimate to restrict AI use at certain stages. On another occasion, a teacher

may explicitly ask students to compare a response produced by the tool with academic sources, identify problems, and propose an improved version. In a research project, AI may assist with the initial organization of questions, provided it does not replace consultation and reading of sources. There is therefore no single rule capable of addressing every situation. Rather, there are principles that must be translated into pedagogical decisions consistent with what is to be taught. Holmes, Bialik, and Fadel (2019) had already warned that the educational value of artificial intelligence depends on its relationship with learning objectives and pedagogical choices, not merely on the functionalities offered by the technology.

Transparency may constitute one such principle. Asking students to report when they used AI, for what purpose, and what they did with the material obtained turns use of the tool into an object of reflection. Tao's (2025) proposal for an AI use statement for older students follows this direction. More than a monitoring measure, such a record may serve a metacognitive function: it requires students to recognize when they resorted to the tool and what its actual contribution to the work was. Transparency thus becomes part of the construction of authorship itself, as it makes visible the distribution of decisions between student and system.

Another criterion concerns assessment. When automated production weakens the correspondence between the final text and learning, it becomes necessary to expand assessment instruments. Oral defenses, classroom production, portfolios, process records, comparisons between versions, and application activities may coexist with work completed with technological support. This does not mean returning exclusively to closed, in-person assessments, but gathering different forms of evidence that enable teachers to understand what students actually know and can do. Tao (2025) points in this direction by advocating more process-oriented assessment, including portfolios, reflections, peer feedback, and oral defenses as ways of preserving the authenticity of learning in contexts shaped by AI.

Teacher mediation therefore assumes a function that does not diminish as technologies advance. Contrary to what an automation-centered perspective might suggest, the growing capabilities of systems

intensify the need for well-informed pedagogical decisions. Although approaching the issue from different perspectives, Selwyn (2019), Holmes, Bialik, and Fadel (2019), the OECD (2023), and UNESCO (2024) converge on the importance of human participation in defining the educational purposes of technology. The teacher ceases to be merely the person who supplies information that can now be found or generated quickly and becomes even more necessary as a professional capable of organizing experiences in which information is questioned, connected, and transformed into knowledge. Between a response produced by a machine and learning constructed by a student lies a distinctly pedagogical space. It is in this space that schools need to act, establishing limits, possibilities, and responsibilities without ignoring technology, but also without handing over to it decisions that belong to the sphere of human development.

FINAL CONSIDERATIONS

The presence of generative artificial intelligence in the Final Years of Elementary Education and in High School confronts schools with a change that goes beyond the incorporation of a new digital tool. By producing texts, organizing information, formulating explanations, and participating in task-solving, these systems begin to operate precisely within activities that, in schools, have always been connected to the development of reading, writing, reasoning, and intellectual autonomy. The analysis conducted throughout this article has therefore shown that the most important educational issue is not whether AI should be present in schools, but what happens to learning when part of the intellectual work can be transferred to it.

In the field of authorship, Bueie, Skar, and Graham (2026) reveal a reality in which generative AI can no longer be treated as a future possibility, while Orlandi (2012) helps explain that authorship involves more than the material origin of words: it presupposes a position assumed in the production of meaning. Santaella and Kaufman (2024), in turn, help situate the shift brought about by systems capable of operating in the domains of language and symbolic creation. In AI-mediated activities, it therefore

becomes necessary to observe who constructed the argument, selected information, evaluated the content received, made decisions, and is able to assume intellectual responsibility for what is presented. School production remains important, but it must be understood in conjunction with the process that made it possible.

The cognitive dimension reinforces this need. Risko and Gilbert (2016) show that transferring certain operations to external resources forms part of the ways in which humans organize cognitive activity. Generative AI, however, considerably expands the scope of such delegation. Tao (2025) relates its use to developmental stages and the degree of autonomy students have already attained, while Farrokhnia et al. (2024) and Liu and Zhong (2025) help demonstrate that the technology's educational effects depend on the tasks performed and the pedagogical conditions accompanying its use. In the Final Years of Elementary Education and in High School, it does not seem reasonable to treat in the same way an established skill, for which AI may offer productivity gains, and a skill still under development, whose performance by the tool may deprive students of a necessary intellectual experience.

The studies analyzed also preclude a conclusion focused exclusively on risks. Wu and Zhang (2025) found positive associations among uses of generative AI, digital literacy, and innovative capacity among secondary education students, while Kasneci et al. (2023) identify possibilities related to personalization, feedback, and support for different learning situations. These contributions nevertheless converge on one point: the mere presence of AI does not in itself produce critical thinking, creativity, or learning. The tool's potential must be converted into pedagogical experience through practices that keep students intellectually active in relation to what they receive.

The discussion becomes even more relevant when situated within the context of hyperconnectivity analyzed by Silva (2025). If speed, immediacy, and fragmented attention already affected how students studied and learned, AI adds the possibility of obtaining not only information rapidly, but also preorganized answers. This ease may be productive when it removes peripheral stages and makes it possible to focus efforts on more complex operations. It may be impoverishing when it eliminates

precisely the difficulty that needed to be confronted for a particular form of learning to become established. The pedagogical challenge lies in recognizing this difference.

At this point, teacher mediation remains central. Selwyn (2019) questions interpretations in which automation appears as the inevitable replacement of human work; Holmes, Bialik, and Fadel (2019) connect AI's value to teaching and learning purposes; and the OECD (2023) and UNESCO (2024) reinforce the need to educate teachers and students capable of making critical decisions regarding digital technologies. Kasneci et al. (2023) and Tlili et al. (2023) add that this integration requires knowledge of system limitations, verification of information, attention to ethical issues, and human oversight. Teachers do not compete with machines' ability to produce answers within seconds. Their role lies in something a ready-made answer cannot resolve: defining why a task should be performed, what kind of effort it should elicit, when assistance is appropriate, how learning can be recognized, and which decisions should not be delegated.

This also entails reviewing certain school practices. Assessment focused exclusively on the final product becomes more fragile when formally sophisticated texts can be generated automatically. Monitoring versions, process records, oral defenses, activities completed under different conditions, and disclosure of AI use may provide more consistent evidence of what students have actually understood. At the same time, educating students for AI literacy means teaching them to question responses, compare sources, recognize limitations, identify bias, and assume responsibility for the choices made with technological assistance. The ethical perspective discussed by Santaella (2025) reinforces that this responsibility cannot be transferred entirely to the system: it remains human and institutional.

The analysis developed here therefore supports the conclusion that generative artificial intelligence can be integrated without compromising authorship, cognitive development, and learning, provided that its use remains subordinate to the educational purposes of schools. This requires distinguishing between support and substitution, attending to developmental stages, ensuring transparency regarding use of the tool, diversifying forms of assessment, and maintaining effective teacher mediation.

AI can collaborate with students in relation to what they are already able to question, evaluate, and transform. It becomes problematic when it silently begins to perform what they still needed to learn how to do.

Schools therefore do not need to choose between preserving a past without artificial intelligence and embracing a future defined by technological possibilities. Their responsibility is more demanding: to decide pedagogically which intellectual experiences remain indispensable to human development in a context in which many of them can be automated. The answer will lie neither in generalized prohibition nor in unrestricted adoption, but in the capacity to preserve the student as the subject of the learning process. As UNESCO's (2023) human-centered perspective maintains, technology should expand human capabilities, not usurp them. In this sense, the most important criterion for assessing the presence of generative AI in schools may also be the simplest: after using it, students need to be able to think, understand, explain, produce, and decide more, rather than merely submit the requested work more quickly.

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