

The Impact of New Technologies and Artificial Intelligence in the School World: An Analysis of the Effects on Students, Teachers, and Administrative, Technical, and Auxiliary Staff in Primary and Secondary Education Institutions, Educational Institutions, and State Special Schools – Algorithmic Data Processing and Legal Considerations

Gino Fontana

Pegaso Digital University, Italy
sl.gf@libero.it

Alessandro Sola

ANIEF – Professional Union Association, EUROSOFIA, Italy
alessandro.sola@gmail.com

Mario Fontana

MIM - Ministry of Education and Merit, Italy
drmariofontana@icloud.com

Marialuisa Russomanno

ANIEF – Professional Union Association, EUROSOFIA, Italy
marialuisarussomanno@gmail.com

Abstract

The integration of artificial intelligence (AI) in education has transformed teaching and learning methodologies by enabling personalized instruction, optimizing administrative processes, and improving decision-making based on data analytics. This study examines the implications of AI adoption in educational institutions in Italy, focusing on students, teachers, and administrative staff. It explores the benefits and challenges associated with AI-driven technologies, particularly in terms of algorithmic data processing, regulatory compliance, and ethical considerations. The research highlights the need for a balanced approach that fosters AI innovation while ensuring transparency, fairness, and adherence to legal frameworks such as the General Data Protection Regulation (GDPR). The study concludes that responsible AI deployment in education requires continuous monitoring, equitable access, and strong governance policies to maximize benefits while minimizing risks.

Keywords Artificial Intelligence, Education, Law and regulations, GDPR, Algorithmic

INTRODUCTION

The advent of the digital era has profoundly transformed traditional pedagogical methods, fundamentally altering both teaching and learning paradigms. Among the most influential technological advancements, artificial intelligence (AI) holds immense potential to revolutionize education. AI-driven tools facilitate personalized learning experiences, optimize teaching methodologies, and streamline administrative processes (Luckin et al., 2016). However, the integration of AI into educational institutions necessitates a comprehensive evaluation of its implications for all stakeholders, including administrative, technical, and auxiliary staff, educators, and students. This study aims to examine the transformative effects of AI in education, identifying both the opportunities and challenges associated with its adoption.

Artificial intelligence encompasses computational systems capable of performing tasks traditionally requiring human intelligence, such as voice recognition, natural language processing, machine learning, and decision-making (Russell & Norvig, 2020). In an educational context, AI applications are utilized to analyze student data, deliver personalized feedback, and enhance institutional management. The adoption of AI-powered solutions in education has facilitated data-driven decision-making, enabling institutions to tailor learning experiences according to student needs and optimize resource allocation (Holmes et al., 2021). Emerging educational technologies extend beyond AI, encompassing an extensive array of digital tools such as mobile devices, e-learning platforms, learning management systems (LMS), and educational applications. These technologies promote student engagement through interactive learning environments, fostering dynamic and adaptive educational experiences (Selwyn, 2019). For instance, e-learning platforms provide remote access to instructional materials, while gamification-based applications offer immersive learning experiences, enhancing student motivation and knowledge retention (Kukulska-Hulme, 2020).

The integration of AI and digital management systems within educational institutions significantly reduces administrative burdens, automating processes such as student enrollment, attendance tracking, and communication with stakeholders (Woolf, 2010). As a result, administrative, technical, and auxiliary personnel can reallocate their efforts towards strategic initiatives and interpersonal support functions, such as student assistance and parental engagement. Despite these advantages, the successful implementation of AI in educational administration necessitates targeted professional development. A lack of digital proficiency among staff may impede the effective utilization of new technologies, potentially hindering institutional efficiency (Eynon & Malmberg, 2021). Consequently, ongoing professional training programs must be prioritized to equip staff with the requisite technological competencies, ensuring the seamless adoption and management of AI-driven educational solutions.

AI-powered educational technologies enable instructors to personalize teaching strategies, adapting instructional methodologies based on individual learning profiles (Schmid et al., 2021). By leveraging AI-driven data analytics, educators can assess student progress, identify learning gaps, and modify

pedagogical approaches to enhance academic outcomes. This level of personalization fosters an inclusive and student-centric learning environment, accommodating diverse learning needs and

preferences (Luckin et al., 2018). However, the widespread adoption of AI in pedagogical settings is met with resistance from some educators, who express concerns regarding the effectiveness of these technologies and the potential erosion of their pedagogical autonomy (Selwyn, 2019). To address these apprehensions, it is imperative to provide educators with comprehensive training and support mechanisms, ensuring their active participation in the digital transition. Bridging the gap between traditional and AI-driven teaching methodologies requires fostering an educational culture that values both technological innovation and pedagogical expertise.

Educational technologies, when effectively integrated, promote active and collaborative learning by fostering student engagement and peer interaction (Hattie & Yates, 2014). AI-driven tools, such as virtual discussion forums, real-time collaboration platforms, and technology-based project management software, facilitate dynamic knowledge-sharing environments. These interactive learning models enhance student participation and cultivate a more cohesive academic community (Means et al., 2014). Nevertheless, disparities in technological accessibility present a formidable challenge, potentially exacerbating educational inequities. Students from socioeconomically disadvantaged backgrounds may experience limited access to digital devices and high-speed internet, impeding their ability to fully engage with AI-enhanced learning platforms (Selwyn, 2020). To mitigate this digital divide, educational institutions must implement inclusive strategies, such as providing technological resources and ensuring equitable access to digital infrastructure.

The integration of AI into education raises critical ethical and social considerations, particularly concerning student data privacy and security (Williamson, 2017). AI-driven educational tools rely on extensive data collection and analysis, necessitating stringent regulatory frameworks to safeguard sensitive information. Educational institutions must adopt robust data protection measures, ensuring compliance with ethical standards and legal regulations to prevent unauthorized data breaches and misuse (West, 2018). Furthermore, AI-based educational technologies must be designed with inclusivity at their core, addressing the needs of diverse student populations. The development of accessible digital tools for students with disabilities, as well as culturally and linguistically diverse learners, is essential to fostering an equitable educational landscape (UNESCO, 2019). Inclusion should serve as a guiding principle in the implementation of AI-driven educational innovations, ensuring that technological advancements benefit all students without exacerbating existing disparities.

Artificial intelligence and emerging educational technologies offer transformative potential for teaching, learning, and institutional management. While AI-driven tools enhance pedagogical personalization, streamline administrative operations, and promote collaborative learning, their successful integration necessitates strategic planning, comprehensive training, and ethical oversight. Addressing concerns regarding digital accessibility, educator resistance, and data privacy is imperative to ensuring a balanced and equitable implementation of AI in education. By fostering a responsible and inclusive approach to AI adoption, educational institutions can harness the full potential of technological advancements while upholding pedagogical integrity and student welfare.

This study was conducted in Italy to examine the transformative effects of AI in education, focusing on primary and secondary schools, including state special schools, and evaluating the perceptions of students, teachers, and administrative staff.

METHODOLOGY

This study was conducted between January and June 2023, using a structured survey methodology across different educational institutions in Italy. A stratified random sampling technique was employed to select participants from urban and rural areas to ensure a representative sample. The final dataset included 1,000 individuals:

- **600 students:** Selected from different age groups and educational levels.
- **200 teachers:** Covering a range of subjects and school types.
- **200 administrative staff:** Including technical and auxiliary personnel.

Data were collected via an online questionnaire designed to assess:

1. **Technology use:** Frequency and type of technological tools employed.
2. **Impact of AI:** Perceptions regarding the role of AI in education.
3. **Training and support:** Accessibility of AI-related training programs.
4. **Overall satisfaction:** Satisfaction levels across various user groups.

A mixed-methods approach was applied in data analysis. Quantitative data were analyzed using descriptive statistics and chi-square tests to determine statistical significance across different demographic groups. Qualitative data, derived from open-ended responses, were subjected to thematic analysis to identify recurrent patterns and concerns.

RESULTS

Technology use:

- **Students:** 85% of students reported regular use of AI-powered educational tools, with applications such as homework management systems and learning analytics being the most common.
- **Teachers:** 75% of teachers integrated AI-based resources into their teaching, favoring e-learning platforms and automated assessment tools.
- **Administrative Staff:** 55% utilized AI-enhanced digital systems for school management and communication.

Impact of AI:

- **Students:** 72% found AI tools beneficial in making learning more interactive, though 28% expressed concerns over dependency and reduced critical thinking.
- **Teachers:** 65% noted improvements in teaching efficiency, but 40% reported feeling unprepared due to insufficient training.
- **Administrative Staff:** 60% appreciated the automation of bureaucratic tasks, but 45% highlighted the need for better training programs.

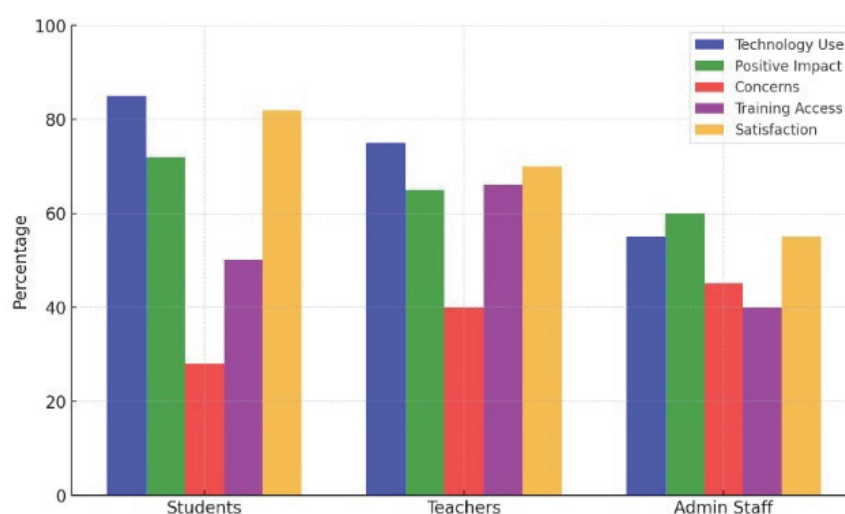
Training and support:

- Only 66% of teachers had access to structured AI training, while figures were lower for students (50%) and administrative staff (40%).

Overall satisfaction:

- **Students:** 82% expressed satisfaction with AI technologies in education.
- **Teachers:** 70% had a positive perception, tempered by concerns regarding evolving technological demands.
- **Administrative Staff:** 55% reported satisfaction, emphasizing the need for continuous professional development.

Picture 1: Combined graph of the metrics used



Own processing

DISCUSSION

The results indicate a strong integration of AI in Italian schools, benefiting students in personalized learning experiences and administrative staff in efficiency improvements. However, the lack of structured training poses a challenge, particularly for teachers, whose effectiveness in AI-assisted classrooms depends on their preparedness. These findings align with previous international research (Holmes et al., 2021; Selwyn, 2019), which emphasizes the necessity of ongoing digital competence training in educational institutions.

ALGORITHMIC DATA PROCESSING AND LEGAL CONSIDERATIONS

One of the fundamental aspects of AI in education is the algorithmic processing of data, which allows for adaptive learning experiences, automated assessments, and real-time student performance tracking. The ability of AI to process large datasets efficiently contributes to evidence-based decision-making in pedagogy, allowing educators to tailor instructional strategies based on student needs. However, this also raises significant legal and ethical concerns, particularly regarding data privacy, transparency, and potential biases embedded in AI models.

From a legal standpoint, AI-driven data processing in educational settings must comply with existing data protection regulations, such as the European Union's General Data Protection Regulation (GDPR). The GDPR mandates strict guidelines on the collection, processing, and storage of personal data, requiring educational institutions to ensure transparency and accountability in AI applications. Specifically, Article 22 of the GDPR prohibits fully automated decision-making that significantly affects individuals without meaningful human intervention, underscoring the need for oversight in AI-powered learning analytics.

Furthermore, algorithmic bias remains a pressing issue, as AI systems trained on biased datasets may reinforce existing inequalities in education. For instance, predictive analytics used for student assessment and performance tracking could disproportionately disadvantage marginalized groups if the underlying data fails to account for socioeconomic, linguistic, or cultural diversity. Ensuring

fairness and equity in AI-driven education requires ongoing audits, algorithmic transparency, and the inclusion of diverse datasets to mitigate discriminatory outcomes.

In addition, the right to data access and informed consent must be prioritized to protect students, teachers, and administrative staff from potential misuse of their personal information. Educational institutions should implement robust data governance policies, ensuring that AI applications respect user rights while enhancing pedagogical outcomes. Ethical AI frameworks, such as UNESCO's Recommendation on the Ethics of Artificial Intelligence (2021), emphasize the importance of responsible AI deployment in education, advocating for human-centric AI systems that uphold democratic values and fundamental rights (Fontana, 2024).

RECOMMENDATIONS

A well-structured and inclusive strategy for integrating AI into education begins with tailored training initiatives. Rather than viewing AI skills as an optional add-on, educational institutions should consider them fundamental competencies that both staff and students need to acquire. For example, specialized professional development programs could be offered to teachers that delve into AI-driven instructional tools, data interpretation, and digital ethics, while students and administrative personnel might receive training aligned with their respective roles. By approaching AI literacy as an ongoing and collaborative process, schools can foster an environment where educators share best practices, and administrative staff become more adept at handling AI-related tasks, ultimately enriching the quality of teaching and learning.

Alongside robust training programs, it is essential to address technological infrastructure gaps, especially in areas where resources may be limited. Efforts should focus on improving access to reliable internet connectivity, modern devices, and technical support. Governments and educational bodies can play a pivotal role here by implementing policies that encourage partnerships between technology providers and public institutions. These collaborations might involve subsidizing the cost of devices for low-income students or providing targeted grants to rural schools to upgrade their digital equipment. The ultimate goal is to ensure that the benefits of AI-driven education are equally distributed, regardless of geographic or socioeconomic factors. Furthermore, the successful integration of AI in education hinges on a transparent and continuous monitoring process. By regularly evaluating how AI-powered tools impact student engagement, teacher workload, and overall institutional efficiency, policymakers can identify potential pitfalls, such as algorithmic biases or privacy risks, at an early stage. This requires not only collecting quantitative data on academic performance and user satisfaction but also integrating qualitative insights from focus groups or interviews with teachers, students, and administrative staff. Such a holistic evaluation strategy can inform evidence-based adjustments to both policies and practices, ensuring that AI deployment remains aligned with core educational objectives. Ultimately, this cyclical process of assessment and adaptation promotes an agile and responsible approach to innovation, allowing schools and policymakers to refine AI's role in education continually.

CONCLUSIONS

This study provides empirical evidence of AI's growing role in Italian education, highlighting both its benefits and challenges. The findings suggest that while AI enhances teaching, learning, and administrative efficiency, its effectiveness hinges on adequate training and equitable access to

technological resources. Future research should explore longitudinal effects and sector-specific AI interventions to optimize educational outcomes in diverse settings.

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