



Teacher education is a deeply pedagogical process rooted in values, ethics, and the social purpose of schooling. Globally, it sits at the core of educational quality and fairness, as research in comparative and international education demonstrates: the training of teachers directly influences students' learning chances, social inclusion, and the democratic aims of schools. Teachers are not simply transmitters of curricula, but active professionals whose convictions, reflective skills, and ability to manage the complexities of classroom life give shape and substance to the educational experience itself.

The pedagogical dimension of teacher education frames teaching as a relational, context-aware, and ethically grounded profession rather than just a set of procedural skills. From a research perspective, this demands robust research methodologies that can critically examine the complex realities of schools and inform evidence-based policies. Equally important is the connection between theory and practice, which helps to bridge the persistent gap between universities and schools.

The contributions gathered in this volume reflect the richness and diversity of experiences showcased during the ATEE Spring Conference 2024, held at the University of Bergamo from May 29 to June 1, 2024. The volume presents 70 selected papers out of more than 300 presented by researchers representing over 40 countries.

This broad spectrum of studies highlights promising directions that can inspire renewed inquiry and concrete proposals aimed at improving contemporary educational systems.

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Teacher education research in Europe: trends, challenges, practices and perspectives

May 29th – June 1st, 2024
S. Agostino, Bergamo



Edited by Nicole Bianquin and Francesco Magni





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BOOK OF PROCEEDINGS

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The use of artificial intelligence (AI) in inclusive learning: an exploratory investigation

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Abstract

The contribution intends to illustrate the research carried out within the Learning Technologies laboratories of the specialization courses for the support of pupils with disabilities or Special Educational Needs (SEN). The research, addressed to the Universities of Sassari, Modena and Reggio Emilia and Trieste, sought to investigate the impact that AI can have in the education process. To answer these questions, a questionnaire was administered to a sample of 263 trainees to survey their views on the use of AI as a support for students with disabilities and other special educational needs and inclusive processes. The results of this survey highlight the views of trainee teachers on the strengths and weaknesses of AI in the inclusive teaching and learning process with SEN.

Keywords: artificial intelligence; inclusion; learning; special education needs.

1. Introduction

There is a lot of excitement in the school world these months, especially among teachers, because of the use or non-use of artificial intelligence (AI) tools (De Kerchove, 2019). Such tools are, without a doubt, capable of performing exceptional performances, such as the production of text, images, objective evidence and many other cognitive products typically produced by humans (Mc Kinsey, 2020). Moreover, the technologies are now integrated into the informal and nonformal learning appendage with which we are all equipped, the smartphone, and therefore, like it or not, everyone finds themselves using them (Vincent- Lancrin, 2020). Over the past decade, the international literature has highlighted the central role of digital technologies in supporting inclusive processes and, concomitantly, the need to promote strong digital competencies in education professionals (Touretzky et al., 2019).

The history of artificial intelligence-based “conversation models” has been, revolutionized by a new comer in the big tech business world: OpenAI. This company was founded in December 2015 in San Francisco, by a group of entrepreneurs, including Elon Musk CEO of Space X and Tesla, Reid Hoffman, co-founder of LinkedIn, and Peter Thiel, co-founder of PayPal (Musk later in 2018, exited the board).

The mission of Open AI, from its origins, is to promote and develop tools for artificial intelligence “and ensure that artificial intelligence is an asset for all humanity,” an ambitious claim, perhaps really too benevolent, for a for-profit venture with a character that is, as we shall see, very aggressive and dynamic. From its origins OpenAI has focused on developing deep learning and machine learning algorithms to process natural language (Natural Language Processing - NLP). In 2016, OpenAI introduced the Generative Pre-trained Transformer (GPT) architecture—literally “Generative Pre-trained Transformer”—which based on initial training on a specific dataset generates text, summaries, and natural language responses from user input (Payne, 2024).

That is, GPT acts by progressively and successively identifying the most determinant elements of the input itself, which is why this technology is also known as the “attention network” (Vaswani, et. Al., 2017).

As of Nov. 3, 2022, Chat GPT realise 3.5 was made available online (Chat GPT-4 was also released on March 15), an artificial intelligence that enables it to generate very accurate natural language responses to questions posed to it in a dialog box quite similar to those used for a text chat such as WhatsApp.

The software architecture that enables this type of new human-computer interaction is based on Large Language Models. This is a subdomain of Artificial Intelligence that uses machine and deep learning applied to huge amounts of textual data to simulate—it is important to reiterate this—human conversational responses (Rivoltella, 2020).

When a question or more generally a request is made to ChatGPT its “conversational model” uses transformer multilayer neural network technology to process, and analyze the text of the question by comparing it with the databases on which it has been “pre-trained” to generate, then, also based on Web sources, its natural language response.

More specifically, “generative pre-training” (supervised machine learning), aims to provide the system with the ability to predict according to a statistical model what the next word within a sentence or set of sentences entered as a prompt within its dialog box will be.

A machine learning (deep learning) model specializes in processing and interpreting sequential data, which makes it particularly valuable for natural language processing tasks, consisting precisely of a sequence of words or syllables (Marino et al, 2020).

To protect the use of AI, the European Union has already moved to protect it by preparing the precautionary principle with the 2020 Assessment List for Trustworthy Artificial Intelligence and the subsequent Artificial intelligence Act (EU 2021b).

1. Responsible and ethical use of artificial intelligence and enshrine the following principles;
2. AI systems should ensure the empowerment of people and ensure adequate control mechanisms in particular:

- the ability - for women and men - to control processes and maintain oversight of them;
- the technological robustness and security of the systems;
- the assurance of privacy and transparent data management;
- the assurance of respect for diversity, non-discrimination and equity;
- the assurance of environmental and social well-being;
- the accountability and reliability of AI systems and their outputs.

Generative artificial intelligence, in fact, is a complex machine learning model to generate original outputs based on the data it has been trained with (DDL - Large Language Model). However, care must be taken with the data, which is not always controlled and therefore may give incorrect answers. In fact, the important help of AI can improve our productivity as teachers, but it cannot replace our function as experts and instructional mediators to students, especially those with Special Education Needs (Fabiano, 2020).

The first priority in using AI is to know is to design the prompt well. In a prompt we need to specify:

- the command we give to the AI (it must be clear and relevant);
- the specific context (the classroom or student learning level);
- the input data we can provide to facilitate the response (any data from a problem to be solved);
- the format in which we want the answer to be given (table, map, text, etc.).

It is not easy to center the right prompt right away; very often we will have to rephrase the request several times before the answer we want is given. One suggestion is to ask the AI directly to recommend the prompt that best suits our requirements (Giorgiutti, 2019).

2. Research objectives

The contribution intends to illustrate the research carried out within the Learning Technologies laboratories of the specialization courses for the support of pupils with disabilities, established in Italy in 2011 by the Ministry of Education.

The research, addressed to specializing teachers at the Universities of Sassari, Modena and Reggio Emilia and Trieste, sought to investigate, in this year 2024, the impact that AI can have in the areas of a:

1. the design of materials to be used in the classroom;
2. customization and the possibility of adapting methodologies to the different needs of students;
3. the ways in which students' academic progress can be assessed;
4. the possibility of offering tutoring to students to 'coach' them in learning.

3. Research design

To answer these questions, a questionnaire was administered to a sample of 262 trainees to survey their views on the use of AI as a support for students with disabilities and other special educational needs (SEN) and inclusive processes. The results of this survey highlight the views of trainee teachers on the strengths and weaknesses of AI in the inclusive teaching and learning process and as a compensatory tool for students with Special Educational Needs. The research also helps to highlight the persistence of compensatory and individual-centered views (centered on the deficits of individual learners) on the part of teachers, to the detriment of emancipatory processes, individuals and contexts.

This survey aimed, therefore, to understand ideas and perceptions about the role of artificial

expertise among the interviewed teachers: the personalization of teaching and learning. While the first question explored intentions, the second question reveals how AI is actually used by teachers in training. The percentages confirm that the second option (fig. 2), "To provide tailored learning experiences for the diverse needs and abilities of students," received 110 preferences, whereas the fourth option, "To design materials for use," gathered 124 responses.

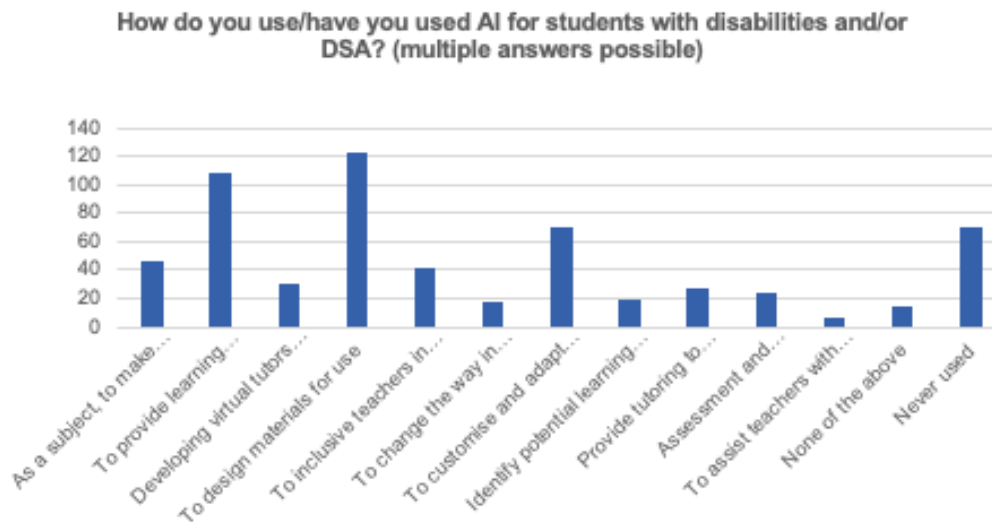


Fig. 2 How do you used AI with disabilities or DSA

When comparing the responses provided with the available literature, a strong correspondence emerges between the perspectives identified by various authors and the statements made by the interviewed students. Numerous studies highlight that one of the most promising uses of AI in inclusive education is the development of personalized assistive technologies for individuals with disabilities (Smith et al., 2023). Student responses indicate that Machine Learning (ML) can be employed to identify effective teaching methods by analyzing classroom interactions in real time, discovering the best strategies for each student, and enhancing educational outcomes through personalized instruction. Other studies emphasize how AI can enhance learning for students with specific challenges, for example, by personalizing educational activities to support those with learning disorders in reading, writing, and mathematics. Furthermore, AI can act as a writing assistant for individuals with dyslexia, correcting frequent errors and adapting teaching materials to individual needs (Zhai et al., 2023). At the same time, it can enrich the educational experience of students from diverse cultural backgrounds by offering personalized learning experiences and fostering their engagement in the classroom (Salas-Pilco et al., 2022).

However, effectively using these tools does not require being "AI experts" but rather having a clear mastery of educational objectives and teaching pathways. The interviewed students highlighted the need for support in inclusive planning and the personalization of educational pathways. Still, it is crucial to have a clear vision of the desired teaching materials before assessing the potential of artificial assistants. Only a solid understanding of educational objectives allows for the targeted and effective use of AI, maintaining coherence between the tasks assigned to AI tools and the reference pedagogical paradigms. Technology, therefore, should be seen as a support, not as a substitute for educational design.

Requesting an artificial assistant to generate content without having the expertise to

evaluate it- or without consulting expert colleagues-can lead to counterproductive outcomes. It is essential that users can understand and interpret the results, ensuring their appropriateness and relevance. The effective use of an artificial assistant involves several steps: selecting the most suitable tool, formulating a prompt aligned with the objectives, critically analyzing the output, and revising it if necessary. This approach ensures that the human component remains central, preserving the dignity, authorship, and responsibility of the educator in the educational process.

Artificial assistants should never be used to relieve teachers from significant tasks related to learning and professional development. Such activities always require the direct involvement of teachers to ensure pedagogical validity and adaptation to students' needs. This concept has also been emphasized in previous studies (Bocchi & Bortolotti, 2023), which highlighted the challenges faced by special education teachers in educational planning. Inclusive teacher training thus represents a strategic lever for promoting quality education that fosters the inclusion of all students. Information and communication technologies (ICT) can serve as a privileged tool for realizing this change, provided they are integrated into thoughtful educational planning. ICT, indeed, offers powerful support for promoting communication, learning, and breaking down barriers that lead to school exclusion. However, they cannot replace the professionalism of teachers.

We conducted an initial exploratory analysis using NVivo14 for question 9 "How could AI be used to support inclusion processes?" (fig. 3).



Fig. 3 How do you use AI with disabilities or DSA



Fig. 4 word: tool

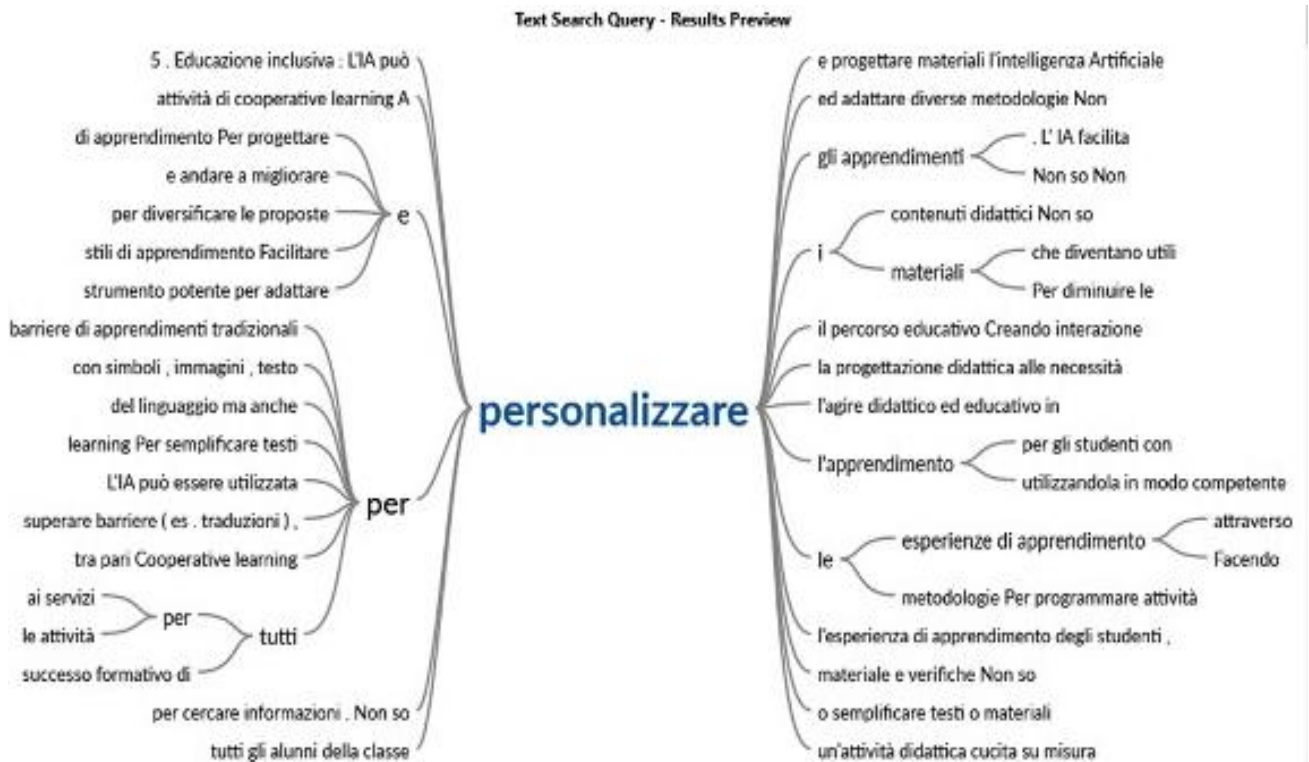


Fig. 5 word: personalization

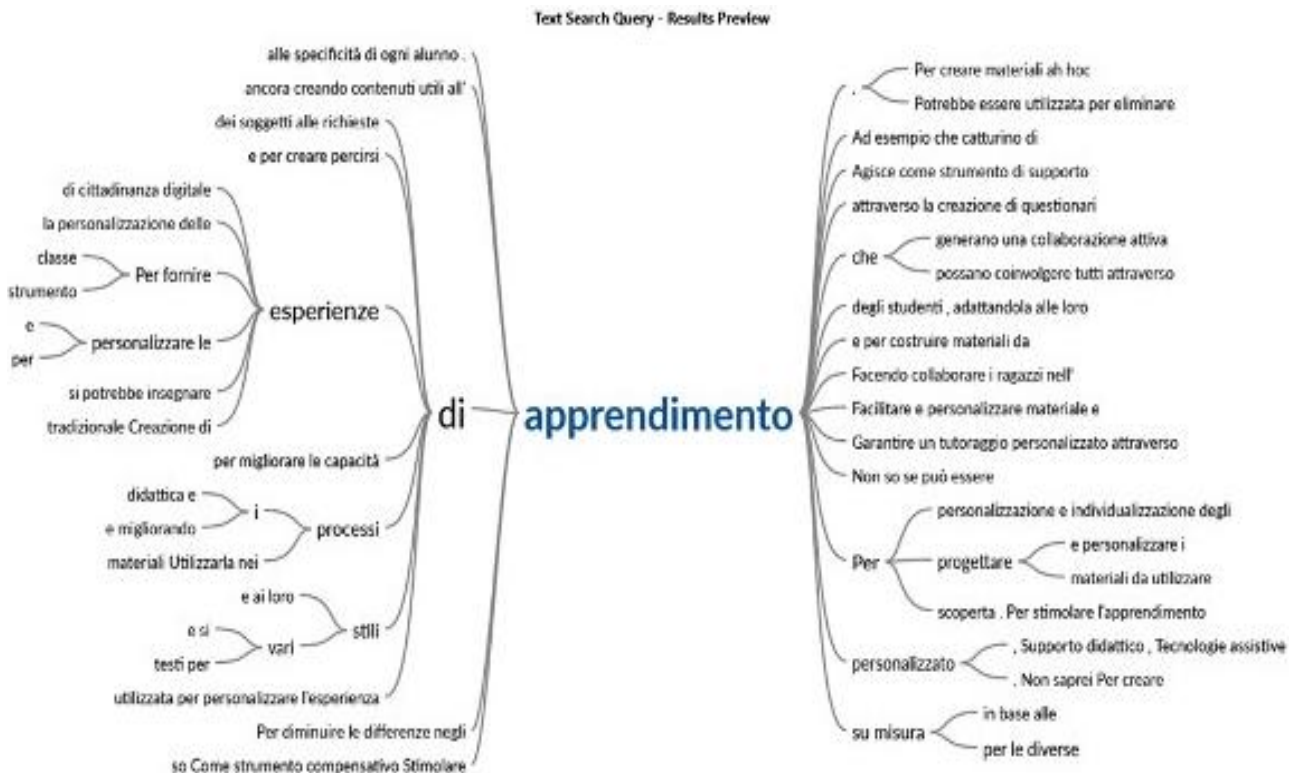


Fig. 6 word: learning

Consistently with what was previously observed, teachers focus on AI's ability to assist them in the design phase, particularly regarding the personalization of educational interventions. In fact, following a semantic analysis of the open-ended question that specifically asked how AI could be used in inclusive learning processes, many responses

highlighted the support it could provide in personalization, goal identification, and subsequent planning. The words identified as most significant were: personalization, tool, learning (fig. 4,5,6).

5. Final reflections

The survey revealed that 33% of the sample have never used AI for inclusive teaching, while 14.6% have never taught at all. Moreover, 64% of respondents reported that they have rarely or never used AI in the past, emphasizing the pressing need for specific training on the application of AI in education. The sample consisted of teachers in training from the support TFA programs in Sassari, Trieste, and Modena-Reggio Emilia. Moving forward, it would be valuable to extend the survey to include in-service teachers, not just those in TFA support training, to gain a more comprehensive perspective. AI can play a significant role in customizing lessons to meet the individual needs of students and designing innovative teaching materials. It is also a compensatory tool, providing tailored learning experiences and facilitating the inclusion of students with Special Educational Needs (SEN). Teachers are increasingly aware of the potential of AI for inclusive teaching and can identify its functional applications in this context. However, creating literacy in the use of AI is essential to maximize its effectiveness. While it has the potential to transform traditional didactic methods, it raises the question of whether AI alone is sufficient or if broader pedagogical changes are needed to truly revolutionize teaching practices.

The introduction of ChatGPT and other artificial intelligence technologies has marked a turning point for teachers participating in specialization courses for support activities, pushing them to update their skills and critically reflect on the impact of these tools in education. Although the application of Artificial Intelligence (AI) in the education of students with disabilities and Special Educational Needs is still an emerging field of research, its potential is increasingly recognized. However, the use of AI to develop personalized support for individuals with disabilities remains limited, due to scarce academic research in this area, the lack of specialized training programs for professionals, and the absence of regulations specifically designed to protect the most vulnerable users. The potential of AI in learning strongly resonates with the goal of promoting inclusive education, as highlighted by prominent international organizations such as UNESCO (2021) and the European Union (2023). This underscores the urgency of incorporating AI into teacher training programs to ensure that pedagogical practices can fully benefit from its capabilities. Nonetheless, one of the main current challenges lies in the limited knowledge of AIED (Artificial Intelligence in Education) among educators. Most teachers lack the necessary expertise to use it effectively, and specific training programs, particularly during initial teacher education, are still scarce (Hrastinski et al., 2019). Recent studies indicate that the teacher training period is critical in shaping attitudes toward AIED, a key factor in ensuring its educational effectiveness once teachers enter the profession (Yang & Chen, 2023).

In conclusion, the targeted use of AI in specific educational areas offers a dual benefit: on the one hand, it relieves educators from repetitive and burdensome tasks; on the other, it fosters continuous improvement of teaching materials through the flexibility and adaptability of digital resources. A conscious use of AI also significantly reduces unnecessary cognitive load, enabling teachers to focus on the most meaningful aspects of their profession.

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