Inclusive education in the age of AI: A critical perspective on policy guidelines through the lens of ecological-systemic theory of technological mediation

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Abstract

Given the recent advancements in generative artificial intelligence, this paper examines the implications of generative artificial intelligence (AI) for educational systems, focusing on inclusion as a critical lens for understanding current political and theoretical trajectories in AI implementation in education. After providing an overview of the main soft policy documents developed by UNESCO in relation to AI and inclusion, the paper will highlight how the theoretical framework that emerges from these documents risks collapsing the theme of inclusion with that of integration and techno-solutionist views, which are inadequate both for understanding the socio-technical transformations driven by these technologies and for addressing the issue of inclusion. Subsequently, this paper employs the philosophical theory of technological mediation and a socio-technical analysis to examine the relationship between generative AI and human development, aiming to elucidate the connections among inclusion, social justice, and artificial intelligence.

Keywords: Inclusion, Artificial Intelligence, Ecological-Systemic Theory, Sociotechnical theory, Post-phenomenology

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1. Introduction

The literature examining the relationship between education and artificial

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intelligence can be traced back to the 1950s (Holmes and Tuomi, 2022). However, recent technological advancements in generative AI have marked a significant turning point, greatly expanding the potential applications of these technologies.

Due to the vast amount of Big Data available for training these algorithms, such technologies are now capable of performing tasks that were considered unthinkable just a few decades ago. For instance, they can engage in long, context-aware conversations, handling highly context-dependent registers like jokes (Gorenz and Schwarz, 2024) and more generally mastering highly complex symbolic registers (Avdeeff, 2019). These characteristics present new challenges for contemporary societies from multiple perspectives: political, cultural, and anthropological. Several studies have examined the impacts of deep fakes in the political and informational spheres (Łabuz and Nehring, 2024; Calvo and Garcia, 2024) or the implications of social robotics on affective and relational dynamics (Bisconti and Carnevale, 2022). In the educational field, as highlighted a recent literature review (Zhang and Aslan, 2021), AI-driven technologies are primarily employed in the following areas: adaptive learning and personalization, deep learning and machine learning algorithms in online educational platforms, educational human-AI interaction (chatbots or virtual tutors), AI-generated data in education to collect, analyse, and interpret data about student performance, learning patterns and risk of dropout (Sorensen, 2019). The integration of AI in education has raised concerns regarding their pedagogical suitability. Recent literature has highlighted significant gaps in AIEd research, including limited incorporation of educational perspectives (Chen *et al.,* 2020; Holmes and Tuomi, 2022) and a lack of robust models in AI-driven e-learning studies (Tang *et al.,* 2021). Moreover, research indicates a lack of participation from clinicians, parents, and teachers in the design of these technologies (Rowe, 2019). Additionally, as evidenced by a recent literature review, there are few studies pertaining to AI ethics and inclusion (Mouta *et al.*, 2023). Furthermore, beyond the applicative dimension, scholars are increasingly emphasizing the need to address postmediality and postmedia literacy, concepts that underscore the discontinuity between traditional media and the revolutionary changes introduced by AI (Buckingham, 2019; Jandrić *et al*., 2019). These discussions reflect the evolution of the debate regarding AI advancements and the necessity for a more nuanced understanding of their implications.

Alongside the legislative interest in regulating and guiding such technologies – evidenced by the recent adoption of the AI Act at the European level – UNESCO has drawn up several documents and guidelines to address the role of AI in education aligning with the UN's 2030 Agenda and SDG 4, dedicated to quality and inclusive education within a broader framework of

environmental protection and social justice. Documents from UNESCO, the European Commission, and OECD, while not legally binding, are influential soft-policy instruments shaping educational futures. Analysing these documents could offer insights into the intersection of inclusive education and AI ethics (Linderoth *et al*., 2024).

This article will analyse key UNESCO publications on AI, focusing on inclusion. It will suggest that theorizing AI through instrumentalist lenses risks overlooking the broader sociotechnical changes it drives, potentially leading to techno-solutionist approaches to inclusion. Conversely, through the theory of technological mediation, we will explore how AI significantly mediates interactions (Ihde, 1990; Floridi, 2020). This perspective would leads us to investigate the relationship between AI, education, and inclusion in a different light, framing it within a systemic framework of hybrid human and social development (Navarro and Tudge, 2023).

2. Soft Policy, Inclusion and AI, back to Integration?

The publication of the Bejing consensus on Artificial intelligence (UNESCO, 2019a) marks the formalisation of research and guidelines on artificial intelligence for the educational and research world; thereafter, the following documents can be considered the most relevant for education and inclusion:

- Artificial intelligence in education challenges and opportunities for sustainable development (UNESCO, 2019b);
- Artificial intelligence and inclusion compendium of promising initiatives (UNESCO, 2020);
- Recommendation on the ethics of artificial intelligence (UNESCO 2021a);
- AI and education guidance for policy makers (UNESCO, 2021b);
- Reimagining our future together: a new social contract for education (UNESCO, 2021c);
- K-12 AI curricula, a mapping of government-endorsed AI curricula (UNESCO, 2022);
- Guidance for generative AI in education and research (UNESCO, 2023).

These documents generally situate the debate on AI within the framework of Agenda 2030 and SDG4, which relates to quality education and inclusion (UNESCO 2019 a; UNESCO 2019b; UNESCO 2021b). Therefore, it is crucial to understand how educational inclusion has been thematized in these key documents.

Inclusion is a central theme of the 2030 Agenda and has been articulated through the guiding principle of Education for All (UNESCO, 2009). UNESCO defines inclusion as a process to modify educational *systems*, ensuring quality education for all students. Unlike integration, therefore, inclusion doesn't focus on correcting individual deficits but aims to transform both educational and social systems – structurally and axiologically – to accommodate all individuals, regardless of their needs. Thus, inclusive perspective focuses on developing individual and social capacities to enable people to lead a full social, cultural, emotional, and political life, encompassing all forms of marginalization (Terzi, 2005). Inclusion is not a technical issue but a complex goal that requires a systemic understanding of the roots and dynamics of exclusion and discrimination, which are both educational and extra-educational (Chiusaroli, 2021). It would indeed be meaningless to consider the creation of an inclusive school without simultaneously reflecting on what constitutes an inclusive society (Baldacci, 2014). Thus, central to the concept of inclusion is a complex idea of education, which involves *school-wide* approaches, involving community and therefore not being limited to the provision of compensatory tools. (Ainscow, 2015; Mitchell and Sutherland, 2020).

This theoretical complexity concerning the debate on inclusion and its connection to broader issues of social justice and democracy, however, is not adequately explored in the UNESCO documents on AI. In fact, the theme of inclusion takes on a dimension that does not go beyond a mere declaration of intent, appearing marginal, or is frequently focused on technical issues such as the digital divide, accessibility, or the representation of differences within datasets (UNESCO 2021b pp.21-22; UNESCO 2019b p.28; UNESCO 2023 p.24). For example, in UNESCO (2023) the section dedicated to inclusion is limited to a focus on the technical aspects of connectivity, as well as the quality and integrity of data and algorithms. In fact, the document lists the following measures:

> «To promote universal connectivity and digital competencies in order to reduce the barriers; to develop criteria for the validation of GenAI systems to ensure that there is no gender bias, discrimination against marginalized groups, or hate speech embedded in data or algorithms; require providers of GenAI to include data in multiple languages» (p. 24).

This approach risks overlooking broader issues such as the epistemological, pedagogical, and sociopolitical dimensions of inclusion, in relation to AI. In fact, these technologies specifically hybridize the interactional and social dimensions, which we know are crucial for inclusive education (Terpstra and Tamura, 2008; Durlak *et al*., 2011). The topic of inclusion is often cited in

relation to AI as a compensatory tool (UNESCO, 2021b, p.22; UNESCO, 2020). While the instrumental use of AI technologies is significant, this narrow focus risks limiting the vision to only the instrumental use of such technologies, and risks overlooking their impact on the systemic hybridization of social and cultural life. As we have discussed, such practices require systemic interventions and teaching methodologies aimed at creating complex learning environments. (Medeghini and Fornasa, 2011; Lascioli, 2014). This perspective is also evident in the document Artificial intelligence and inclusion compendium of promising initiatives (UNESCO, 2020), which is specifically dedicated to AI and inclusion. Although a section is dedicated to international cooperation as a key dimension for addressing the inclusive aspects of AI (pp. 9-15), the document subsequently adopts a predominantly instrumental perspective of AI, treating it as a neutral tool for achieving equity and inclusion objectives (pp. 16-34).

Regarding more pedagogical aspects such as personalization and collaboration, the document Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development (2019b) states, for example, that «AI can help advance collaborative learning» (p.12), facilitating cooperation through an online environment; however, it is highly deterministic to assume that online environments are inherently cooperative. Evidence from the COVID-19 pandemic suggests that digital reliance can exacerbate isolation, alienation, and relational difficulties (Xu and Wang, 2023). Claims about AI's personalization capabilities are also debated (Bulger, 2016). Moreover, this instrumental view of AI leads to framing it as a palliative to address socio-economic deficits that do not guarantee access to education, evidenced by passages such as: «Robotics allow students with special needs to attend schools at home or hospital, or maintain continuity of learning in emergencies or crises. In this way, it is able to support inclusion and ubiquitous access» (UNESCO, 2019b, p.12).

This predominantly instrumentalist focus through which the relationship between technology and society is interpreted risks oversimplifying the interactions between subjects and objects within social systems. As a consequence, the dialectical relationship between socio-political and technological development is not thematized. For example, in the document AI Education and Guidance for Policy Makers it is stated: «By 2030, 68.8 million more teachers need to be recruited globally. In this challenging context, many AI technologies might be used, or further developed, to help improve education – especially for older people, refugees, marginalized or isolated communities, and people with special educational need» (UNESCO, 2021, p.21).

Although the document clarifies that this statement should not suggest that AI can solve a specifically socio-political problem, it still does not address

inclusion from a pedagogically grounded perspective or discuss the technologies' connection to the social and political context. Then, the document highlights exemplary practices from AI applications, however, it appears to lack a systemic vision: «There are various examples of AI being used to advance inclusion and equity in education: Telepresence robots for students who are unable to attend school, The Global Digital Library, AI and augmented reality applications to help deaf children» (p.22). This object-oriented and application-focused approach carries the risk of reverting to an individualistic biomedical model. Furthermore, it may lead to a naturalistic analysis of the sociopolitical issue of educational access, treating it as a problem to be solved with technological tools rather than addressing its underlying systemic causes.

In the document Challenges and Opportunities for Sustainable Development (UNESCO, 2019b), inclusion is only mentioned in relation to the digital divide or the inclusivity of data systems, thus presenting it in an exclusively technical manner. This focus is also reflected in the section dedicated to the future of education. The beginning of the document is quite revealing:

> «Businesses are generally quick to adopt AI-based solutions. This means an increasing demand for new types of jobs and skills that are linked to the use of AI in industry (…) there is strong imperative for the education sector to respond in that curricula must be reworked and policies reformulated» (p.18).

The document appears to instrumentalize the educational dimension, framing it primarily as a means to prepare the future workforce. This approach aligns educational priorities with a neoliberal agenda, potentially reducing AI education to a matter of technical proficiency rather than a broader socio-educational consideration. This approach echoes the document issued by the World Economic Forum, which supports the same neoliberal view of education: «Children must be prepared to become both productive contributors of future economies and be responsible and active citizens in future societies. Realizing this vision requires children to be equipped with four key skill sets» (WEF, 2020, p.7). This perspective appears to be present also in relation to the document K-12 AI Curricula: A Mapping of Government-Endorsed AI Curricula (UNESCO, 2022), where we can observe the pedagogical orientation towards education in new technologies. The dimension of inclusion is not even mentioned in the section dedicated to ethics; for the rest it is reduced to a question of representation in data samples. In fact, in general these documents address AI ethics primarily through the lenses of data quality and algorithmic fairness, which, while essential, are reductive of the broader social and ethical issues that AI may present concerning development, trustworthiness, and democracy in educational systems (Holmes *et al.*, 2022; Cesaroni *et al.*, 2024).

We hypothesize that this perspective is driven from two key factors. First, a functionalist perspective on education, where AI is understood as a means to enhance the performance of both students and teachers, or as a tool to align education with labor market transformations (Panciroli and Rivoltella, 2023). Second, a strongly instrumentalist and dualistic perspective on technology that treats technological objects as separate from their socio-political and socio-symbolic contexts (Winner, 2017). This perspective risks reducing inclusion to integration or techno-solutionism, potentially obscuring AI's fundamental innovations and dynamic interactions with human development and societal structures (Chiriatti *et al.,* 2024). Such an approach may overlook the broader implications of AI technologies beyond their empirical applications and objectual attributes.

3. Towards an Ecology of Technology

We posit that AI necessitates a more sophisticated theoretical framework to comprehend its impact on complex domains such as education and inclusion. AI presents anthropological and sociopolitical challenges, requiring a systemic analysis of its influence on contemporary societies and human development (Floridi, 2014; Accoto, 2017). According to Floridi, AI technologies are reshaping our ontological and epistemological relationship with the world, blurring boundaries between online and offline, real and virtual, material and information. In education, several scholars argue that it is necessary to study these socio-technical transformations holistically, reflecting on what it means to develop AI education that addresses the datafication of modern societies (Knox, 2019; Rivoltella, 2020).The educational field faces the challenge of not only teaching AI instrumentally but also fostering a critical culture of technology and developing empowerment in the algorithmic age (Boyd and Crawford, 2012; Funk *et al.*, 2016).

The necessity for a different theoretical framework for AI can be explored from philosophical and socio-political perspectives.

In the philosophy of technology, theory of technological mediation, developed by postphenomenological scholars (Ihde, 1990; Winner, 2017) and others (Gunkel, 2012; Coeckelbergh, 2019), challenge instrumentalist and dualist views of technology, rejecting the notion of technologies as pre-existing objective entities. Instead, these approaches posit technological objects as active mediators between humans and the world, shaping our actions, language, ideas, and values while embodying socio-political and symbolic contexts. This perspective emphasizes the dynamic, co-constitutive relationship between humans and technology, moving beyond rigid subject-object distinctions.

Generative AI technologies have further accentuated the limitations of instrumentalist and dualistic perspectives on technology. According to Floridi, these technologies are characterized by their ability to *decouple* intelligent behavior from the presence of actual intelligence. Consequently, «more and more problems and actions can be resolved or performed by AI with relative success without the need for a human – endowed with understanding, sensitivity, situational awareness, and responsibility – to guide the process» (Floridi, 2020, p. 24). Thus, AI can be classified as a *third-level* technology, capable of autonomous interaction with other technologies, potentially relegating human intervention to a peripheral role or even eliminating it entirely. Unlike previous information technologies that primarily served as intermediaries between subjects, AI possesses the capacity for direct interaction. This interaction transcends simple boolean connections, instead engaging in cooperative construction of knowledge and semantic artifacts (Bisconti *et al*., 2024). Indeed, AI exhibits objectual characteristics that make it more similar to an agent than to an inert tool, thus qualifying as a *quasi-other* (Ihde, 1990). Several philosophers argue that AI, unlike earlier modern technologies, directly influences cognitive processes and redefines the criteria for interpreting and understanding reality, extending beyond mere transformation of the material world (Carnevale, 2016; Chiriatti *et al.,* 2024). This perspective highlights AI's unique capacity to shape not only our physical environment but also our cognitive frameworks and interpretive mechanisms. These characteristics raise philosophical, pedagogical, and anthropological questions about how the production and reproduction of knowledge are being reshaped, as well as how relational dynamics evolve within pedagogical interactions and educational systems. In light of these considerations, by hybridising systemic Bronfenbrenner's (1979) concept of proximal development processes to include AI actors, we can contextualize technological hybridization within an ecological framework. This perspective may illuminate the mediation processes occurring through technological integration in contemporary societies. In fact, a systemic perspective reveals the reciprocal influences between AI and socio-political systems (Coeckelbergh, 2020; Bisconti, 2024), moving beyond narrow concerns of bias and data quality. In education, this broader view would foster critical dialogue between AI ethics and ethics of education (Holmes *et al.*, 2022), enabling a more comprehensive understanding of AI's impact on human development and societal structures. In fact, the design of technologies configures itself as politically relevant, as it epistemologically and axiologically organizes the production and reproduction of knowledge, communicative-expressive interactions, and their forms of socialization (Bisconti, 2024). If the situated nature of these technologies is not grasped and if the relationship they weave both with the structural elements of

societies and with their ideological and value-based elements is not analysed, the risk is to underestimate their real impact, functionalities and potentialities. Therefore, without a detailed analysis of the principles and epistemologies underlying the design and implementation of these technologies, there is a risk of perpetuating forms of exclusion, often masked as seemingly inclusive educational practices. The combination of a technology capable to automate relational, cognitive, and creative aspects within a socio-political context focused on economic productivity risks creating societies and educational systems that generate new forms of marginalization, exclusion, and vulnerability.

4. Conclusions

The debate on the relationship between AI and education remains open. As we have discussed, with regard to inclusion. Guidelines and soft policy documents generally tend to analyze AI in terms of their instrumental functionality as assistive technologies or compensatory tools.

Academic literature specifically addressing the dialogue between AI in Education (AIED) and inclusion (Knox *et al.,* 2019; Bulathwela *et al.,* 2024) adopts broader perspectives, reflecting on pedagogical practices. Indeed, some scholars argue for the necessity of grounding AI in learning and human development theories, moving beyond technical-functional characteristics and general AI ethical frameworks (Holmes and Tuomi, 2022; Tuomi, 2023).

Aligned with this direction, we argue that problematizing the conceptual categories used to investigate technology in educational contexts provides a more adequate interpretive framework for understanding AI and its socio-technical transformations. This approach considers AI's broader implications for individual development and socialization (Biesta, 2012). The digital age calls for a human-centered approach to shaping technology (Floridi, 2020), making it crucial to address the challenges of datafication and automation in education. It is crucial to examine the implications of an increasingly datafied society and the growing automation of educational processes, as these trends risk profoundly altering our conceptions of public, accessible, and democratic education.

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