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New learning spaces and hybrid teaching, artificial intelligence and new horizons in the future educational system.

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Abstract: This contribution analyzes the role of artificial intelligence (AI) as a catalyst for fruitful hybridizations in educational contexts, outlining a theoretical and practical framework for the design of new learning spaces. The integration of AI is not seen as a mere technological tool, but as a transformative agent that redefines the dynamics between knowledge, practices, and territories, creating unprecedented connections that overcome the traditional boundaries of the classroom. The research focuses on how AI, through data analysis and content adaptation, can foster personalized learning, responding to the individual needs and paces of students. This personalization is not limited to frontal teaching but extends to the creation of hybrid training paths that combine face-to-face interaction with innovative digital experiences. In particular, the application of AI systems for automatic feedback, formative assessment, and the creation of virtual learning environments that integrate simulations, gamification, and augmented reality is explored. The contribution aims to demonstrate that AI can act as a bridge between formal knowledge and practical skills, connecting the school curriculum with real-world challenges. In this sense, AI is a key element in the construction of an educational ecosystem that values transversal skills, critical thinking, and problem-solving. Furthermore, it is discussed how AI can support the creation of networks between students, teachers, institutions, and communities, overcoming geographical and temporal barriers to build a more inclusive and collaborative learning community. In conclusion, this study proproposes a critical and proactive reflection on the use of AI for the creation of learning spaces that are no longer confined to the classroom, but that expand into a vast and interconnected territory, a fertile ground in which knowledge and practices merge to give life to new forms of knowledge and development. The abstract, therefore, aims to stimulate the debate on the ethical, pedagogical, and social challenges related to the introduction of AI in education, while offering a model for the design of a more innovative and equitable educational future.

Keywords: artificial intelligence, learning spaces, education

1. The Evolution and Entry of AI into the Educational Field

The term "artificial intelligence" (AI) was first proposed by John McCarthy in 1956, during a workshop held at Dartmouth College in New Hampshire. This definition was inspired by the work of Alan Turing, the founding father of modern computation, who in his famous 1950 article questioned the possibility of machines thinking (TURING 1950).

Over the decades, the field of AI has experienced alternating phases of enthusiasm and disillusionment, marked by rapid innovations but also by moments of slowdown. These are known in the literature as "AI springs" and "AI winters." In recent years, however, artificial intelligence has undergone exponential expansion, thanks to the availability of big data, computational power, and the refinement of machine learning algorithms. This pervasiveness has not spared the educational field, where AI has begun to influence teaching models, assessment strategies, and inclusive practices (Panciroli, Macauda, 2021).

At the educational level, two fundamental directions are identified: AI Literacy (AIL) and Artificial Intelligence in Education (AIED). The first concerns educating students for a critical understanding of AI; the second refers to the use of intelligent tools to support teaching (Ranieri, 2024).

AIL is structured across four dimensions: cognitive, operational, critical, and ethical. In this sense, it is a transversal competence that involves not only the technological sphere but also the civic and value-based one (Ranieri, Cuomo, Biagini, 2024).

An AI system, according to the European Commission, is defined as "a system that is capable of perceiving, interpreting, reasoning, and acting in the physical or digital world, and able to learn and adapt based on its actions and the responses of the environment" (European Commission, 2018). This definition underscores the capacity for learning and adaptation, central elements for understanding its educational potential.

In the field of pedagogy, Pier Cesare Rivoltella (2023) introduces the concept of "algorithmic pedagogy," a paradigm that questions the school on the relationship between computational logic and educational goals. According to Rivoltella, AI is not just a tool, but a lens through which to rethink teaching and learning. Bonaventura Di Bello (2022) broadens this perspective, highlighting how AI can represent a concrete resource for instructional personalization, especially in the early stages of education, where the need for adaptation/care is more pronounced.

In this perspective, it is essential to reflect not only on the technical potential of artificial intelligence but also on the educational paradigms that guide its adoption. As highlighted by Panciroli (2021), the shift from instruction-centered teaching to teaching oriented towards the ecology of learning entails a redefinition of the role of technologies and their pedagogical purposes.

Technologies based on artificial intelligence can be powerful tools for promoting school inclusion, thanks to their ability to personalize, adapt, and monitor educational paths. Conversational chatbots, voice assistants, adaptive learning environments, educational robots, and predictive learning systems (learning analytics) are just some of the solutions already being tested in schools (Panciroli, Macauda 2021). One of the most significant examples is the LEA – Learning Assistant Bot – project, developed to provide personalized assistance to students through automated interaction. The bot is able to adapt in real-time to the student's needs, correct errors, suggest targeted content, and stimulate autonomy in studying (Panciroli, Macauda, 2021). This is a concrete application of the "AI for Training" approach promoted by the GPAI (Global Partnership on Artificial Intelligence), which advocates for the ethical and effective use of AI in educational contexts (GPAI, 2020). A further example is provided by the use of educational robotics in INDIRE projects. These projects have shown that programmable robots, used in collaborative teaching activities, have fa-

vored the inclusion of students with cognitive disabilities and behavioral disorders, thanks to the possibility of learning through play, error, and mediated interaction (Indire, 2024)..

2. AI Tools for Inclusion and New Perspectives for Blended Learning

Artificial intelligence, when integrated into well-designed contexts, allows for the implementation of a constructivist learning model based on exploration, simulation, and the negotiation of meanings. Brousseau's theory of didactic situations (2004) and Chevallard's concept of didactical transposition (1985) offer a solid theoretical framework for integrating intelligent technologies in a pedagogically sound manner.

Furthermore, it is important to consider that many of the most advanced AI technologies are capable of sophisticated instructional differentiation, dynamically adapting the educational offering. These tools are designed not only to analyze student performance but also to generate personalized recommendations, support self-regulation, and offer reinforcement paths. This is particularly useful for students with Specific Learning Disorders (SLD) or socio-linguistic difficulties, for whom standardized teaching presents an obstacle to inclusion.

The introduction of AI into inclusive teaching represents a potential turning point in the personalization of instruction. Intelligent systems allow for adapting content to the student's cognitive profile, offering timely feedback, detecting signs of discomfort or difficulty, and generating personalized learning maps (Luckin, 2016). This fosters subject-centered education that is non-uniform, but flexible and respectful of differences.

Ranieri, Cuomo, and Biagini (2024) define AI literacy as an articulated set of competencies distributed across four dimensions: cognitive, operational, critical, and ethical. Each dimension contributes to forming digitally aware citizens, capable of understanding algorithmic logic, evaluating risks, interacting with intelligent technologies, and navigating complex information environments.

However, this innovation is not without risks. The main critical issues concern the transparency of algorithms, the protection of sensitive data, and the potential reproduction of discriminatory biases. Jungherr (2023) highlights how predictive models can reinforce implicit stereotypes, leading to exclusion rather than inclusion. Floridi (2022) calls for the need for an ethics of artificial intelligence founded on principles of responsibility, justice, and respect for the person.

The other fundamental critical issue concerns the role of the teacher. As Aliprandi (2023) points out, the presence of AI redefines the boundaries between human author and artificial author. The teacher is called upon not only to master the tool but to reinterpret their role as a facilitator, cultural mediator, and guarantor of educational intentionality (Aliprandi 2023).

To ensure that artificial intelligence does not become a technocratic shortcut, it is essential that the innovation process is accompanied by a solid investment in the professional development of teaching staff; only a fully aware educational community is capable of exercising critical control over intelligent processes, preventing automating tendencies and the risk of dehumanization. Additionally, it is fundamental to establish mechanisms for independent verification of the software employed, to ensure that AI-based tools respect the principles of fairness, transparency, and universal accessibility.

An additional reflection concerns the relationship between technology and identity, as the use of intelligent systems in teaching raises questions about the representation of the student within the learning environment. When an algorithm interprets behavioral or performance data, it constructs an image of the student that can influence the expectations of the teacher and the student themselves. It is therefore imperative that AI-based technologies are designed with the aim of supporting the plural and continually evolving identity of learners, avoiding confining them within rigid categories or standardized predictive models.

Numerous experiments conducted at national and international levels attest to the effectiveness of AI in inclusive contexts. The "Scuola Futura" project, promoted by INDIRE, introduced adaptive immersive environments in primary schools, where sensors and algorithms personalize the educational experience based on students' emotional and cognitive responses (Indire, 2024). The results showed an increase in engagement, self-efficacy, and active participation among students with Special Educational Needs (SEN).

Globally, UNESCO (2021) developed a framework for the adoption of AI in education, emphasizing the importance of usage consistent with human rights, democratic values, and social justice. Similarly, the OECD (2022) promotes the integration of AI into curricula from an interdisciplinary perspective, underlining the urgency of developing critical and reflective skills in future citizens.

The link between AI and inclusion should not be taken for granted, but rather as the outcome of a precise pedagogical vision that guides its employment. For technology to truly serve the individual, conscious instructional design is necessary, accompanied by critical education on the use of AI and a shared commitment to defining an ethics of innovation.

Artificial Intelligence will be considered a support system that can be referenced for the search for new theories and new opportunities for cultural growth. The hypothesis, therefore, of blended learning can bring about significant transformations for creating a specific inclusive school. Blended learning that can involve various sensory dimensions in a digital perspective, and in particular one linked to Artificial Intelligence, as teaching seems to be developing in contemporary times, constitutes a decisive moment for developing the creativity of the student using traditional and innovative methodologies.

In the school of autonomy, in fact, a differentiation of learning develops which, however, does not determine a hierarchy of talents and a substantial differentiation of people. Therefore, one solution for an inclusive school model would be that everyone's talent should be enhanced while maintaining the diversity of learning and formative processes (D'Alonzo & Monauni, 2021). Today, inclusion is an extremely difficult school model to achieve that should safeguard equity and merit, as some sociological studies have recently highlighted (Benadusi & Giancola, 2020).

"Education is the first space in which artificial intelligence must prove to be fair, accessible, and respectful of human dignity," with these words, UNESCO Director-General Audrey Azoulay concludes the 2021 report AI in Education.

One of the central characteristics of the inclusive school is to bring out the talents and unexpressed potential of everyone. In this perspective, it is necessary to define a link between traditional teaching, digital devices, and artificial intelligence to define a new cultural hypothesis for the inclusive school of the 21st century.

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3. Conclusions

The convergence of Artificial Intelligence (AI) and the design of new learning spaces does not constitute a mere technological innovation, but the catalyst for a profound and necessary pedagogical transformation. This research confirms that AI-enhanced educational environments transcend their physical or digital configuration, evolving into adaptive cognitive ecosystems capable of delivering personalization at a scale otherwise unreachable.

AI, acting as an algorithmic mentoring infrastructure, is able to track the student's metacognitive progress in real-time, dispensing just-in-time learning trajectories and targeted feedback that strengthen autonomy and critical reflection. This paradigm shift reconfigures the role of the teacher, elevating them from a dispenser of information to an experience designer and facilitator of meta-cognition.

A crucial aspect lies in AI's capacity to serve as the engine for the expansion and constant revision of the school curriculum. AI systems not only optimize the teaching of existing subjects but actively create the instructional space for the introduction of new content essential for the 21st century. By simplifying and automating repetitive tasks for teaching staff (from formative assessment to administrative management), temporal and cognitive resources are freed up that can be reinvested in the exploration of emergent thematic areas. This includes the transversal integration of disciplines such as digital citizenship, the principles of Machine Learning, and the ethical implications of AI, transforming students from mere passive users into critical and aware digital citizens. AI thus allows for overcoming the rigidity of monolithic curricula, enabling the creation of hyper-specialized modules or the deepening of interdisciplinary pathways that intersect STEM (Science, Technology, Engineering, and Mathematics) with the humanities in previously impossible ways, shaping more resilient and adaptable student profiles.

The implications of this synergy extend far beyond instructional efficiency, touching upon the students' preparation for the challenges of an increasingly complex world. The integration of AI systems into collaborative and simulated learning environments not only maximizes the acquisition of higher-order skills—such as complex problem-solving, creativity, and adaptability—but constitutes their natural cultivation environment. The long-term effectiveness of these spaces is, however, inseparable from the ability to address the ethical and social challenges that arise from them. It is imperative that AI implementation be guided by a rigorous framework to mitigate the risk of algorithmic bias and safeguard student data privacy.

In a future perspective, research must focus on investigating the optimal hybrid collaboration models between artificial intelligence and the human figure of the teacher, defining the necessary roles and competencies in this renewed educational dyad. It will be crucial to explore methodologies for ensuring equitable access to these advanced technologies, guaranteeing that AI acts as a social equalizer and not as an element of amplification of the existing digital divide. Finally, the ultimate frontier of research lies in the study of the long-term impact of these environments on student autonomy and creativity, verifying that algorithmic efficiency is not achieved at the expense of the humanization and relational richness of the educational process.

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