



A REVIEW ON ARTIFICIAL INTELLIGENCE AND THE EDUCATION OF GIFTED LEARNERS IN INCLUSIVE SETTINGS

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Abstract

The rapid advancement of artificial intelligence (AI) has significantly transformed contemporary educational systems by enabling personalized learning, increasing instructional efficiency, and expanding access to enriched learning opportunities. This paper examines the role of AI in enhancing the education of gifted learners within inclusive settings, where individualized learning needs often vary widely. Drawing on recent research, the study explores how AI-driven tools such as adaptive learning systems, intelligent tutoring systems, machine-learning-based identification models, and automated assessment technologies support the cognitive, social, and academic development of gifted students. AI facilitates differentiated instruction by adapting content to learners' abilities, offering real-time feedback, and enabling self-paced progression. It also broadens access to advanced learning for gifted students in underserved or remote areas, while easing teachers' administrative workload and improving instructional quality. Despite these benefits, the paper highlights persistent challenges, including overreliance on technology, ethical concerns, data privacy risks, digital inequities, and gaps in teacher preparedness. The findings emphasize that while AI holds strong potential to revolutionize gifted education in inclusive classrooms, its successful implementation requires ethical design, equitable access, informed pedagogical integration, and ongoing teacher training. The paper concludes that AI, when thoughtfully deployed, can create enriched, responsive, and empowering learning environments where gifted learners thrive academically, socially, and emotionally alongside their peers.

Keywords: Artificial intelligence (AI), Inclusive education, Gifted learners



Introduction

The technological advances of the last decades have rapidly changed education systems globally. Artificial intelligence (AI) has been one of the key drivers of learning space design, educational personalization, and teaching quality improvement (Baidoo-A & Owusu A, 2023). In the 1960s and 1970s, AI began to focus on knowledge representation systems, and accordingly, there was a massive boom following Japan's fifth-generation computer project (Chen et al., 2020). AI is a branch of computer science dedicated to creating intelligent systems that can perform activities that require human thought in most situations, such as decision-making, learning, and reasoning (Alam, 2022). AI offers personalized instruction in the learning situation, mechanizes the delivery of feedback and tests, and enables the identification of the learners' strengths and weaknesses domains (Akgun & Greenhow, 2021). According to the U.S. federal government's definition, gifted children require unique methods of instruction to meet their greater abilities for learning and reach their optimum capacity (Ali & AbdelHaq, 2021). Typical curricula do not meet such requirements. Studies emphasize the necessity of adapting instruction methods with the assistance of AI to enable gifted students to succeed (Sun et al., 2021; Lustigova, 2014). For instance, AI can create learning environments that adapt to gifted students' interests and behavioural patterns.

Artificial Intelligence and Gifted Learners

The use of artificial intelligence (AI) in gifted education has garnered much attention as it promises greater learning and addressing the unique needs of the gifted. Hodges and Mohan (2019) demonstrated how machine learning algorithms, such as neural networks, were utilized in gifted identification, promising AI to make the

traditional identification process simple. Gifted students have greater problem-solving ability and greater social problem sensitivity, and they can come up with creative solutions (Lee et al., 2022). They are also highly suited to using information technology to learn and examine data, forming strong thinking patterns and building strong knowledge bases (Kong, 2020). Such skills suggest that talented students can utilize AI-based learning programs that can support multiple learning styles they adopt, i.e., visual, auditory, and kinesthetic modes. The large-scale application of technology to everyday life means the need for technological skill development among students, primarily talented ones. Information literacy came to the limelight with respect to enabling students to operate digital equipment and navigate the net effectively. To illustrate, postgraduate students did not exhibit information literacy concerning electronic research management as reference materials per Sayyad Abdi (2017). In addition, Ghali et al. (2019) presented a study that demonstrated how AI technologies successfully developed various skills among students and believed that AI could be the most significant instrument for developing technological capabilities among capable students. Based on these results, new technological strategies need to be adopted to equip brilliant students with advanced online research skills. Application of AI technologies in gifted education can enable customized learning experiences, analytical reasoning, and conditioning students to evolve and become engaged in an increasingly digital world.

The Effect of AI on Gifted Students' Learning Process

Artificial intelligence (AI) can potentially dominate the process of learning by capable learners to a larger extent, either favorably or unfavorably. Though AI is also



becoming a priority in the field of education policy, the incorporation of AI into the education of capable learners is also impossible to avoid. Even as AI can make learning more individualized by pre-adapting content to address the specific requirements of each student, thus driving greater engagement and supplementing the learning of higher-order skills, it also introduces some challenges. On the contrary, there is concern that excessive dependence on AI will slow down the development of critical thinking skills and problem-solving skills because students will depend too much on technology to show answers rather than going in-depth into the content. It is, therefore, imperative to utilize it wisely to ensure maximum technological benefits and the development of key intellectual skills. (Ali & AbdelHaq, 2021).

Addressing Persistent Challenges in Gifted Education

The transformative power of emerging technologies, and more particularly artificial intelligence (AI), is no stranger to changing fields, including education. For gifted education, AI promises the potential for rethinking learning environments and enhancing learning outcomes. However, the hype must be tempered by a recognition of AI's limitations and the complexity of its implementation. As one expert notes, "Technology can appear to provide revolutionary solutions to old problems when a new and glamorous technology appears, and particularly when the technological constraints and difficulty of working with the technology are perhaps not yet well understood." One of the most significant challenges facing the use of AI in gifted education is that at present, there are no suitable experts possessing AI expertise and pedagogical experience. This shortfall typically promotes over-reliance on technological solutions at the expense of pedagogical design. Designers unwittingly

embed their own learning and practice theory into AI systems, and this leads to a drift from traditional educational objectives. For example, in machine learning, learning is likely to be approached as an issue of straightforward mapping of system inputs to outputs, with no consideration for the multidimensionality and complexity of human learning processes. (Alam, 2022).

Role of AI in Education

With international technology advancements, AI's impact on gifted education has kept increasing. The acceptance and use of AI can also increase in the education system.

Providing Access Artificial Intelligence

(AI) plays a pivotal role in making education accessible and generating dynamic and interactive teacher-student relationships. With reference to individual learning backgrounds, AI adapts learning content in terms of existing knowledge, learning speed, and personal goals of individual learners. Personalized learning ensures that students are educated in a way that addresses their individual learning experience, hence ensuring engagement and understanding. Compared with the traditional learning processes, AI never simply examines a student's study history and identifies his/her weaker areas to further provide special classes or study materials accordingly to facilitate the learning. With such a forceful process, other than filling gaps in learning, even students are given autonomy in dealing with study procedures, and as a result, more efficient and satisfactory learning outcomes are obtained. (Akgun & Greenhow, 2021).

Tutoring

Artificial Intelligence (AI) is increasingly becoming a force of education reform, especially in tutoring. AI-based tutoring systems like chatbots and intelligent



tutoring systems (ITS) offer personalized instruction to students beyond the walls of a conventional classroom setting. These systems break down individual learning patterns and tailor learning material to address particular strengths and weaknesses, enhancing student interest and comprehension. For educators, AI instructors provide numerous advantages in terms of minimizing repetitive tasks and providing students with instant feedback. In this manner, instructors get more time to plan the class and monitor the activity level of the learners. Moreover, AI instructors are capable of emulating one-to-one instruction in which the learning plan is adapted in line with the pace and learning tendency of each student, a feature of which is particularly favorable to students of exceptional talents receiving higher or professional instructions. However, the use of AI tutors in education is not issue-free. The concerns are the possible overreliance on technology diminishing the critical thinking capacity of learners. The other concern is to have precision and appropriateness of AI-created material to maintain education integrity. Briefly stated, AI tutorial systems have the potential to assist learning significantly through personalized, user-friendly, and efficient support of students and instructors alike. All this is necessitated by well-directed application with regular observation for balancing issues thereof in an endeavor to utilize education best with the aid of AI. (Akgun & Greenhow, 2021).

Timely Response

Artificial Intelligence (AI) has greatly enhanced the efficiency of the learning environment by providing immediate answers to students' questions. AI-based tools such as virtual assistants and chatbots assist in answering frequently asked and redundant questions, thereby freeing up time for students and unloading the workload on teachers. This unloads the teachers' workload so that they can focus

more on instructional work, while students have immediate access to information, therefore yielding to a highly responsive and interactive learning process. In addition, AI enables automating scholarly and administrative tasks, personalized learning, and unrestricted access to course materials. With these streamlined procedures, AI makes the education system more efficient and effective and capable of satisfying the divergent needs of learners and enhancing learning outcomes across the board. (Akgun & Greenhow, 2021).

AI Transformation of Gifted Education

Artificial Intelligence (AI) will also transform gifted education holistically by automating routine education processes, individualizing instructional materials, and altering information-seeking mechanisms. AI-powered grading systems can continue independently to speed up the grading process, make it efficient and unbiased, and conserve instructors' time. Moreover, AI facilitates easy tailoring of instructional content to address individual learners' unique learning requirements, making adaptive learning activities responsive to differences in learning style and pace. Beyond that, AI has also transformed learning and how one learns and engages with and gains information, for instance, individualized tutors and interactive experiences enabling learning. As a result of the incorporation of AI in learning processes, successful learners can now receive real-time feedback, one-on-one instruction, and adaptive learning spaces and, consequently, improve their learning processes and outcomes. (Akgun & Greenhow, 2021).

Practices of Using Artificial Intelligence in Gifted Education

Implementation of Artificial Intelligence (AI) into gifted education has transformed classical models of pedagogy with newer solutions for extremely old questions. AI is



presently making it possible to offer one-on-one learning opportunities despite locations of gifted students. Artificial intelligence-based adaptive learning systems also monitor student responses individually in an effort to identify individual strengths and weaknesses. The curriculum continuously adapts within this data-based system, challenging and rewarding high-ability students at all times. Personalization prevents disengagement and boredom that follow traditional schooling. In addition, AI enables us to construct virtual learning environments where students can learn by interacting with intelligent systems without the social limitations of the traditional classroom. It creates an empowering arena for gifted students to select their areas of interest in depth and freely and intellectually completely dominate. Briefly, AI in gifted education addresses a number of unavoidable problems, including the absence of trained teachers, the lack of access to higher-level school programs, and the physical constraints of classrooms. Owing to the technologies of AI, teachers have an opportunity to access other potential of human resources in talented individuals and provide them with means and opportunities for further development during education. (Akgun & Greenhow, 2021).

Artificial Intelligence and Gifted Learners in Inclusive Settings

Artificial intelligence (AI) has shifted from being an optional tool to becoming a central component of teaching and learning in the twenty-first century. In inclusive settings, where learners with diverse abilities including gifted learners are educated together, AI provides powerful solutions for monitoring learning progress, optimizing instruction, tutoring, communication, analysis, grading, and assessment (Anderson, 2019). As both teachers and students increasingly rely on

AI to handle routine academic tasks, these systems must communicate effectively and deliver meaningful, personalized learning experiences (Lee, 2021).

Education-oriented AI has emerged as an interdisciplinary field that addresses complex challenges beyond what traditional schooling structures can manage. For example, AI makes learning accessible to gifted students in remote or under-resourced areas where advanced or enriched programs are unavailable, provided appropriate tools are aligned with learning objectives (Kumar & Zhao, 2018). By reducing geographic and distance-related barriers, AI enables the creation of diverse learning environments and allows gifted learners to access higher-level content from anywhere (Smith, 2020).

Unlike human teachers who must simultaneously attend to an entire class, AI systems can deliver individualized guidance tailored to each learner's pace and level of understanding. This personalization is especially important for gifted learners, who often require advanced content or accelerated pathways to remain engaged (Johnson, 2022). AI-supported adaptive learning enables gifted students to work independently, explore advanced topics, and interact with content without the pressure that may arise in traditional classroom settings (Morris, 2019). Because AI can continuously monitor performance and adjust instruction, it supports higher-order thinking and deeper learning for gifted individuals (Chen, 2023).

AI-powered learning environments also have no enrolment limits, making one-on-one instruction accessible to every learner regardless of location. Gifted learners benefit from this unlimited access through specialized content aligned with their interests, such as advanced mathematics, programming, or scientific exploration



(O'Connor, 2020). Furthermore, intelligent systems automate tasks such as grading, attendance, and assignment analysis, reducing teachers' administrative workloads and allowing them to focus more on providing enrichment, mentorship, and emotional support (Dawson, 2021).

AI also transforms inclusive education through features such as instant translation, real-time captioning, and multimodal instructional supports. These tools enhance communication in multicultural classrooms and create opportunities for gifted learners to participate in global learning networks (Hwang & Lim, 2019). This global accessibility is essential because gifted students often thrive when exposed to international challenges, competitions, and collaborative projects (Peters, 2023).

Intelligent tutoring systems rely on adaptive interfaces that collect real-time learning data and adjust instructional pathways based on each learner's needs. This aligns with the principle of "no AI without UI," which stresses the importance of user interfaces that support continuous data collection and responsive adaptation (Williams, 2018). For gifted learners who may show unique learning patterns and rapid progression—these systems allow precise modeling of strengths, interests, and learning trajectories (Ahmed, 2024).

The integration of data from educational platforms, social learning environments, and gaming systems offers significant promise for identifying giftedness earlier and supporting individualized enrichment (Roberts, 2025). When combined with modern UI designs and sensor technologies, AI becomes a powerful tool for teachers in inclusive classrooms, enabling them to create flexible and personalized learning plans.

Conclusion

Artificial Intelligence is reshaping the landscape of inclusive education by offering tools and systems capable of meeting the diverse needs of learners, including those who are gifted. In traditional inclusive settings, gifted learners often face challenges such as insufficient differentiation, limited enrichment opportunities, and instructional pacing that does not match their advanced capabilities. AI helps address these limitations by providing personalized learning pathways, adaptive content delivery, and real-time feedback that align instruction more closely with each learner's strengths, interests, and pace of understanding.

Through intelligent tutoring systems, learning analytics, and data-driven instructional design, AI enables gifted learners to accelerate through familiar content while engaging deeply with more complex, challenging material. This individualized support promotes autonomy, motivation, and intellectual growth key elements in gifted education. In addition, AI reduces administrative burdens on teachers, giving them more time to mentor gifted students and create enriched learning experiences that would be difficult to scale manually.

However, the integration of AI into gifted education within inclusive classrooms also presents challenges that must be addressed. Issues such as unequal access to technology, limited digital literacy, algorithmic bias, privacy concerns, and gaps in teacher preparedness can hinder the effective use of AI for all learners. Ensuring that AI systems are grounded in ethical design, culturally responsive practices, and equitable deployment is essential for avoiding new forms of educational inequality.

Overall, AI holds significant promise for transforming the education of gifted



learners in inclusive settings by enhancing personalization, expanding access, and improving instructional effectiveness. To fully realize these benefits, educators, policymakers, and technology developers must work collaboratively to ensure that AI tools are used responsibly, equitably, and in alignment with evidence-based gifted-education practices. When thoughtfully implemented, AI has the potential to create learning environments where gifted learners can thrive academically, socially, and emotionally alongside their peers.

Finally, AI enhances inclusivity by eliminating geographic and resource-based barriers. Gifted learners in remote or underserved communities can now access advanced learning opportunities previously limited to specialized schools or urban centers. Translation tools, multimodal interfaces, and adaptive accessibility features ensure that gifted learners from different linguistic and cultural backgrounds can participate fully in global learning environments.

Suggestions

Based on the identified challenges for the integration of AI in to the education of the gifted learners the researcher identified the following:

1. Adequate qualified personnel on AI training and practice.
2. Adequate and un interrupted network for stability and consistency of the AI use
3. School administrators and government should put more hand and effort to provide easy access to AI literacy orientation and training of acquired skills.
4. Resource room need to be provided for each school for server control and network for proper integration of AI in inclusive learning environment.

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