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Reconfiguring Education in the Age of Artificial Intelligence: A Critical Theoretical Inquiry into Pedagogy, Knowledge, and Human Agency

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ABSTRACT

The rapid integration of Artificial Intelligence (AI) into educational systems has generated both enthusiasm and unease, often framed through instrumental narratives of efficiency, personalization, and innovation. However, such perspectives risk overlooking the deeper epistemological, pedagogical, and political transformations that AI introduces into the field of education. This article offers a critical theoretical examination of the future of education in the age of AI, arguing that AI is not merely a technological enhancement but a restructuring force that redefines the conditions of knowledge production, learner subjectivity, pedagogical authority, and institutional governance. Drawing on contemporary scholarship in educational theory, critical data studies, and digital sociology, the article interrogates how AI reconfigures key educational concepts such as learning, assessment, literacy, and expertise. It further examines the tensions between personalization and standardization, automation and human agency, and datafication and ethical responsibility. While acknowledging the transformative potential of AI in expanding access and supporting adaptive learning, the article contends that its uncritical adoption risks reinforcing technocratic models of education, algorithmic inequality, and epistemic dependency. The study concludes by articulating a set of human-centered principles for AI integration, grounded in critical pedagogy, ethical reflexivity, and the preservation of education as a space of intellectual and social formation rather than mere performance optimization.

KEYWORDS

AI Literacy

Artificial Intelligence

Critical Pedagogy

University Students

Datafication

Digital Sociology

Educational Theory

Introduction

The growing presence of Artificial Intelligence (AI) in educational contexts is frequently framed through narratives of innovation, efficiency, and disruption. Across policy reports, institutional strategies, and educational technology discourse, AI is often celebrated as a transformative force capable of modernizing teaching and learning through personalization, automation, and data-driven decision-making. Educational stakeholders are increasingly told that AI can tailor learning experiences to individual needs, automate assessment processes, identify at-risk students, and improve institutional planning with unprecedented speed and precision (Holmes et al. 14; UNESCO). This broader transformation is also becoming visible within the Moroccan educational context, where recent scholarship has called for the integration of AI into secondary-school curricula while emphasizing the need to consider the specific

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conditions and challenges of the Moroccan educational system (El Khayati et al.). Within such narratives, AI tends to be positioned as a largely neutral and beneficial instrument whose principal role is to optimize existing educational systems and make them more effective.
Recent debates surrounding generative AI have further complicated this optimistic narrative by highlighting the pedagogical and epistemic risks associated with large language models in educational settings. While such systems may support accessibility, personalized learning, and rapid feedback, scholars also warn that they may contribute to misinformation, superficial learning practices, overreliance on automated systems, and the erosion of critical engagement if adopted uncritically. In this sense, the educational implications of AI extend beyond efficiency and innovation to broader concerns about knowledge reliability, intellectual autonomy, and the future of human learning itself (Kasneci et al. 2-4).

While these claims are not without substance, they often remain confined to an instrumental understanding of technology, one that treats AI primarily as a set of tools designed to solve practical problems (Zawacki-Richter et al.). Such a framing, however, risks obscuring the deeper significance of AI's integration into education. AI does not merely enhance pre-existing educational practices; it also participates in reshaping the conceptual, epistemological, and social foundations upon which those practices are built. It alters not only how education is delivered, but also how learning is imagined, how knowledge is valued, how students are represented, and how institutional decisions are made. In this sense, AI should not be viewed simply as an innovation applied to education from the outside, but as a transformative force that is increasingly implicated in the internal reorganization of educational life itself.

Recent scholarship increasingly challenges technocratic perspectives by arguing that AI should be understood as a socio-technical phenomenon embedded within broader relations of power, governance, and knowledge production (Williamson and Eynon 225; Selwyn 47). From this perspective, AI does not simply enter education as an external innovation; it reshapes what counts as knowledge, how learning is measured, and how educational subjects are constituted.

This transformation has also intensified ethical concerns regarding surveillance, bias, and inequality within educational environments increasingly shaped by AI infrastructures. Recent research emphasizes that algorithmic systems may reproduce existing social inequalities through biased datasets, uneven access to technological resources, and forms of automated decision-making that disproportionately affect marginalized learners. As Akgün and Greenhow argue, educational AI systems must therefore be examined not only in terms of functionality, but also in relation to questions of fairness, accountability, and social justice (435-36).

What becomes educationally meaningful, measurable, or actionable is increasingly shaped by the computational logics and data structures through which AI systems operate. For this reason, the future of education cannot be reduced to narrow questions of implementation, technical effectiveness, or classroom utility alone. It must also be approached as a contested terrain in which broader struggles over authority, human agency, equity, and the purpose of education itself are being negotiated. To ask what AI will do to education is therefore also to ask what kinds of educational futures are being imagined, whose interests they serve, and what forms of knowledge, pedagogy, and personhood they privilege. The integration of AI raises not only practical concerns about tools and methods, but also deeper philosophical questions about what education is for in a world increasingly shaped by algorithmic systems.

Methodologically, this article employs critical conceptual analysis as its primary mode of inquiry. Rather than presenting empirical data or evaluating the effectiveness of particular AI applications, it examines how the integration of AI into education alters the meanings, assumptions, and relations underlying established educational concepts. The analysis proceeds by bringing key concepts, such as learning, knowledge, pedagogical authority, assessment,

authorship, and learner agency, into critical dialogue with scholarship in educational theory, critical data studies, and digital sociology. AI is therefore approached not simply as a technological object, but as a socio-technical formation whose educational significance becomes visible through the concepts and institutional practices it reorganizes.

The inquiry proceeds through a comparative and interpretive reading of these conceptual transformations. First, it identifies the assumptions embedded in dominant accounts of AI in education, particularly those that frame AI in terms of efficiency, personalization, automation, and optimization. It then examines how these assumptions intersect with broader processes of datafication and algorithmic governance, asking what forms of knowledge, visibility, authority, and learner subjectivity they privilege. The analysis subsequently places these transformations in dialogue with established theoretical perspectives, including constructivism, critical pedagogy, and theories of educational purpose and human agency. This approach makes it possible to identify tensions that may remain obscured within purely instrumental accounts of educational technology, particularly the tensions between personalization and standardization, automation and agency, and epistemic abundance and epistemic responsibility.

The article thus adopts a critical rather than predictive or technologically deterministic orientation. Its purpose is not to establish a single model for the future of AI in education, but to interrogate the conceptual and normative consequences of increasingly AI-mediated educational environments. By examining what becomes newly visible, measurable, authoritative, or actionable through AI systems, the analysis seeks to uncover the assumptions and power relations that accompany technological change. The resulting argument is consequently interpretive and theoretical: it evaluates competing understandings of education in light of AI-driven transformations and uses those tensions to articulate the conditions under which technological integration might remain compatible with human agency, critical judgment, and the broader intellectual and social purposes of education.

Theoretical Foundations: Education, Datafication, and Algorithmic Governance

Datafication and the Reconstitution of the Learner

One of the most significant theoretical developments in recent scholarship on Artificial Intelligence in education is the concept of datafication, a term that has become central to critical discussions of digital governance, platformization, and algorithmic power. As van Dijck explains, datafication refers to "the transformation of social action into online quantified data" (198), a process through which behaviors, interactions, and practices become available for tracking, analysis, and predictive intervention[1]. In educational contexts, this process is increasingly visible through the proliferation of learning management systems, adaptive learning platforms, biometric attendance systems, automated feedback software, intelligent tutoring systems, and learning analytics dashboards. Through these tools, learners are no longer engaged solely as students in a pedagogical relationship, but also as data-generating subjects whose every action may be rendered measurable and computationally meaningful.

This process reflects a broader transformation in contemporary digital culture, where human activity is increasingly converted into extractable and economically valuable data. Recent critical scholarship has conceptualized this phenomenon as a form of data colonialism, through which human life itself becomes a resource appropriated by digital infrastructures for economic and computational purposes. Within educational contexts, this raises important concerns regarding ownership, consent, and the commodification of learner behavior (Couldry and Mejias).

The implications of AI-driven educational transformation, however, cannot be understood adequately through experiences of technologically advanced educational systems alone. In many parts of the Global South, and particularly across African educational contexts, the integration of AI takes place within conditions marked by uneven digital infrastructure, linguistic diversity, resource constraints, and persistent inequalities in access to educational technologies. Recent scholarship on AI and personalized learning in African education points to the limited visibility of developing-country contexts within the dominant research literature and highlights the importance of infrastructure, contextual adaptation, digital inequality, and ethical governance when AI systems are introduced into resource-constrained educational environments (Nzama and Nkomo). These conditions complicate universal claims about the transformative potential of AI. What may appear as increased personalization or efficiency in technologically mature systems may, in other contexts, also intensify existing inequalities or reproduce educational models whose assumptions are imported from elsewhere.

The African context also draws attention to a cultural and epistemic dimension of AI that remains insufficiently visible in predominantly Western accounts of educational technology. Recent discussion of AI in African education has raised concerns that educational systems may become dependent on technologies whose linguistic, cultural, and epistemological assumptions are developed elsewhere. Such concerns are particularly significant in educational environments where local languages, indigenous knowledge systems, and culturally situated forms of learning are already underrepresented in digital infrastructures. The question, therefore, is not simply whether African educational systems can gain access to AI, but whose knowledge, languages, values, and conceptions of learning become embedded in the systems through which that access is mediated. A genuinely human-centered approach to AI in education must consequently account for contextual differences and resist treating technological integration as a culturally neutral process.

What is particularly important about this transformation is that it is not limited to the digitization of educational activity; rather, it entails a deeper shift in how learning itself is understood, represented, and governed. Datafication does not merely record educational practices after they occur; it actively shapes the categories through which educational reality is perceived. In this sense, it reorganizes the epistemological foundations of educational judgment. Behaviors such as time spent on a task, frequency of participation, click sequences, hesitation intervals, quiz completion rates, and interaction histories increasingly become proxies for engagement, motivation, comprehension, and even potential. The learner is thus translated into a profile of measurable indicators through which institutional systems seek to make educational processes more visible, manageable, and predictable. As a result, educational subjectivity is increasingly mediated by systems that claim to know the learner through patterns extracted from data rather than through dialogic, contextual, or relational understanding.

This transformation is not merely technical but ontological. As Williamson argues, learners are increasingly constituted through data infrastructures that determine what becomes visible, measurable, and actionable within education (9). Learning is thus interpreted through behavioral traces rather than broader intellectual or social dimensions, producing what may be understood as a calculable learner.

A concrete illustration of this process can be found in Purdue University's Course Signals, an early-warning learning-analytics system designed to identify students who might be experiencing academic difficulty. Rather than relying exclusively on grades, the system drew on multiple categories of data, including students' current academic performance, prior academic history, demographic characteristics, and measures of effort derived from their interactions with the university's learning management system. These data were processed to

generate a traffic-light indicator (green, yellow, or red) communicating different levels of academic risk and enabling instructors to intervene through personalized messages or referrals to academic support (Arnold and Pistilli 267–70).

Course Signals provides a concrete example of what this article conceptualizes as the "calculable learner." The student becomes institutionally legible through selected variables that can be quantified, compared, and translated into a prediction of future performance. The significance of this process lies not in claiming that such indicators are necessarily inaccurate or pedagogically harmful; indeed, early-warning systems may enable timely forms of support. Rather, the case demonstrates that prediction depends on decisions about which aspects of a learner are computationally visible and which remain outside the model. Engagement, for example, becomes partly knowable through recorded interaction with a learning management system, while less quantifiable dimensions of learning (personal circumstances, intellectual curiosity, informal study, changing motivation, or the relational context of the classroom) are more difficult to encode. The "calculable learner" is therefore not the learner in their entirety, but a computational representation constructed from those dimensions of educational life that the system is capable of measuring.

The implications of this are profound. Learning becomes legible less through human interpretation and more through behavioral traces: click patterns, response times, navigation pathways, frequency of logins, assessment performance, and error rates. While such indicators may indeed reveal useful information, they remain partial and often reductive representations of educational experience. They privilege externalized and observable behaviors over the interior, relational, and socially embedded dimensions of learning. In doing so, they contribute to the construction of what may be called the "calculable learner"[2], a student whose educational identity is increasingly defined through metrics, probabilities, and predictive models rather than through lived experience or pedagogical encounter. The learner becomes not simply someone who studies, questions, struggles, and grows, but someone whose educational future can supposedly be anticipated through algorithmic interpretation.

This reconstitution of the learner as a data object must be understood within a broader framework of power. In many ways, it resonates with Michel Foucault's analysis of disciplinary power, particularly his argument that modern institutions operate through techniques of surveillance, normalization, and examination. Schools, like prisons, hospitals, and barracks, historically functioned as disciplinary spaces in which individuals were observed, classified, corrected, and compared. However, the contemporary digital educational environment extends this logic in new and more pervasive ways. Surveillance is no longer limited to the classroom gaze or the institutional report card; it now unfolds continuously and invisibly through platform infrastructures that collect and process learner data in real time. The learner is not only watched but also computationally interpreted, scored, categorized, and nudged (Foucault 170-94, 195-228).

Yet datafication in education goes beyond classical disciplinary power and enters what contemporary scholars describe as algorithmic governance: a form of power that, as Beer notes, is "increasingly embedded in everyday decision-making processes through the use of data and algorithms" (3), operating through automated prediction, behavioral modeling, and anticipatory control. Algorithmic governance differs from older forms of institutional regulation in that it does not simply react to student performance after the fact; rather, it seeks to intervene preemptively by forecasting risk, identifying likely outcomes, and recommending action before events fully unfold. A student may be flagged as "at risk" not because they have failed, but because their digital behavior resembles the patterns of previous students who did. In this way, AI systems do not merely describe educational reality; they increasingly participate in producing it.

This concern resonates with wider critiques of opaque algorithmic systems operating across contemporary institutions. Frank Pasquale warns that many algorithmic processes increasingly function as "black boxes," where important decisions are made through systems whose internal operations remain inaccessible to those affected by them (3). In educational environments, such opacity may limit students' and teachers' ability to understand how algorithmic judgments are formed or challenged.

This predictive logic has serious implications for learner autonomy and educational agency. When students are categorized through predictive models, they may come to be treated not according to who they are or what they might become, but according to what the system has calculated they are likely to do. Such processes risk narrowing educational possibility by replacing openness with probability. A student's future may be quietly shaped by an algorithmic assumption before the student has had the opportunity to exceed, resist, or redefine it. In this sense, datafication can subtly transform education from a space of possibility and formation into a space of anticipatory management. The learner is no longer simply educated; they are increasingly *pre-empted*.

Moreover, the logic of datafication tends to privilege forms of educational value that are easily quantifiable, thereby contributing to a broader managerial rationality within educational institutions. Students become dashboards, risk profiles, and performance indicators. Teachers may be encouraged to respond to metrics rather than to students' lived complexity. Institutional success becomes increasingly tied to retention rates, predictive accuracy, and measurable outcomes. While such developments are often justified in the language of support and efficiency, they also reflect a subtle but significant redefinition of educational purpose. Education risks being reframed less as a process of human development and more as a field of optimization governed by data extraction and algorithmic intervention.

This does not mean that educational data use is inherently harmful. Learning analytics may reveal exclusion patterns and support intervention. The central issue concerns how data are interpreted, who controls them, and what dimensions of learning disappear when data become the dominant lens through which education is understood.

For this reason, datafication must be approached not merely as a technological development but as a political and pedagogical reconfiguration of the learner. It compels us to ask not only what educational systems can know about students through data, but also what they fail to know, what they choose not to value, and what forms of subjectivity they ultimately produce. The future of education in the age of AI will depend, in large part, on whether institutions continue to treat learners primarily as data points to be optimized or whether they preserve an understanding of education as a fundamentally human, relational, and open-ended process of becoming.

Algorithmic Rationality and the Technocratic Turn in Education

The increasing reliance on Artificial Intelligence in educational settings signals what may be described as a broader technocratic turn in education, a shift in which educational processes, judgments, and priorities are increasingly shaped by computational logics, managerial frameworks, and data-driven systems of control. In this emerging landscape, decision-making processes that were once grounded primarily in professional expertise, pedagogical intuition, institutional culture, and contextual understanding are progressively being mediated by algorithmic models and predictive infrastructures. Whether in the form of early-warning systems, automated assessment tools, performance dashboards, adaptive platforms, or

predictive analytics, AI is increasingly positioned not merely as a support mechanism, but as an authoritative actor in educational governance.

At first glance, this development appears highly desirable. Educational institutions have long struggled with large student populations, uneven learning outcomes, administrative overload, and limited resources. In this context, AI promises efficiency, scalability, and precision. Predictive systems can identify students deemed "at risk," recommend interventions, optimize resource allocation, and support institutional planning with a degree of speed and consistency that human actors alone may not always be able to achieve. Such tools are often presented as objective and evidence-based, offering seemingly neutral forms of insight that can improve educational effectiveness and reduce human error.

Yet the apparent neutrality of such systems must be critically interrogated. What is at stake is not simply the adoption of new technologies, but the emergence of a new form of epistemic authority in education, one in which algorithmic systems increasingly participate in defining what counts as valid knowledge, credible evidence, effective learning, and educational success. In other words, AI does not merely assist educational institutions in making decisions; it also begins to reshape the very grounds upon which those decisions are made. When predictive models identify "risk," when dashboards define performance, or when adaptive systems determine what content a learner should encounter next, they do more than inform practice: they establish particular norms of visibility, value, and intervention.

This development reflects what may be called algorithmic rationality[3], a mode of reasoning grounded in the logic of calculation, prediction, optimization, and procedural efficiency. Algorithmic rationality privileges what can be formalized into data structures, modeled computationally, and rendered actionable through automated systems. It operates according to the assumption that educational processes can be improved by making them more measurable, more predictable, and more controllable. In this framework, complexity is often treated as a problem to be reduced, uncertainty as a variable to be managed, and deviation as a pattern to be corrected.

Such a rationality is not unique to AI, but AI significantly intensifies its reach and legitimacy. Educational institutions have long been shaped by bureaucratic and managerial logics, particularly under neoliberal reforms that emphasize accountability, benchmarking, standardization, and measurable outcomes. However, AI gives these tendencies a new technical infrastructure and a new language of inevitability. It enables educational systems to move from retrospective evaluation to anticipatory governance, in which future outcomes are modeled in advance and institutional action is increasingly guided by probabilities rather than by pedagogical dialogue or ethical deliberation. This is particularly visible in systems that classify students according to predicted dropout risk, future performance, or engagement likelihood. Such systems do not simply observe students; they position them within computational forecasts that may shape how they are treated before their educational trajectories have fully unfolded.

This anticipatory orientation can also be understood through Shoshana Zuboff's analysis of surveillance capitalism, particularly her account of how the extraction and analysis of behavioral data enable digital systems to move from observing conduct toward predicting and shaping future behavior. Although Zuboff develops her argument primarily in relation to digital capitalism rather than education, her analysis offers a useful conceptual lens for understanding datafied educational environments. When learner activity is continuously converted into behavioral data and subsequently used to generate predictions about performance, engagement, or dropout, the educational subject increasingly becomes an object of anticipatory knowledge: a profile whose possible future is modeled before it unfolds. The significance of this process lies not only in surveillance or data collection, but also in the shift from retrospective description

toward predictive intervention. In educational settings, the question is therefore no longer simply what a learner has done, but what the system predicts the learner will do and which institutional responses may follow from that prediction. Zuboff's account thus strengthens the argument that datafication can transform educational governance by making prediction a basis for intervention and by potentially narrowing the space for human judgment within computationally organized futures.

The problem, then, is not only that educational decisions are becoming more automated, but that educational reasoning itself is increasingly being reorganized around the principles of optimization. Algorithmic systems operate according to a logic that seeks to maximize efficiency, reduce variability, and improve outcomes according to predefined indicators. They prioritize those dimensions of education that can be measured, compared, and improved over time. In many cases, this may include attendance, test scores, completion rates, task accuracy, or platform engagement. While such indicators are not inherently irrelevant, they represent only a narrow slice of what education entails. As Selwyn notes, the growing influence of AI reflects a broader shift toward what he describes as "data-driven schooling," in which educational value is increasingly articulated through dashboards, metrics, performance indicators, and forms of computational accountability (47).

This has serious implications for the future of pedagogy. When educational institutions become increasingly dependent on algorithmic systems, they may begin to privilege only those forms of learning that are legible to such systems. This creates a subtle but powerful pressure to redefine educational success in machine-readable terms. Learning becomes valuable insofar as it can be tracked, performance becomes meaningful insofar as it can be visualized, and intervention becomes legitimate insofar as it can be justified through data. As a result, educational priorities may gradually shift away from broader humanistic aims and toward a narrower conception of education as measurable progression through predefined benchmarks.

This narrowing effect is particularly concerning because many of the most important dimensions of education resist easy quantification. Critical reflection, interpretive depth, ethical reasoning, intellectual risk-taking, creativity, ambiguity tolerance, dialogic understanding, and emotional maturation are central to meaningful education, yet they do not lend themselves easily to algorithmic capture. These forms of learning often unfold slowly, unevenly, relationally, and in ways that cannot be fully translated into behavioral metrics or performance dashboards. If educational institutions become too reliant on algorithmic rationality, there is a real danger that such dimensions will be marginalized, not necessarily because they are unimportant, but because they are inconvenient to systems designed around efficiency and measurability.

This concern invites a deeper theoretical reflection on the nature of educational knowledge itself. Education has never been only about the acquisition of information or the optimization of performance. At its richest, it is also about formation: the cultivation of judgment, self-reflection, social responsibility, and the capacity to engage critically with the world. These dimensions are not incidental; they are central to the emancipatory and democratic potential of education. However, when education is increasingly governed through computational systems, there is a risk that it will be reimagined less as a process of formation and more as a process of management. Students become performance profiles, teachers become data interpreters, and institutions become optimization environments.

Moreover, algorithmic rationality tends to privilege a particular model of knowledge, one that values prediction over interpretation, correlation over causation, and operational usefulness over conceptual depth. This has epistemological consequences. Educational systems may begin to trust what algorithms can detect more readily than what teachers can perceive or what

students can articulate. In such a context, professional judgment may be subtly displaced by technical authority, and pedagogical wisdom may be subordinated to computational recommendation. The teacher's interpretive understanding of a student's silence, confusion, or resistance may become less institutionally visible than the data signal generated by platform interaction. This marks not only a shift in tools, but a redistribution of authority within educational space.

For this reason, the future of education depends not simply on whether institutions adopt AI, but on whether they can resist allowing algorithmic rationality to become the dominant grammar of educational value. The central question is not whether AI can make education more efficient, but whether education can remain intellectually, ethically, and socially meaningful under conditions increasingly governed by optimization. If educational value is defined primarily through what can be quantified, predicted, and improved, then education risks losing its capacity to cultivate precisely those forms of thought and being that matter most. The challenge, therefore, is not to reject AI outright, but to ensure that educational institutions do not surrender pedagogy to the seductive but ultimately limited logic of data-driven control.

Reconfiguring Knowledge and Learning in AI-Mediated Environments

From Scarcity to Abundance: The Epistemic Shift

Historically, education has been organized around the problem of knowledge scarcity. For much of its institutional history, access to information was limited, unevenly distributed, and often mediated through authoritative structures such as schools, universities, libraries, and scholarly communities. Within this context, educational institutions functioned as central sites of knowledge transmission, where teachers and academic authorities played a crucial role in selecting, organizing, and legitimizing what was worth knowing. Learning, therefore, was largely structured around the acquisition of scarce and institutionally curated knowledge, and educational success was often measured by the extent to which learners could retain and reproduce this information.

The emergence of Artificial Intelligence, particularly generative systems, profoundly disrupts this model by introducing an environment of radical epistemic abundance. Information is no longer limited by access or availability; it can now be produced, reformulated, and expanded on demand.

Recent scholarship on large language models suggests that this shift may fundamentally alter traditional relationships between learners and knowledge production. Gan et al. argue that generative AI systems increasingly function not merely as repositories of information, but as active participants in content creation, explanation, and academic interaction (3). As a result, learners now encounter knowledge in forms that are dynamically generated rather than statically retrieved, thereby transforming how educational authority and expertise are experienced.

Learners are no longer dependent on institutional gatekeepers to encounter knowledge, as AI systems can generate explanations, summaries, arguments, and even entire texts in real time. This shift does not simply increase the quantity of accessible information; it fundamentally alters the conditions under which knowledge is encountered and engaged with.

The implications of this transformation for learning are significant. If knowledge can be instantly generated, then education can no longer define its primary task as the accumulation or retrieval of information. Instead, the emphasis must shift toward the development of epistemic competencies: the ability to evaluate credibility, interpret meaning, identify bias, and situate information within broader intellectual and social contexts. In this sense, learning becomes less about possession of knowledge and more about navigation within complex informational

environments. As Luckin et al. suggest, the role of education in an AI-mediated world increasingly lies in supporting learners to move from passive consumption toward what they describe as "human intelligence working in partnership with artificial intelligence" (14), fostering more active and critical engagement with knowledge systems.

Luckin et al. offer a substantially more affirmative account of AI in education than the critical perspective developed here. Their argument is not simply that AI can automate existing educational practices, but that artificial intelligence can expand access to forms of individualized support that conventional educational systems cannot provide at scale. They envision intelligent tutoring systems, adaptive learning environments, and other AI-supported tools as means of extending personalized guidance, supporting teachers, and enabling learners to develop forms of intelligence suited to an increasingly technological world. From this perspective, AI is not primarily a threat to educational purposes but a resource through which those purposes can be reimagined and extended.

Yet this optimistic account also raises a question that is central to the present analysis: what conception of education is embedded in the process of extending learning through intelligent systems? The promise of individualized support depends on translating aspects of learning into forms that computational systems can detect, model, and respond to. Even when AI is conceived as a partner rather than a replacement for teachers, this partnership remains structured by the categories, data, and forms of intelligibility available to the system. The issue, therefore, is not whether AI can provide useful personalization or expand access to educational support; it is whether the pursuit of these benefits risks privileging those dimensions of learning that can be rendered computationally visible. A human-centered approach must consequently ask not only what AI can do for learners, but also which educational purposes should remain grounded in forms of judgment, dialogue, interpretation, and relational understanding that cannot be reduced to algorithmic optimization.

However, this condition of epistemic abundance is not without its risks. While AI-generated outputs are often fluent, coherent, and rhetorically persuasive, they are not inherently reliable or grounded in verifiable sources. Generative systems produce content based on probabilistic patterns rather than epistemic accountability, which means that inaccuracies, simplifications, or fabricated information may be presented with the same level of confidence as accurate knowledge. This creates a condition of epistemic opacity[4], closely related to the concern with explicability identified by Floridi et al., in which the processes through which knowledge is generated remain largely inaccessible to the user. Unlike traditional sources, where authorship, methodology, and citation can be examined, AI-generated content often lacks transparent grounding, making it more difficult to assess its validity.

In this context, learners require new forms of AI literacy. Contemporary scholarship emphasizes that students must understand not only how to use AI systems, but also their limitations, algorithmic logics, and broader social implications (Stolpe and Hallström 2). Educational institutions therefore face the challenge of cultivating learners capable of critically interrogating rather than merely using AI technologies.

It is no longer sufficient to evaluate sources in conventional terms; learners must also understand how AI systems construct responses, how training data shapes outputs, and how fluency can mask uncertainty or error. This involves a shift from evaluating information as a static product to interrogating it as a dynamic and probabilistic construction. The challenge for education, therefore, is not simply to adapt to an abundance of information, but to cultivate learners who can critically engage with knowledge in environments where the boundaries between accuracy, approximation, and fabrication are increasingly blurred.

Constructivism Revisited: Learning as Interaction with Intelligent Systems

At first glance, the integration of Artificial Intelligence into education appears to resonate strongly with constructivist theories of learning, which emphasize that knowledge is not passively received but actively constructed through interaction, feedback, and experience. AI-driven environments, particularly adaptive platforms and conversational systems, offer learners opportunities to engage dynamically with content, receive immediate feedback, and follow individualized learning pathways. Such features seem to align with the constructivist emphasis on learner-centeredness, autonomy, and the importance of interaction in shaping understanding. In this sense, AI can be seen as extending earlier pedagogical efforts to move beyond transmission-based models toward more participatory and responsive forms of learning.

However, this apparent alignment requires careful qualification. Constructivism, particularly in its social and socio-cultural variants (e.g., Vygotskian perspectives), does not simply prioritize interaction in a generic sense; it emphasizes meaningful, socially situated interaction, where knowledge emerges through dialogue, negotiation, and shared interpretation within a community of learners. From this perspective, interaction is not merely a technical exchange of input and output, but a relational process grounded in mutual understanding, intentionality, and responsiveness. AI-mediated interaction, by contrast, typically occurs between the learner and a system that can simulate understanding but does not possess consciousness, experience, or genuine interpretive agency. This distinction complicates the assumption that all forms of interaction are pedagogically equivalent (Vygotsky 79-91).

The question, then, is not whether AI enables interaction, but what kind of interaction it enables. When learners engage with AI systems, they encounter responses that are generated through pattern recognition and probabilistic modeling rather than through lived experience or dialogic intention. While such systems can produce contextually appropriate and often highly useful feedback, they do not participate in meaning-making in the same way human interlocutors do. This raises important theoretical questions: Can knowledge be meaningfully co-constructed when one of the participants does not truly "understand"? To what extent does simulated dialogue support, or potentially displace, the social and interpretive dimensions that constructivist theory considers central to learning?

In response to these concerns, some scholars propose reframing AI not as a substitute for teaching, but as a cognitive partner that can augment learning processes without replacing human interaction (Holmes et al.). In this model, AI functions as a supportive tool that assists learners in exploring ideas, testing hypotheses, and receiving formative feedback, while the deeper processes of interpretation, reflection, and social negotiation remain anchored in human relationships. This perspective allows for a more balanced integration of AI within constructivist frameworks, acknowledging its potential benefits without overstating its pedagogical equivalence to human dialogue.

Recent research suggests that learners may attribute excessive epistemic authority to AI-generated responses, especially when fluent outputs mask inaccuracies. This reinforces the need for educators to frame AI as a cognitive support rather than an authoritative source of knowledge (Krupp et al. 6).

However, this balance is not guaranteed. Without careful pedagogical framing, there is a risk that learners may begin to treat AI systems as authoritative sources of knowledge rather than as provisional tools. The fluency, speed, and apparent confidence of AI-generated responses can create an illusion of epistemic reliability, encouraging passive acceptance rather than critical engagement. In such cases, AI may inadvertently reinforce a return to quasi-transmission models of learning, where knowledge is received from a seemingly authoritative source, albeit a machine rather than a teacher.

For this reason, revisiting constructivism in the age of AI requires more than simply integrating new tools into existing frameworks. It calls for a renewed emphasis on critical interaction, where learners are encouraged not only to engage with AI outputs, but to question, interpret, and situate them within broader contexts of knowledge production. The challenge is not to replace human interaction with intelligent systems, but to ensure that AI-mediated learning remains embedded within pedagogical environments that preserve dialogue, reflexivity, and the co-construction of meaning as fundamentally human practices.

Pedagogical Authority and the Transformation of Teaching

The Decentering of the Teacher

The rise of Artificial Intelligence in education fundamentally challenges long-standing assumptions about pedagogical authority and the teacher's traditional role within the classroom. For much of modern educational history, the teacher has occupied a central position as a primary source of knowledge, explanation, and intellectual direction. This authority was closely tied to the relative scarcity of information and the institutional role of schools and universities as sites of authorized knowledge transmission. However, in an educational environment increasingly shaped by AI, where explanations, summaries, examples, and even entire lesson structures can be generated on demand, the teacher's role as the principal holder and transmitter of information becomes less central than it once was.

This shift should not be interpreted as evidence that teachers are becoming obsolete. Rather, it signals a reconfiguration of what educational authority means in the first place. In AI-mediated learning environments, the teacher's value lies less in exclusive access to knowledge and more in the ability to interpret, contextualize, and critically mediate it. Teachers increasingly function as guides who help students navigate complex informational ecologies, evaluate the credibility of sources, identify superficial or misleading content, and develop the intellectual habits necessary for independent judgment. The Moroccan context further illustrates the importance of teacher preparation in this transition. Nafidi's study of trainee secondary-school teachers in Morocco found substantial awareness of AI's educational potential but comparatively limited actual use, with the absence of AI training emerging as a significant barrier to effective integration. These findings reinforce the view that the transformation of pedagogical authority depends not only on access to AI tools, but also on teachers' capacity to critically and pedagogically mediate their use. In this sense, pedagogical authority is gradually shifting from the possession of knowledge to the capacity to make sense of knowledge within broader ethical, social, and disciplinary frameworks.

The use of Foucauldian analysis alongside Freirean critical pedagogy in this article requires qualification, since the two traditions do not share an identical conception of the subject, power, or emancipation. Foucault's analysis emphasizes the productive character of power, showing how subjects are constituted through discourses, institutional practices, and regimes of knowledge rather than existing prior to these relations as fully autonomous agents. Freire, by contrast, emphasizes critical consciousness and transformative action through dialogical education, retaining an explicitly emancipatory conception of pedagogy. These positions therefore cannot simply be treated as cumulative stages of a single theory of power and liberation.

This article does not attempt to erase this difference. Instead, the two perspectives perform distinct analytical functions. Foucauldian concepts are used primarily to examine how AI-mediated educational environments produce forms of visibility, classification, normalization,

and subject formation through datafication and algorithmic governance. Freirean critical pedagogy enters at a different level, providing a pedagogical and normative vocabulary for considering dialogue, critical reflection, human agency, and the purposes of education. The movement from Foucault to Freire is therefore not intended to establish theoretical equivalence, but to move from an analysis of how educational subjects are constituted within relations of power toward a consideration of how they might critically engage with and negotiate those relations.

The tension between the two perspectives is consequently retained as analytically productive. The article does not assume that learners can simply step outside relations of power through critical consciousness, nor does it regard subjectivity as so completely determined by power that resistance or transformation becomes impossible. Rather, Foucault helps identify the conditions within which educational subjects are formed, while Freire directs attention toward the possibilities of dialogue, critical reflection, and transformation within those conditions. Used in this deliberately differentiated manner, the two perspectives allow the article to examine both the power relations through which AI-mediated education is organized and the pedagogical possibilities for preserving human agency within those relations.

This transformation resonates strongly with Paulo Freire's critique of what he termed the "banking model" of education, in which "education thus becomes an act of depositing, in which the students are the depositories and the teacher is the depositor" (72). In contrast, Freire advocates a dialogic pedagogy grounded in mutual inquiry, critical consciousness, and the co-construction of meaning. In some respects, AI appears to reinforce the move away from transmission-based teaching by reducing the teacher's monopoly over information. However, it also introduces a new complexity that Freire's model did not have to confront: dialogue is no longer limited to human participants. Students now increasingly interact not only with teachers and peers, but also with intelligent systems that can simulate responsiveness, explanation, and even conversation.

The presence of AI thus complicates the pedagogical relationship in important ways. It raises questions about trust, credibility, and the distribution of authority within the learning environment. If students can receive immediate answers from AI tools, whose explanations are perceived as more trustworthy, the teacher's or the machine's? How is authority negotiated when learners can move between human instruction and algorithmically generated responses? And what happens to the teacher's role when students increasingly encounter knowledge first through AI before bringing it into the classroom? These questions suggest that the future of teaching will not simply involve using AI as an additional resource, but negotiating a transformed educational landscape in which authority is more dispersed, contested, and technologically mediated.

For this reason, the decentering of the teacher should not be understood as a loss of relevance, but as a shift toward a more intellectually and ethically demanding role. Teachers remain indispensable not because they can outproduce AI in terms of information, but because they are uniquely positioned to help students engage with knowledge critically, responsibly, and reflectively. In the age of AI, the teacher may no longer stand at the uncontested center of the classroom, but their role becomes all the more vital in ensuring that learning remains a human, dialogic, and meaning-oriented process.

Rather than eliminating teaching, AI may intensify educators' roles as interpreters and ethical mediators of knowledge. Bayne argues that automated systems often reveal rather than replace the relational dimensions that make teaching distinctively human.

Teaching as Ethical and Relational Practice

Despite the accelerating integration of Artificial Intelligence into educational environments, teaching remains, at its core, a profoundly relational and ethical practice. Education is not reducible to the transmission of information, the management of performance, or the efficient delivery of content. It is also a process through which individuals are formed in relation to others, to institutions, and to the broader social world. In this regard, teaching cannot be understood solely in cognitive or technical terms. As Gert Biesta argues, education encompasses not only qualification, the acquisition of knowledge, competencies, and skills, but also what he defines as "the ways in which, through education, individuals become part of existing social, cultural and political orders (socialisation) and become subjects of initiative and responsibility (subjectification)" (21). In other words, education is also about introducing learners into social, cultural, and normative worlds, while simultaneously supporting their emergence as ethical, reflective, and responsible subjects. These dimensions of education are foundational, and they resist full automation[5].

This distinction is particularly important in contemporary discussions of AI. While AI systems can increasingly simulate dialogue, generate explanations, and respond to student input in ways that appear pedagogically useful, they do not participate in education as moral or relational beings. They do not carry responsibility for the learner in any meaningful human sense. They do not care, empathize, hesitate ethically, or bear the consequences of pedagogical decisions. Their responsiveness is procedural rather than relational. This distinction is not trivial. It goes to the heart of what education is. Teaching is not simply about helping students arrive at correct answers; it is also about accompanying them through uncertainty, helping them confront complexity, encouraging responsibility, and creating conditions in which they can develop as thinking and socially situated individuals.

Teachers remain indispensable not only because of what they know, but because of the relational conditions they create. They recognize vulnerability, interpret nuance, and foster trust, accountability, and ethical responsiveness in ways automated systems cannot replicate.

In this context, the growing presence of AI may paradoxically intensify, rather than diminish, the importance of human teaching. As education becomes more technologically mediated, the relational and ethical dimensions of pedagogy become more visible and more necessary. The more learners interact with systems that simulate communication without truly inhabiting it, the more vital it becomes to preserve forms of education grounded in empathy, dialogue, and human responsibility. Far from rendering teachers secondary, AI may ultimately clarify why teaching has never been a merely informational task in the first place. It is, and remains, a fundamentally human practice of ethical relation.

Critical analyses increasingly argue that AI systems are embedded within broader structures of power and inequality. Crawford suggests that AI infrastructures reflect forms of extraction and institutional influence that shape their social consequences (8). Educational debates about AI therefore require ethical as well as pedagogical scrutiny.

AI, Assessment, and the Reconfiguration of Academic Practice

The integration of Artificial Intelligence into educational systems is not only transforming how students learn and how teachers teach; it is also reshaping the very structure of academic practice, particularly in relation to assessment, evaluation, and the production of academic work. Among the most visible and institutionally consequential applications of AI in education is its use in assessment systems, where it is increasingly deployed to grade responses, provide feedback, detect plagiarism, track performance, and support predictive judgments about student

achievement. These developments are often welcomed because they appear to address long-standing challenges within education, including large class sizes, delayed feedback, administrative burden, and the pressure for consistency in evaluation.

Yet assessment is never a purely technical process. It is also a deeply pedagogical and epistemological one. To assess is not merely to measure performance, but to make judgments about what counts as learning, what kinds of knowledge are valued, and what forms of intellectual labor are considered legitimate. For this reason, the growing presence of AI in assessment raises broader questions that go beyond efficiency. It invites a reconsideration of what educational systems choose to recognize, reward, and render visible as evidence of learning. In this sense, AI does not simply change assessment procedures; it contributes to a wider reconfiguration of academic practice itself.

The Limits of Automated Assessment

AI-driven assessment systems are often presented as highly attractive solutions to some of the most persistent challenges in contemporary education. They promise efficiency, scalability, speed, and consistency, allowing institutions to process large quantities of student work, generate immediate feedback, and reduce the workload associated with repetitive forms of grading. In contexts where educational systems are increasingly pressured to do more with fewer resources, such tools can appear not only useful but necessary. AI can be particularly effective in evaluating structured or rule-based responses, such as multiple-choice questions, short factual answers, grammar exercises, or standardized tasks where correctness can be clearly defined.

Recent studies evaluating large language models in educational assessment suggest promising capacities for grading open-ended responses and generating feedback. Nevertheless, researchers also note substantial limitations regarding consistency, interpretive nuance, and contextual understanding, particularly in disciplines requiring critical reasoning or subjective evaluation (Pinto et al. 4). Such findings reinforce concerns that technical efficiency should not be equated with educational adequacy.

However, the pedagogical usefulness of automated assessment quickly becomes more uncertain when learning moves beyond clearly measurable performance. Not all forms of educational achievement are equally amenable to algorithmic evaluation. While AI may be effective in assessing procedural accuracy or structural conformity, it is far less capable of engaging meaningfully with ambiguity, creativity, interpretive subtlety, or conceptual originality. Forms of student work that rely on layered argumentation, ethical reasoning, contextual sensitivity, or stylistic nuance often exceed the capacities of systems designed primarily to detect patterns and assign scores based on predefined criteria.

This limitation should not be understood merely as a technical shortcoming that will eventually disappear with better software. More fundamentally, it reflects an epistemological tension between what can be measured and what is genuinely educationally meaningful. Automated systems tend to privilege forms of knowledge that can be standardized, formalized, and computationally recognized. In doing so, they risk reinforcing a narrower vision of learning, one in which what counts most is what can be efficiently captured and evaluated by the system. As a result, assessment practices may gradually begin to align with the capacities of the technology rather than with the broader aims of education.

Reliance on AI-driven assessment may gradually reshape curricula themselves, encouraging assignments designed for automation and privileging measurable outputs over interpretive depth. Education risks becoming increasingly oriented toward machine legibility rather than intellectual complexity.

For this reason, the limits of automated assessment must be taken seriously not only as a matter of technological design, but as a question of educational philosophy. The challenge is not simply whether AI can assess more efficiently, but whether education is willing to preserve forms of judgment, interpretation, and intellectual evaluation that cannot, and perhaps should not, be fully automated.

Generative AI and the Reconfiguration of Authorship

The emergence of generative AI has profoundly unsettled long-standing assumptions about authorship, originality, and academic integrity within educational settings. Tools capable of producing essays, summaries, responses, outlines, and analytical commentary in a matter of seconds have disrupted the traditional relationship between student labor and academic output. In doing so, they have raised urgent questions not only about plagiarism or misuse, but also about the very nature of authorship in contemporary education. If a student can produce a coherent academic text with substantial assistance from AI, then the boundaries between writing, thinking, and authorship become far more complex than earlier academic models assumed.

Emerging scholarship highlights tensions between productivity and intellectual dependency, warning that excessive reliance on generative AI may weaken reflective processes traditionally associated with deeper learning (Yan et al. 5). This raises concerns that efficiency may be privileged over intellectual formation.

This development matters because writing has never functioned solely as a means of displaying knowledge already possessed. In many educational traditions, writing is also understood as a mode of thinking, a process through which ideas are clarified, refined, tested, and transformed. Students often discover what they think through the act of trying to articulate it. Drafting, hesitation, revision, and struggle are not simply obstacles to finished writing; they are often integral to intellectual development itself. When writing is partially or extensively outsourced to AI systems, this formative relationship between writing and thinking may be disrupted. The risk is not only that students submit work that is not fully their own, but that they may bypass the very cognitive and reflective processes through which deeper learning often occurs.

At the same time, the disruption caused by generative AI should not be understood only as a threat. It also presents a significant opportunity to rethink what educational assessment values and how academic work is designed. If AI can generate polished final products with increasing ease, then educational institutions may need to move away from overreliance on static outputs as the primary evidence of learning. Traditional assignment structures that focus mainly on the finished essay or final written response may no longer be sufficient for evaluating intellectual engagement in a meaningful way.

In response, educators may need to place greater emphasis on process, reflexivity, and intellectual positioning. This could involve designing assessments that foreground the development of ideas rather than only their final presentation: annotated drafts, reflective commentaries, oral defenses, revision histories, research logs, peer dialogue, and classroom-based writing processes may all become more important. Such approaches would not simply function as anti-cheating mechanisms; they would also align more closely with the deeper educational purpose of writing as a space of inquiry, self-positioning, and critical formation.

Seen in this light, generative AI does not simply destabilize academic authorship; it compels education to ask more fundamental questions about what it means to produce knowledge, to express understanding, and to claim intellectual ownership in an age of machine-generated language. The challenge is not merely to defend older models of authorship unchanged, but to

develop new pedagogical frameworks in which students remain accountable for thought, judgment, and interpretation even as the tools through which they write continue to evolve.

Conclusion

The integration of Artificial Intelligence into education is far more than a technical innovation or a passing institutional trend. It represents a profound transformation in the ways knowledge is accessed, produced, organized, and legitimized within contemporary educational systems. As this article has argued, AI is not simply adding new tools to existing pedagogical frameworks; it is actively reshaping the conditions under which learning takes place, the forms of authority that structure educational relationships, and the criteria through which academic value is increasingly recognized. In this sense, AI must be understood not as a neutral enhancement, but as a force that reconfigures education at epistemological, pedagogical, and institutional levels.

At the same time, the significance of AI in education cannot be reduced to either optimism or alarmism. On the one hand, AI offers substantial possibilities: it can support accessibility, personalize aspects of learning, assist with feedback, and expand educational resources in ways that may benefit both learners and institutions. Evidence from Moroccan higher education similarly points to a combination of perceived benefits and persistent concerns, with academics recognizing the potential of AI to enhance educational practices while also identifying challenges related to access, academic integrity, and student–instructor interaction (Mjahad et al. 3, 7). On the other hand, it also introduces serious tensions related to datafication, automation, algorithmic authority, epistemic opacity, and the narrowing of educational value to what can be measured, predicted, and optimized. These challenges cannot be adequately addressed through technical adjustments alone because they are not only technical problems; they are also ethical, political, and philosophical ones.

For this reason, the future of education must be shaped not by technological determinism, but by sustained critical reflection. The central question is not whether AI should be used in education in some absolute sense, but under what conditions, according to which values, and toward what educational ends.

This theoretical inquiry nevertheless has limitations that should be acknowledged. Because the analysis is primarily conceptual and interpretive, it cannot by itself determine how AI-mediated educational practices operate across different institutional, cultural, and socioeconomic contexts, nor can it establish the extent to which the risks identified here materialize in practice. These claims therefore invite empirical investigation through classroom-based studies, interviews with teachers and learners, and research examining how AI systems are actually incorporated into assessment, learning, and institutional decision-making. Comparative research across different educational contexts, particularly between technologically advanced systems and contexts in the Global South, could further test whether the tensions identified in this article take similar or different forms across settings. Such research would complement the theoretical analysis developed here by examining how algorithmic systems are negotiated, resisted, or adapted within concrete educational environments.

Ultimately, education must remain a space where learners develop critical judgment, ethical responsibility, and reflective agency. The future of education depends not only on technological innovation, but also on preserving equity, AI literacy, and profoundly human purposes within increasingly automated environments (Chen et al.).

Notes

1. The concept of datafication is closely linked to broader processes of platformization and surveillance capitalism (van Dijck et al.).
2. This notion resonates with critiques of quantification in education.
3. Algorithmic rationality extends managerial and bureaucratic logic through computation.
4. Epistemic opacity refers to the difficulty of understanding or accessing the processes through which complex computational systems generate outputs.
5. Biesta's tripartite model (qualification, socialization, subjectification) is central in contemporary theory.

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