



# Artificial Intelligence and Special Educational Needs: Exploring the Potential for Personalized and Inclusive Learning

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## Abstract

*Artificial Intelligence (AI) represents an unexplored frontier in the field of education and teaching. The development of digital skills and a renewed awareness of new technologies and their role in teaching and learning are priorities that both students and teachers need to address. One promising potential of Artificial Intelligence in secondary education can be found in the opportunity to promote personalized and effective learning. This contribution aims to contribute to the ongoing discussion on the potential of AI, with a focus on the benefits it can offer to students with Special Educational Needs (SEN), along with inclusive strategies such as Universal Design for Learning (UDL). The combination of instructional design adhering to UDL principles and emerging AI systems, could support a qualitative differentiation recognizing the value of diverse materials and different learning modalities that is essential for some and useful for all. Examples include AI-powered intelligent tutors and information processing through analysis and synthesis algorithms that address the concrete and crucial needs of students with SEN, such as explaining complex concepts, providing instant feedback, extracting key concepts from complex texts, facilitating comprehension and information processing. In this perspective, AI technologies can provide support for personalized learning based on students' needs and learning styles, offering access to advanced educational resources.*

**Keywords:** *Artificial Intelligence, Special Educational Needs, Technologies, UDL, Personalization*

## 1. Introduction

Over the past few decades, the technological landscape has undergone rapid transformation, marked by one of the most notable advancements – the widespread integration of Artificial Intelligence (AI). AI represents an unexplored frontier in the field of education and teaching. The development of digital skills and a renewed awareness of new technologies and their role in teaching and learning are priorities that both students and teachers need to address. This paradigm shift carries substantial potential within the realm of education, necessitating educators to adapt their pedagogical approaches and capitalize on the potential benefits it offers, given its pervasive influence on students. More specifically, AI can play a decisive role in addressing the distinctive needs of learners with Special Educational Needs (SEN) [1], both within the confines of educational institutions and beyond. The present paper delves into the evolution of AI technologies and their application within the context of SEN, elucidating the myriad benefits they offer to learners, educators, and educational institutions alike, as well as acknowledging their inherent limitations.

## 2. Literature Review

In the contemporary landscape, Artificial Intelligence (AI), has become an integral facet of our daily lives, assuming a central role in addressing some of the most critical global challenges. The term Artificial Intelligence refers to the capacity of computers or other machines to exhibit or simulate intelligent behavior, enabling them to execute tasks typically necessitating human intelligence, such as speech recognition, decision-making, visual perception, and cross-linguistic translation. Within a constantly changing perspective, AI systems demonstrate intelligent behaviors as they assess their environments and occasionally engage in autonomous actions to achieve specified objectives, as elucidated by the European Commission [2]. AI has, notably, arisen as a feasible instrument for the progression of inclusivity. According to Fulcher and Davidson [3], inclusivity means fostering an atmosphere that facilitates equitable access and participation for every learner, regardless of their individual characteristics, cultural backgrounds, skills, or learning preferences. Through the provision of individualized educational content, flexible learning encounters, and precise evaluative insights, AI technologies present innovative approaches to accommodate the diverse requirements of learners [4]. Exemplifying AI-driven technologies, natural language processing and machine learning algorithms



hold promise in their capacity to conform to the abilities, predilections, and advancements exhibited by each learner. This has prompted reflection regarding the notion of adaptive learning and the redirection of reform efforts away from a one-size-fits-all teaching approach towards personalized education as the path forward for educational reform in the future [5].

From this perspective, the integration of the Universal Design for Learning (UDL) framework presents an opportunity to design adaptable educational environments and resources that comprehensively address the diverse needs of all students [6]. UDL advocates for the provision of various modes of representation, avenues for participation, and means of expression to enhance the quality of learning experiences across diverse mediums. Furthermore, the framework emphasizes the incorporation of interactive technologies and the cultivation of collaborative learning environments to provide a wide spectrum of relevant learning experiences, fostering students' interest and motivation. The synergy between UDL principles and AI has the potential to empower educators to establish inclusive settings that are responsive to the manifold requirements of learners, thus ensuring equitable access and contributing to effective personalization and student advancement. An approach to AI that places paramount importance on the welfare of both individuals and society, with particular attention to those facing vulnerability and adversity, can be established as a fundamental principle for harnessing a technology replete with significant promise.

The domain of Special Educational Needs encompasses a wide range of learning challenges, from disabilities to developmental disorders, as well as various types of transitory challenges, such as socio-economic and linguistic disadvantages. Historically, addressing these challenges necessitated tailored interventions and extensive human resources. However, the integration of AI technologies into education has introduced innovative and more efficient methodologies to support learners with SEN. AI-powered adaptive learning platforms are now capable of analyzing individual learning profiles and delivering customized content and interventions in real time. As delineated in the European Framework for the Digital Competence of Educators [7], digital technologies possess the capability to support differentiation and personalization in education, with a primary focus on ensuring accessibility for all students. This adaptability not only fosters greater engagement but also accelerates the learning process by catering to each learner's strengths and addressing their specific areas of improvement. Natural Language Processing (NLP), a subfield within the domain of AI, is dedicated to the pursuit of enabling computers to comprehend and communicate proficiently using human language. NLP has evolved into a valuable technological facet replete with a multitude of applications in the realm of education. These applications encompass the development of intelligent instructional systems, chatbot implementations, language assessment tools, and speech recognition technology [8].

### **3. Discussion**

One promising potential of Artificial Intelligence in the educational field can be found in the opportunity to promote personalized and effective learning. The combination of instructional design adhering to UDL principles and emerging AI systems can offer to students a qualitative differentiation of materials taking into consideration different learning modalities, that is essential for some and useful for all. AI can foster individualized learning pathways that adjust in real time based on the learner's progress and preferences, ensuring an optimal and inclusive educational experience. AI-driven assistive technologies, such as speech recognition and text-to-speech tools, empower learners with communication disabilities to actively participate in educational activities, fostering a sense of independence and confidence. Additionally, AI can also facilitate early identification of learning challenges through data-driven analysis, enabling educators to intervene proactively and provide timely support. Furthermore, AI-powered educational games and simulations provide a dynamic and engaging learning environment, enhancing sensory experiences and promoting active learning for learners with diverse needs.

Such an approach ensures that students could receive instantaneous feedback, promotes metacognition, and obtains tailored in-depth explanations of complex texts and concepts. Students with SEN may encounter difficulties in reading and comprehending written texts, experiencing challenges in extracting key concepts from them. The inherent capability of Natural Language Processing (NLP) to generate summaries and highlight key words from lengthy texts can represent a significant added value for disciplinary study. This substantial support, widely extendable even beyond formal educational contexts, can foster motivation, self-esteem, and a sense of self-efficacy, factors that are frequently lacking in students with SEN. Additionally, AI can provide support to newly arrived international students who frequently struggle with the understanding of disciplines because of the lack of specific lexicon. They can turn to AI-powered tools for resolving difficulties, translating and comprehending texts, posing specific questions about disciplinary content based on their levels of



language proficiency. From an educator's perspective, AI has the potential to significantly enhance teaching practices by generating personalized content and materials that align with students' interests and needs, ultimately boosting motivation and engagement. AI can also assist in the creation of lesson plans, develop class syllabi, and generate glossaries tailored to students' proficiency levels and specific topics, all of which contribute to optimizing the overall learning experience. From an assessment perspective, chatbot systems could serve as a viable alternative to make the student evaluation process less anxiety-inducing. Several studies [9] have highlighted that when there is no human or human-like agent present in any way, people are more inclined to overcome psychological barriers that could otherwise hinder their responses.

Within this framework, it is essential to consider issues and limitations of the tool, which can at times yield inaccurate information or generate results that are not truthful. The issues of data privacy and security, along with transparency, constitute pivotal ethical concerns. Educators have the obligation to ensure the protection of individuals' privacy by transparently communicating the processes of data collection, its objectives, and its intended utilization to their students [10].

The potential for algorithmic bias and hallucination in AI systems is yet another ethical concern. AI systems depend on training data, and if that data contains bias or represents a limited range of perspectives, it can lead to biased predictions or to nonsensical or unfaithful texts by the algorithms. In this context, it is advisable to promote a conscious and critical utilization of generative artificial intelligence systems within the educational context. These systems can offer significant support for both educators and students, particularly those with Special Educational Needs (SEN), proving to be valuable compensatory tools to be integrated within personalized and customized learning, based on each student's strengths, needs, skills, and interests. Simultaneously, promoting an awareness of the limitations of generative AI systems can contribute to understanding their degree of reliability, which inevitably cannot be detached from human supervision and control over both outcomes and data [11].

#### **4. Conclusion**

The integration of AI into the realm of Special Educational Needs represents a crucial moment in the evolution of education. The transformative potential of AI technologies to address the unique challenges faced by learners with SEN is rapidly reshaping traditional educational paradigms. In this uncharted domain, the collaboration between AI and Special Educational Needs offers the prospect of fostering equitable and inclusive education. Exploring this phenomenon represents an intriguing avenue for future research.

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