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For a Debate on the Use of Artificial Intelligence in Schools: The Importance of Some Contributions from the 1990s onwards for a Better Understanding of the Current Times

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Abstract

In the first decades after its inception in the USA, computer science and ICT teaching were primarily aimed at providing adequate scientific and technical preparation; this approach strongly characterised informatics teaching in Italy during the 1970s and 1980s. In subsequent decades, a larger European trend toward integrating technological skills led informatics education to coexist with digital education in all subjects, often causing confusion about the true disciplinary nature. This conceptual paper draws on historical analysis of Italian educational debates from the 1990s onwards to examine current challenges posed by artificial intelligence (AI) integration in schools. A group of deeply engaged Italian intellectuals and educators has contributed significantly to clarifying these issues, proposing an informed pedagogical approach that integrates scientific and technical rigour with humanistic reflection. Today, their work is crucial for teacher training, particularly because of the increasing integration of artificial intelligence into education, which demands careful epistemological and ethical considerations for its social implications. Methodologically, the article synthesises selected Italian scholarship alongside international frameworks (such as UNESCO's Guidance for generative AI in education and research, 2023), suggesting which computer science foundations teachers should master to critically assess AI systems. Informatics now faces the challenge of combining its traditional scientific and technical dimensions with a renewed humanism.

Keywords: *informatics education, artificial intelligence, digital humanism.*

1. Introduction

1.1 The Aim and Positioning of the Article

This conceptual paper reconstructs a distinctive strand of Italian educational debate from the 1990s onwards, connecting early critiques of image-centred digital didactics to contemporary challenges of AI integration in schools. Guiding questions include the following. What computer science foundations are essential for teachers to critically evaluate AI tools? How can historical Italian reflections inform international AI literacy frameworks? Methodologically, it synthesises peer-reviewed Italian scholarship, key policy documents, and select international sources (1990–2025), distinguishing normative claims from empirical observations.

1.2 The Computer Ethics in Education

The beginning of Computing Education (CEd) can be considered 1967, the year in which Seymour Papert (1928-2016), Cynthia Solomon (1938-) and Wally Feurzeig (1927-2013) created the Logo programming language, the first specifically designed to teach Computer Science (CS) to young students. However, from the mid-1970s to the early 1990s, CEd slowly penetrated schools around the world. However, despite its great popularity in the 1980s, CEd has not yet managed to become a full-fledged part of the public education system, as Papert et al. hoped [1]. A prime example is the Italian school system, where the truly cultural role of computer science remains largely underdeveloped. Therefore, while some schools achieve genuine innovation, many others simply use ICT, neglecting CS and CEd [2,3,4] (according to Gorn, the term 'informatics' includes both CS and ICT [5]).
In contrast, international Baccalaureate (IB) schools have shown greater attention to the many facets of computer science through two distinct subjects: CS and Digital Society (DS). Unlike CS, DS focusses on the social impact of technology. The following questions are just a few examples of the key issues that characterise it:

- Is what is legal invariably justifiable from an ethical perspective?
- How can we balance freedom of information, censorship, and privacy?
- What impact does technology have on different educational systems?

The Theory of Knowledge (ToK) subject contributes to the effectiveness of this approach: DS topics often refer to those of ToK, with entire sections aimed at developing critical thinking through questions such as:

- How do we acquire knowledge?
- What can we be certain of?
- What assumptions underlie the information we receive?

Rather than seeking definitive answers, the goal is to promote ongoing inquiry through discussions between students and teachers [2,3], according to the Computer Ethics (CE) approach [6].

2. Artificial Intelligence in the Educational Context

The questions listed above (and many others) have become particularly urgent since artificial intelligence (AI) systems have invaded our daily lives, not sparing school systems.
CEd should emphasise that AI functions through probability and logic rather than consciousness. Because generative systems rely on probabilistic models of language, they prioritise plausibility over factual accuracy, even though recent studies show that LLMs such as GPT-4 can approach human reliability on constrained short-answer tasks [31] and match human examiners in ranking open-text answers [35], while remaining fragile on open-ended ones [32]. Consequently, users must have a basic understanding of the subject matter to verify the results [7]. Due to these risks, many industry experts recommend against integrating AI into the education of school-aged children [8]. Furthermore, language generators have been defined as ‘stochastic parrots’ incapable of thinking but dangerous for their effectiveness in perpetuating dominant points of view; this translates into increased inequalities and power imbalances [9]. Furthermore, the powerful computing infrastructure required makes AI an extremely energy-intensive system, with recent peer-reviewed analyses calling for standardised reporting of environmental impacts [33], leading to colonial practices of exploitation [10] and accelerating climate change [11]. These issues make the introduction of digital humanism in schools urgent [12].

2.1 International Policy Frameworks

These concerns align with major international guidelines. UNESCO’s Guidance for generative AI in education and research [34] advocates human-centred and age-appropriate deployment with strong teacher training and safeguards. The US Department of Education’s 2023 emphasizes “human-in-the-loop” oversight and risk mitigation [36]. The OECD frameworks [37] situate AI literacies within governance across education systems, complementing the Italian debate.

2.2 The Italian Case

Other highly problematic issues are posed by the Educational Technology (EdTech) sector, which is interested in promoting the massive use of digital tools and the old myth of personalization of learning [13], in its dual role as economic and public entities, appropriating a large amount of sensitive information and accelerating the commodification of education [14]. The following case is illustrative rather than representative: an article published in an online magazine edited by Romano Luperini [15], a prominent intellectual in the national cultural scene. The authors first recall Winnicott's definition of a "potential space," an essentially relational space that requires the presence of another subjectivity. This space is where play, creativity, and the ability to adapt to the world arise. Psychological growth occurs when the child moves from the illusion of an "omnipotent object" (which immediately responds to their needs) to the recognition of the other as an external subject, with their own will and pace. Waiting and lack are essential for the birth of thought and desire. According to the authors, AI obliterates the "potential space" because the machine lacks the emotional and subjective dimension. AI risks becoming an "omnipotent illusory object" that provides instantaneous responses (without the necessary waiting time for thought) and acts like a "mirror" or a "bubble," confirming the user within their limitations instead of pushing them toward the discovery of the unexpected. At this point, the article quotes Headmaster Salvatore Giuliano, who illustrated his school's "Book in Progress AI" project on personalised learning during a broadcast on a national radio station. In short, the project consists of a free environment for students and families where teachers insert subject content with in-

depth analysis and multimedia content. The content, initially adapted to eight learning styles, is transformed into slides from which concept maps are derived. Finally, students receive feedback on their learning progress. Students also have the option of obtaining summaries and additional information, with increasingly targeted adaptations based on their learning style [16]. Beyond recalling the commercial relationship between customer and service provider translated into education, this approach raises numerous questions: How can we know a student's cognitive style in advance? Is a cognitive style always uniquely defined? Even if it were possible, is it right to limit the learning process to this single cognitive style? These are legitimate doubts. Quattrociocchi et al. [38] have renewedly used the term “epistemia” to describe an era where knowledge merges with mere appearance: LLMs generate statistically coherent texts lacking epistemic grounding (verification, real-world anchoring), replacing epistemic criteria with stylistic/linguistic plausibility. This explains the EdTech illusion: AI personalisation creates a 'feeling of knowing' without critical judgement, accelerating cognitive fragility. Beyond the potential of AI, it is, in fact, field practice that legitimises respect for the ethical dimension. Despite numerous problem areas (of which the case described is just one example), Italian university policy encourages the use of artificial AI in the pedagogical field. In 2024, the "Scientific-disciplinary groups" (GSD) were introduced, within which the updated "Scientific-disciplinary sectors" (SSD) are reported. Within GSD 11/PAED-02 "Educational Research, Didactics, Special Pedagogy and Experimental Pedagogy" the SSD "Didactics and Special Pedagogy" is defined. The SSD declaration mentions "advanced technologies, including those based on artificial intelligence, and their potential contribution to inclusive educational environments and ecosystems" [17].

3. The Italian Debate since the 90s

Criticisms of the use of AI in education are the result of a tradition that began in the 1990s, led by Italian intellectuals who were particularly attentive to the school context. At the time, the debate focused on the use of video games as an educational tool, but the objections raised reflect current criticisms of the use of AI [20].

3.1 Historical Background

Computer science was introduced into the Italian school curriculum in the 1970s, with the aim of training qualified technicians for industry. Computer science contributed to the so-called post-war "Italian miracle" [18] a remarkable economic recovery despite the lack of raw materials, similar to that of the post-unification period of the nineteenth century, largely due to graduates from the physics and mathematics departments of technical institutes [19]. Since the 1990s, the progressive penetration of computer science into schools other than technical institutes has been accompanied by the ever-increasing diffusion of digital environments across all subjects. This has led CEd to be confused with digital education, emphasising the role of images in learning. This trend is driven by advances in neural network design, which have had a significant impact on educational research [21, pp. 42-59].

3.2 Postmodern Didactics and AI Critiques

An emblem of the enthusiasm for the use of images in learning is the educationalist Roberto Maragliano (1946-), who defined the video game as the greatest epistemological revolution of the century, as it allows us to exalt dimensions of intelligence that have been belittled by abstract culture [21, p. 90]. According to Lucio Russo (1944-2025), the emphasis on the digital dimension and the use of images reveals an educational tendency privileging the development of passive skills over the cultivation of active critical thinking about digital technologies, imported from other countries where industrial development is instead growing; in other words, Italian schools are increasingly orientated towards the education of consumers, not producers of knowledge [21, pp. 11-25]. Indeed, the widespread use of the term "digital" by Italian educationalists still ignores in-depth considerations of the scientific foundations of informatics, leading to simplifications that diminish the complexity of the topic. Specifically, the confusion is evident in the way technology is presented as a "natural" entity in the educational context, sacrificing the rigour that should be applied to recognising the role of CS as an autonomous science that interacts with digital technologies in an extremely complex relationship.
Moreover, this trend was strongly encouraged by a partly decontextualised reception of Papert's thinking, which in the 1990s insisted heavily on the use of video games in the development of transversal skills, essential for a constantly evolving job market [22]. The combination of these factors (digital dimension, transversal skills, use of images, and cognitive theories based on the study of

neural networks) stimulated reflections on AI in education in the 1990s. Giovanni Stelli (1941-) was among the first to theorise the advent of a postmodern teaching method that assigns secondary importance to disciplines [23]. Programming languages themselves are victims of this conception: their linear and sequential logic would not do justice to the complexity of reality. According to this vision, AI would have dealt the final blow to the development of disciplinary knowledge and logical thinking, to the advantage of a sensorimotor dimension linked above all to the use of images [23].

In a subsequent contribution, Alberto Giovanni Biuso (1960-) reevaluates the nexus between artificial intelligence and pedagogical learning, contextualising it within the broader ontological debate concerning the mind-brain relationship. By critically engaging with contemporary research on neural networks, the author questions the problematic implications these technologies impose on educational practices [24]. Furthermore, Biuso provides a rigorous critique of the structures and inherent limitations of postmodern didactics as formulated by Stelli [23].

The resulting inquiry offers a nuanced perspective that eschews the technological fetishism of the computer-as-myth, while simultaneously acknowledging its substantial utility as a cognitive instrument. Crucially, the author posits that no digital medium can supersede the Socratic method, the most fundamental of epistemic strategy, which prioritizes the intersubjective educational bond between the learner and educator. Within this framework, the deep disciplinary expertise is respected as a *conditio sine qua non* for the efficacy of any pedagogical intervention [24].

This line of reasoning finds recent resonance in the work of Roberto Finelli (1945-), who contends that human mental processes are nonreducible to mere mechanistic or algorithmic computation. Ultimately, both scholars underscore the imperative to restore the anthropological dimension to the centre of the technological discourse [25]. It is self-evident that technological knowledge must be acquired; however, a fundamental distinction persists between the architectural design of a video game and its mere consumption [26]. Computer science education should serve as the foundational prerequisite for digital education, thereby preventing the latter from being used to impart a superficial veneer of innovation to otherwise arbitrary pedagogical methodologies.

Although the official description of the GSD 11/PAED-02 disciplinary sector makes a tentative reference to the specificities of individual academic subjects [17], didactic instruction within Italian universities is predominantly entrusted to pedagogists who lack a formal scientific and technological background. Although digital education aligns well with the transversal nature of general didactics, this approach is no longer sufficient. In particular, with the advent of AI, it has become imperative for students to attain a robust mastery of computer science fundamentals. Such knowledge is essential for comprehending critical concepts, including: the distinctions between Machine Learning (ML), Large Language Models (LLM), and Generative Artificial Intelligence (GAI); the dichotomy between Weak and Strong AI; the nuances of prompting versus querying; the technical process of training an LLM and the inherent nonneutrality of such operations; and the mechanics of generative pattern matching as opposed to AI hallucinations.

Certain pedagogical circles tend to prioritize learning modalities that are largely, if not entirely, decoupled from the actual subject matter of the learning process. This phenomenon originates from a specific reception of the cognitive sciences, of which Alan M. Turing (1912–1954) was a seminal founding figure.

Many scholars have highlighted the dangers of this educational vision, based on general "learning to learn" regardless of the subject of study. More recently, a text opposing Competence-Based Education (CBE) has argued in favour of Bildung-Orientated Education (BOE). While the OECD-backed CBE model treats education as the sum of quantifiable skills, BOE prioritises a holistic 'big picture' approach to learning. The CBE leaves students ill equipped for today’s world. In contrast, BOE fosters the genuine autonomy and social responsibility required to navigate modern, post-industrial complexities [27].

Furthermore, as Dario Generali (1953-) wrote, it must be reaffirmed that pedagogy is situated at the disciplinary intersections of philosophy, psychology, sociology, and anthropology, among others. Such an epistemological characterisation is prototypical of the human sciences, with which pedagogy shares both its theoretical framework and the rigorous – yet distinct – levels of scientific character inherent to these fields. These theories often articulate multiple and frequently incompatible, perspectives that rarely achieve universal consensus within the discipline’s own scientific community. However, far from constraining the efficacy of the formative process, this theoretical pluralism constitutes an enriching element of a free and critical pedagogical practice [28].

4. Final Reflections

The Hybrid Human-Artificial Intelligence (HHAI) paradigm constitutes an emerging field of inquiry that advocates for the necessity of a synergistic partnership between humans and machines. This framework proposes the development of hybrid systems designed to simultaneously leverage artificial intelligence and human cognition, aiming to achieve a level of performance that transcends the individual capabilities of either entity in isolation. The ultimate objective is to amplify human cognitive faculties – specifically within the domains of learning, reasoning, complex problem solving and strategic decision-making – thus fostering a co-evolutionary advancement of human and machine intelligence [29].

In light of the results resulting from the intensive use of digital devices [30] – which has inevitably permeated contemporary instructional methodologies – this brief contribution seeks to prompt reflection on the practical implications of human-machine integration as envisioned by pedagogical theories such as HHAI. For teacher education, educators should master at least the following key computer science foundations to reason about AI systems:

- differences between ML, LLMs, and GAI;
- prompting vs. querying;
- training data non-neutrality;
- probabilistic output and error modes (hallucinations).

These map to age-appropriate AI literacy outcomes:

- primary: Basic prompting and verification [35];
- secondary: Critical evaluation of bias/environmental costs (OECD, 2024–2025). Classroom checklists should include: ‘Does this AI tool prioritize plausibility over accuracy?’ and “What human oversight is in place?’ [36].

In a conventional school setting, will these developments merely translate into projects akin to 'Book in Progress AI'? Would it not be more appropriate to extend the teaching of CS across all curricula and introduce digital education within subjects such as DS in IB schools? Human-machine hybridisation in the educational sphere risks fostering a dangerous form of pedagogical totalitarianism, particularly given the ethical implications briefly outlined in the opening section. The professional development of educators must, therefore, be grounded in the principles of intellectual freedom and the values of humanism, which are more indispensable than ever in an era defined by profound external conditioning.

ETHICS AND RESEARCH INTEGRITY SYSTEM

This article does not report any study involving human participants, animals or personally identifiable data, and therefore did not require ethics approval or informed consent. The author declares no conflicts of interest.

DISCLOSURE OF GENERATIVE AI USE

Generative AI tools (Writefull) were used solely for polishing the language in the final editing. All intellectual content, structure, arguments, and final language remain the sole responsibility of the author, who assumes full responsibility for the manuscript.

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