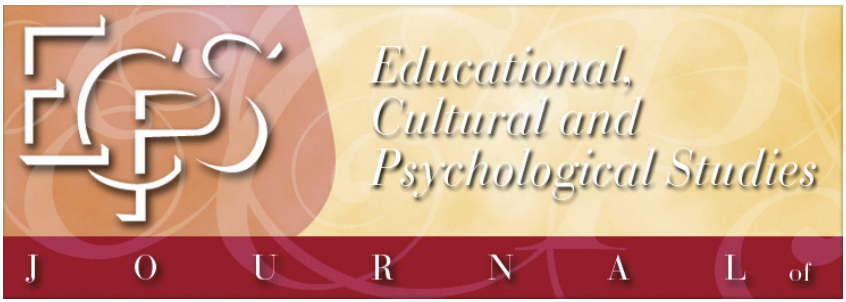

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alla qualificazione dei processi di istruzione

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Gaetano Domenici
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Artificial intelligence and Quality Education: The Need for Digital Culture in Teaching

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INTELLIGENZA ARTIFICIALE E ISTRUZIONE DI QUALITÀ: LA NECESSITÀ DELLA CULTURA DIGITALE NELL'INSEGNAMENTO

Abstract

This paper critically explores the concept of «quality education» as defined by SDG 4, emphasizing inclusivity and equity, particularly in the context of digital transformation. Quality education, in this sense, goes beyond knowledge acquisition to fostering lifelong learning, accessible to all. The integration of artificial intelligence (AI) in education is examined through a socio-pedagogical interdisciplinary lens, highlighting how it reshapes traditional pedagogical models. This shift requires digital literacy and a digital culture, addressing the «digital divide» and promoting inclusivity while raising challenges that necessitate rethinking existing educational frameworks. The rise of digital culture presents a critical pathway for addressing the educational mismatch of contemporary society. By fostering a value-oriented digital culture, educational models must emphasize ethical engagement, critical thinking, and digital citizenship. This transition requires a multi-level approach, acknowledging students' increasing agency in a bottom-up digital culture. Moving towards Education 4.0 necessitates a rethinking of traditional pedagogies, with teachers adopting new mindsets, roles, and competencies.

Keywords: AI; Digital culture; Digital equity; Digital inclusivity; Education 4.0.

The notion of quality education, as outlined by the United Nations' Agenda 2030, *Sustainable Development Goal 4* (SDG 4), emphasizes the provision of «inclusive and equitable quality education» and «lifelong learning opportunities for all» (United Nations, 2015). This goal reflects a broader understanding of education not only as a means of acquiring knowledge but as a comprehensive system that should foster equality, inclusivity, and ongoing learning for diverse populations. The introduction of digital technologies, particularly artificial intelligence (AI), into educational systems holds transformative potential in shaping how we conceptualize and deliver this vision of quality education. In this context, the principles of equity and inclusivity demand critical reflection, especially in relation to how AI can contribute to – or hinder – the creation of opportunities for all learners.

Education of quality is often defined through the lens of equity and inclusivity, concepts that have been central to sociological discourse. Equity in education means recognizing and addressing the individual needs of learners to ensure that everyone has the opportunity to succeed, regardless of their socio-economic background, gender, ethnicity, or abilities. According to sociologist Pierre Bourdieu, social inequalities are often reproduced through education, where unequal access to resources can reinforce existing social hierarchies (Bourdieu, 1977). In the digital age, this reproduction of inequality can manifest as a «digital divide», where marginalized communities lack the same access to digital tools, infrastructure, or learning platforms. A quality education system, therefore, must integrate mechanisms to mitigate these disparities, ensuring that digital tools such as AI are accessible to all.

Inclusivity, on the other hand, is the practice of creating learning environments where all individuals feel valued and supported, regardless of their identity or abilities (Ainscow *et al.*, 2006). This extends to learners with disabilities, students from minority groups, and those with different learning needs. Sociologist Basil Bernstein argued that educational systems tend to privilege certain «codes» of communication and knowledge over others, thereby marginalizing students who do not conform to the dominant norms (Bernstein, 1971). Inclusivity, then, requires a shift from uniformity to flexibility, where the curriculum, pedagogy, and assessment practices are adaptable to meet the diverse needs of all students. AI, if coherently «prompted», has the potential to contribute to this flexibility by offering personalized learning experiences, adaptive technologies, and tools that cater to various learning styles and abilities.

The integration of AI in education opens up numerous opportunities for fostering a more equitable and inclusive learning environment. AI-powered tools such as intelligent tutoring systems, adaptive learning platforms, and real-time feedback mechanisms can create personalized

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learning pathways for students, accommodating different learning paces and styles. For instance, through machine learning algorithms, AI systems can analyze a student's progress, identify areas where they are struggling, and adjust the level of difficulty or present material in a different format. This personalization can be particularly beneficial for students who might otherwise fall behind in a traditional classroom setting, thereby promoting a more inclusive learning environment.

Additionally, AI technologies can offer solutions to language barriers, another key factor in educational equity and inclusivity. Automated translation and language learning platforms can assist students who are non-native speakers of the language of instruction, providing them with the necessary tools to engage more fully in their education. Furthermore, AI can assist students with disabilities by offering assistive technologies such as text-to-speech software, eye-tracking devices, and speech recognition systems, which allow them to access educational content in ways that align with their needs and abilities. In this way, AI contributes to creating opportunities for learning that transcend traditional limitations.

However, the mere presence of AI in educational systems does not automatically guarantee equitable and inclusive outcomes. Scholars such as Neil Selwyn have critiqued the uncritical adoption of digital technologies in education, cautioning that these tools can sometimes reinforce rather than alleviate existing inequalities (Selwyn, 2011). For instance, access to AI-powered educational tools may be limited in lower-income contexts or in regions with insufficient technological infrastructure, exacerbating the digital divide. Therefore, the challenge for policymakers and educators is to ensure that AI is deployed in ways that actively promote equity and inclusivity, by making digital tools widely accessible and by designing AI systems that take into account the diverse backgrounds and needs of students.

One of the key tenets of SDG 4 is the promotion of «lifelong learning opportunities for all». In the context of digital education, this notion becomes even more critical. Lifelong learning emphasizes the idea that education is not confined to formal schooling but extends throughout a person's life, in various formal and informal contexts. Sociologists like Ulrich Beck have highlighted the importance of continuous learning in an age of rapid technological and social change, where individuals must constantly acquire new skills to adapt to an evolving world (Beck, 1992). AI can play a significant role in supporting lifelong learning by offering flexible, on-demand educational resources and self-paced learning modules, enabling individuals to learn at their own convenience, irrespective of time or place.

Moreover, AI-driven platforms can create learning ecosystems that connect learners across different geographies and backgrounds, facilitating

collaborative learning experiences that contribute to personal and professional development. This democratization of learning through AI-enhanced platforms can reduce barriers to education, making lifelong learning more accessible and inclusive for all. Yet, as with other aspects of AI in education, the equitable distribution of these opportunities remains a significant challenge.

1. Digital transformation in education: beyond equity and inclusivity

While equity and inclusivity form the foundational pillars of quality education, as defined by SDG 4, achieving this goal also demands a deeper engagement with the ongoing digital transformation (DT) in society (Reis *et al.*, 2018). Digital transformation, a complex socio-techno-economic phenomenon, is reshaping the world at multiple levels, and education is no exception. In this context, providing quality education involves the use of advanced technologies to enhance teaching, personalize learning, and expand access to educational resources. The growing digitization of all aspects of teachers and students' life, as well as society at large, introduces a new imperative: fostering digital literacy and building a digital culture as indispensable prerequisites for accessing the opportunities of the digital age. Without these, even the most equitable and inclusive education systems will fail to prepare learners for the demands of a profoundly digitalized world.

However, it is crucial to note that digital transformation is not just about technological change. As sociologist Manuel Castells (2009) argued in his work on the network society, digital technologies are part of broader social and cultural transformations that influence how individuals interact, learn, and participate in society. For education to be of quality, it must prepare students not only to use these technologies but to critically engage with them in ways that are meaningful and responsible.

Digital literacy is crucial in modern education, extending beyond technical skills to include understanding how digital technologies influence the world and addressing ethical issues they raise. It equips students to critically engage with the digital landscape, as emphasized by Neil Selwyn (2011), fostering reflection on technology's societal role. Without it, learners risk exclusion from opportunities brought by digital transformation, deepening existing inequalities. The digital divide, which includes access and skill disparities, highlights the urgency of integrating digital literacy

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for inclusive education. Moreover, education must nurture a broader digital culture, promoting adaptability, creativity, and collaboration.

For educators, this shift requires rethinking traditional pedagogical approaches. As suggested by Paulo Freire (1970) in his seminal work *Pedagogy of the oppressed*, education should be a process of empowerment, where learners are active participants in their own learning journey. In the digital age, this means using technology to enable learners to explore, create, and connect in ways that were not previously possible. For instance, collaborative platforms, online communities, and AI-driven learning systems allow students to engage in peer-to-peer learning and knowledge-sharing on a global scale, breaking down the barriers of geography and social status.

In conclusion of this first part of the study, we must acknowledge that, despite the promising potential of digital technologies in education, most current discussions of digital transformation focus too narrowly on the technical aspects – tools, platforms, and systems – while neglecting the cultural and social dimensions. As sociologists like Ulrich Beck (1992) and Zygmunt Bauman (2000) have argued, technological change is never neutral; it is always embedded within social, cultural, and economic contexts. To understand the impact of digital transformation in education, it is necessary to consider how these technologies interact with existing power structures, cultural norms, and institutional practices.

This broader perspective helps educators and policymakers recognize that digital transformation is not just about equipping students with technical skills but about preparing them to navigate a world in which technology is reshaping every aspect of life. By fostering both digital literacy and a digital culture, education systems can provide learners with the tools they need to thrive in the 21st century – while also ensuring that these tools are used in ways that promote equity, inclusivity, and social justice.

2. The educational mismatch in the digital age

The concept of an «educational mismatch» highlights the growing gap between the learning models provided by traditional educational institutions and the skills demanded by an ever-evolving, technology-driven society (Padua, 2020). This gap is increasingly evident in a world shaped by artificial intelligence (AI), machine learning (ML), virtual reality (VR), and augmented reality (AR). Traditional educational frameworks, which often prioritize rote learning and memorization, struggle to prepare students for the demands of a globalized economy that prizes creativity, critical thinking,

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adaptability, and technological fluency. This mismatch underscores the urgent need for new methodologies that align with the dynamic needs of modern society.

John Dewey's progressive educational theory, outlined in *Experience and education* (1938), remains remarkably relevant to addressing this issue. Dewey argued that education should not be about passive absorption of facts but rather an active process rooted in experience and reflection. He emphasized that learning is most effective when it is connected to real-world experiences and problem-solving activities – an approach that resonates with today's demand for experiential and skill-based learning models. Dewey's vision aligns closely with modern calls for education systems to shift away from rigid, standardized curricula and towards more flexible, student-centered approaches that foster 21st-century skills. Today's global institutions, such as the European Union and World Economic Forum, have recognized this need and developed frameworks to address the skills gap. These include «Key citizenship competences», «Lifelong learning key competencies», «Life skills», «Skills for future jobs», «21st century skills» as abilities needed for future jobs. However, traditional educational systems have been slow to adopt these frameworks, often continuing to rely on outdated methodologies that fail to equip students with the digital literacy and technological proficiency necessary to thrive in a rapidly changing world.

This «educational mismatch» is not only a failure of curriculum design but also a reflection of deeper socio-economic and technological changes. Yet, many educational institutions continue to prioritize subjects and teaching methods that are increasingly disconnected from these new realities. As a result, students are often left ill-prepared for the workforce of the future, exacerbating issues of unemployment and underemployment.

Given this scenario in the educational environment, it is clear that certain prerequisites must be in place before implementing AI technology. The first is the acquisition of a digital culture to foster a digital mindset; the second is a shift from Education 2.0 to Education 4.0. Finally, we must ask ourselves what will be the new role of teachers.

3. Digital culture and digital mindset

In light of what we have discussed – the necessity of providing a quality education that fosters equity and inclusion, while being contextualized in the complex environment of digital transformation that all sectors, including education, are experiencing – it becomes essential to develop an adequate

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«digital culture». This culture is key to resolving the «educational mismatch» discussed above. It will allow us to educate future societies to inhabit the global dimension fully and respectfully, adhering to human principles. But what do we mean by «culture» and, specifically, by «digital culture»?

According to the mainstream definition, culture is an asset composed, first of all, by values, norms, definitions, languages, symbols, signals, behavioural patterns, mental and body techniques, bearing a function which is cognitive, affective, valuative, expressive, regulatory, and manipulatory. All these essential social elements are connected and regulated by humans. The complex side of the matter is when we insert in this definition the variable «digital technology» as it raises questions about power dynamics between humans and technology. As technology advances rapidly, it increasingly influences not only external symbols but also internal human needs, like AI anticipating desires (i.e. Alexa). This undermines creative, instinctual behaviors, reshaping culture and mindsets by prioritizing efficiency over spontaneity. Therefore, when we speak of «digital culture», we are not merely referring to the technical skills required to navigate digital tools and platforms. Rather, digital culture encompasses a set of values, mindsets, and practices that guide how individuals interact with digital environments. It shapes how students and educators alike engage with technology in a manner that fosters responsible, ethical, and empowered participation in the digital world. The rise of digital culture requires a multi-level approach, which I will examine below.

a. *Value-oriented digital culture* – At its core, a value-oriented digital culture involves teaching students to engage critically and responsibly with digital technologies. This means fostering a sense of digital citizenship that encourages students to become responsible «netizens» who respect core human values, such as empathy, integrity, and respect for others. As Dewey (1938) noted in his work on experiential learning, education is not just about knowledge transmission but about developing the skills and values necessary for participation in democratic life. In the digital era, this extends to how students interact in online spaces, where their actions can have a significant impact on the broader community.
Critical thinking, in particular, is a foundational element of this digital value system. The ability to assess the credibility of online information, understand how algorithms shape what we see, and engage in responsible online discourse are vital skills for navigating the digital world. In a society where disinformation and digital manipulation are pervasive, students must be taught to critically evaluate the sources of information they encounter online. The challenge is not just technological but ethical: it is about ensuring that students are not dominated by the digital

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world but understand its mechanisms and can make informed decisions. Furthermore, educators themselves must be adequately trained to navigate and teach within this digital landscape. As noted by theorists like Freire (1970), who emphasized the role of education in liberating individuals, teachers must be equipped with the digital literacy needed to foster an empowering educational experience. Digital culture requires teachers to understand the broader context in which digital tools are applied, not just their technical aspects. This understanding will help educators create learning environments that are not only technologically enhanced but also aligned with the development of critical and reflective citizens.

b. *Social dimensions of digital culture* – The second dimension of digital culture focuses on the social transformations that technology has introduced. The digital era has fundamentally changed how individuals relate to one another, how knowledge is produced and shared, and how societal paradigms operate. The participatory nature of digital platforms, especially social media, has led to a culture where bottom-up processes, such as user-generated content, crowd-sourced knowledge, and collaborative platforms like Wikipedia, dominate. This «bottom-up» culture reflects the increasing agency of individuals in the digital age, a shift that education systems must recognize and incorporate into their pedagogical practices.

   For Generation Z, participation and agency are not just preferences but expectations. The need for deeper student involvement in learning aligns with this generational shift. Participatory behaviors are now a fundamental part of social life, and they manifest in various aspects of everyday existence, from entertainment to health, news, and education. The implications for education are profound: pedagogical models that emphasize «flipped classrooms», «open-access creative learning environments», and «inquiry-based learning» are becoming more relevant. These methods encourage a dialogical, question-based approach to education, fostering dynamic, personalized, and interactive learning environments. Additionally, digital culture has brought about a shift toward horizontal, peer-to-peer models of learning. In traditional education, knowledge often flowed unidirectionally from teacher to student. However, digital platforms have democratized access to information, enabling peer-to-peer learning environments where students share knowledge and collaborate on equal footing. The rise of «collective content-building», exemplified by tools like wikis and shared documents, is a testament to this shift. Such collaborative learning environments allow students to engage in «challenge-based learning», where they work together to solve

real-world problems – an approach that mirrors the «hackathon» model borrowed from the tech world.

Dewey's (1938) idea of experiential learning, in which knowledge is built through experience and reflection, finds new relevance in these digital environments. Today's «engaged learning» involves students actively applying their knowledge to real-world situations, whether through simulations, digital collaboration tools, or hands-on projects. This method not only prepares students for the workforce but also instills in them the critical thinking, problem-solving, and collaborative skills needed for success in an interconnected, digital world.

Finally, The rise of digital culture demands a rethinking of traditional educational models. As sociologists like Castells (1996) have noted, the information society has changed the nature of work, communication, and social interaction. Educational systems must adapt by fostering a «digital literacy» that goes beyond basic technological skills to include an understanding of the social, ethical, and economic implications of digital technologies. The «sharing culture» prevalent in digital spaces, where information is collaboratively produced and freely distributed, also finds its way into education through models like open-source learning and collective knowledge building. In these new educational models, the teacher's role shifts from being the sole source of knowledge to that of a facilitator or guide. The use of digital platforms enables students to take greater control over their learning, working collaboratively with peers to construct knowledge in a more decentralized and democratic way. This approach aligns with the cultural shifts in broader society, where collaboration and collective problem-solving are increasingly valued. AI acts as an enhancer of these technologies, enabling increasingly effective and efficient personalization and management of these innovative educational models.

4. A shift from traditional education models to Education 4.0

As we reflect on the evolution of education in the digital era, it becomes evident that merely fostering digital literacy and promoting a digital culture are insufficient for true transformation. What we need is the development of a «digital mindset». But what exactly is a digital mindset?

If culture is the toolbox, a mindset is how the tools are used. It represents a fixed mental framework shaped by culture, dictating ways of thinking

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and acting. However, in the dynamic digital era, traditional mindsets are rigid and insufficient. A transformational mindset is required – one that is agile, adaptable, and capable of navigating the fluid and complex digital landscape. This shift is essential for teachers and students to achieve true digital transformation. Therefore, the transition from conventional education to Education 4.0 is not merely about adopting new technologies but about fostering a radically different mindset. It's like wearing glasses with new lenses: we may not immediately notice the change, but we begin to see and think differently. This shift in perspective leads us to approach learning in a multidimensional way, integrating, connecting, and synthesizing various media, platforms, and channels. The digital environment offers an infinite array of possibilities for these connections, allowing for the fusion of traditional learning models with cutting-edge digital tools. For instance, consider how history is taught. In the traditional education model, it can be a tedious and didactic subject for students when it is presented through rote memorization of dates and events. But Education 4.0, with its digital tools, allows history to be experienced in immersive and interactive ways. Virtual environments can bring historical events to life, not just as isolated facts, but as part of a broader, emotionally engaging narrative. Students can «experience» history through simulations, virtual reality, or interactive timelines, gaining a deeper understanding of the cultural, social, and emotional contexts of events. This experiential approach to teaching is a hallmark of the digital mindset. In digital learning environments such as Google Classroom, Microsoft Teams for Education, Moodle and other Open-source learning management systems (LMS), Kahoot!, Padlet, students are no longer passive receivers of information. Instead, they become active participants, engaging with content through multiple modalities – visual, auditory, kinesthetic – while collaborating with peers in real-time or asynchronously across various platforms. This fosters critical thinking, creativity, and problem-solving, all of which are essential competencies for navigating today's complex digital world. The flexibility of Education 4.0 also lies in its ability to merge online and offline learning seamlessly. Traditional educational methods – such as reading texts, discussing with peers, or writing essays – are not discarded, but instead enhanced by digital tools that allow for deeper interaction and exploration. Following the same previous example, in teaching a historical event, a teacher might blend a traditional lecture with a virtual tour of the event's location, multimedia resources such as documentaries, and interactive group discussions online. These integrated approaches not only make the content more engaging but also cater to different learning styles, ensuring a more personalized and inclusive education.

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5. Conclusions: the new role of teachers

The role of the teacher in this new digital ecosystem is pivotal. In Education 4.0, educators transition from being mere transmitters of knowledge to becoming facilitators of learning. They guide students through the vast digital landscape, helping them curate resources, foster critical thinking, and make meaningful connections. Teachers are also essential in ensuring that students remain grounded in core human values – empathy, respect, and collaboration – while exploring the possibilities of the digital world.

As we move from Education 2.0 to Education 4.0, educators must shift their mindset to embrace continuous learning, adapting to new tools and technologies. This requires technical proficiency and a willingness to rethink traditional pedagogical models, blending them with digital tools to create dynamic, personalized, and student-centered hybrid learning environments. The digital mindset encompasses not only the use of technology but also critical thinking about its role in society, questioning its impact, and making informed decisions about its application. While digital tools can enhance learning, they must serve pedagogical goals rather than dictate them, fostering a balanced relationship between online and offline experiences.

In summary, as we transition to Education 4.0, teachers are transforming into designers of interdisciplinary learning environments. They serve as facilitators and project leaders, balancing convergent and divergent thinking. This shift from the traditional top-down approach requires a culture and mindset that encourages collaboration and creativity.

Interdisciplinary approaches are crucial in this new educational model. Teachers are now tasked with creating learning experiences that integrate multiple fields of knowledge, drawing connections between traditionally separate subjects. For instance, a project on climate change might combine science, geography, economics, and ethics, encouraging students to approach complex problems from various perspectives. This demands that teachers develop a flexible and innovative mindset, moving beyond subject silos to foster deeper engagement with real-world issues.

Navigating this new educational landscape relies heavily on trust – in both the teacher's competence and the collaborative learning process. Teachers must earn students' trust in the digital realm, demonstrating mastery of digital tools that are essential for effectively leading and inspiring students. This includes acquiring new digital skills as well as psychological and sociological insights to engage students meaningfully in both online and offline contexts. AI plays a significant role in this dynamic, serving as an enhancer that augments the learning environment with possibilities for personalization and engagement. It can provide real-time feedback, suggest

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tailored resources, or create immersive simulations. However, the teacher remains central in guiding these experiences, ensuring that AI aligns with broader pedagogical goals of fostering critical thinking, creativity, and collaboration. Additionally, AI can support effective and inclusive education by identifying learning gaps and providing targeted interventions, offering customized experiences for students of varying abilities and backgrounds. Yet, teachers must actively interpret data and address individual needs, fostering a supportive learning environment. In this paradigm, teachers become curators of knowledge and architects of learning environments. They create spaces where convergent and divergent thinking coexist, allowing students to develop a well-rounded approach to problem-solving. As facilitators of interdisciplinary projects, they guide students through the complexities of modern education, connecting different areas of knowledge and applying insights to real-world challenges.

Ultimately, the success of this educational shift depends on teachers' ability to embrace their new roles with confidence and adaptability. As the digital landscape evolves, educators must commit to lifelong learning, continuously updating their skills and methodologies to meet the changing needs of their students. Only then can they harness the potential of Education 4.0 and prepare students for future challenges and opportunities.

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Riassunto

Questo documento esplora criticamente l'impatto dell'intelligenza artificiale (IA) sull'«istruzione di qualità» come definita dall'SDG 4, enfatizzando inclusività ed equità, in particolare, nel contesto della trasformazione digitale. L'istruzione di qualità, in questo senso, va oltre l'acquisizione delle conoscenze, promuovendo l'apprendimento permanente accessibile a tutti. Attraverso esempi, l'integrazione dell'IA nell'istruzione viene esaminata con un approccio interdisciplinare socio-pedagogico. Emerge, pertanto, la necessità di una cultura digitale e di nuove competenze digitali da parte di educatori e studenti. La cultura digitale rappresenta una componente fondamentale per affrontare il «disallineamento educativo» della società contemporanea, promuovendo modelli educativi che enfatizzino l'impegno etico, il pensiero critico ma anche accolgano approcci partecipativi da parte degli studenti, promotori di una cultura digitale «bottom up». Il passaggio verso l'Educazione 4.0 necessita di un ripensamento delle pedagogie tradizionali, di nuovi mindset, ruoli e competenze da parte degli insegnanti.

Parole chiave: Cultura digitale; Educazione 4.0; Equità digitale; IA; Inclusione digitale.

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