Guest editorial: AI in education: transforming teaching and learning

Artificial intelligence (AI) continues to evolve and transform many disciplines, including education. In education, AI has been adopted to innovate teaching and improve learning outcomes, increase productivity and efficiency, and prepare students for the future of work with AI. Governments, policymakers and educational institutions at the local and global levels have been rethinking education in the age of AI (Pedro *et al.*, 2019). The rising interest in AI in education has been remarkable, especially after the release of the generative AI (GenAI) tool ChatGPT in late November 2022. AI affords new opportunities for innovating teaching and making learning experiences more personalized and accessible to a wide spectrum of students (Baidoo-Anu and Ansah, 2023). It can transform pedagogical methods, learning approaches and learners' experiences (Bates *et al.*, 2020; Onesi-Ozigagun *et al.*, 2024). Despite these opportunities, AI and GenAI have raised concerns among educators and other stakeholders regarding ethical and societal implications, bias, privacy, safety (Akgun and Greenhow, 2022; Chiu, 2024), inclusivity and digital divides (Pedro *et al.*, 2019; Cardona *et al.*, 2023; Singh *et al.*, 2023).

Integrating GenAI in education brings challenges that will impact the future of teaching and learning (Wu, 2023). The USA Department of Education, Office of Educational Technology issued a report in which Cardona *et al.* (2023) addressed the need to share foundational knowledge of AI and develop policies for adopting it in education. The report builds on "listening sessions the Department hosted to engage and inform all constituents" (teachers, educational leaders, policymakers, researchers, and educational technology innovators and providers. The authors made key recommendations for harnessing the benefits of AI and mitigating risks and harms. These recommendations include keeping humans in the loop in designing AI solutions, creating AI models that align with a vision of learning, making AI explainable and overridable, harnessing formative assessment to reduce bias and focusing on research and development to enhance trust and safety. Given that AI technologies continue evolving quickly, as are the landscapes of their use in education, stakeholders will need to continue addressing opportunities and challenges for education at all levels. AI in education has become a highly generative area for socio-technical systems, information and learning sciences and educational technology research (https://tech.ed.gov/files/2023/05/ai-future-of-teaching-and-learning-report.pdf).

In May 2023, the Guest Editors of this special issue submitted the Call for Papers, *AI in Education*: *Transforming Teaching and Learning*. This is the first among many anticipated special issues that will address this topic of concern and in this initial foray, the call was broad and wide open. The guest editors aimed to elicit scholarly articles about AI uses from various educational disciplines and perspectives to develop an understanding of its applications, opportunities it affords, impact and challenges. Even since then, many developments in GenAI have occurred. Notably, tools similar to ChatGPT were released, including Microsoft's Copilot chatbot (https://copilot.microsoft.com) and Google's Gemini chatbot (https://gemini.google.com/app), the integration of AI Companions in many applications (e.g. Zoom AI, www.zoom.com/en/ai-assistant), AI Assistants (e.g. Adobe Acrobat Suite) and most recently Microsoft's AI-powered agents that are expected "to revolutionize industries, workplaces, and everyday life" (https://news.microsoft.com/en-cee/2025/01/08/6-ai-trends-youll-see-more-of-in-2025).

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The Call for Papers for this special issue solicited submissions on the following themes:

- AI education in iSchools and library and information science programs.
- AI in K-12 Education.
- ChatGPT and other GenAI tools in education.
- New theories, models or frameworks for integrating AI into education
- AI literacy.
- Democratizing AI in education.
- User interactions with AI-assisted systems in education.
- AI in informal learning.
- Large language models (LLMs) in AI-assisted education.
- Multimodal AI applications in education.
- Societal impacts and ethical concerns of applying AI in education.
- AI application in promoting personalized or precision education.
- AI applications or tools in physical classroom settings.
- Intelligent tutoring applications or systems.
- AI for advancing Diversity, Equality, Inclusion and Accessibility (DEIA) in education.
- AI and student engagement and learning.
- AI and mitigation of potential harms, risks, biases and drawbacks in education.

The guest editors received thirty-three submissions, of which eight (24%) were peer-reviewed and accepted for inclusion in this special issue. We summarize each of these articles below, provide a collective summary and suggest future research directions.

Advancing the integration of AI in education necessitates both the innovative design of learning tools and the cultivation of comprehensive AI literacy among educators. Yi and Rieh's special issue article herein, entitled *Children's Conversational Voice Search as Learning: A Literature Review*, reconceptualized voice-based conversational agents (VCAs) as dynamic educational tools that transcend traditional search functions and position them as active facilitators of children's learning. By integrating the concept of search as learning, the authors propose that VCAs can be designed to promote deeper cognitive engagement, critical thinking and self-directed learning among young users. The article introduces several innovative design strategies, including incorporating contextual support, communication repair mechanisms and emotional intelligence, which collectively aim to enhance the educational impact of VCAs. The authors emphasize the importance of culturally diverse and longitudinal studies to comprehensively assess the long-term effects of these tools on children's educational development and to refine their design to support meaningful and sustained learning outcomes.

Going beyond existing literature, the article emphasizes the need to address key challenges associated with reconfiguring VCAs as *child-centered* learning support and educational tools, providing scaffolding strategies and reinforcement mechanisms to foster a more reflective and iterative learning process. They also stress the importance of creating socially responsive systems and data sets to ensure VCAs effectively cater to children from varying backgrounds. By addressing these challenges, the article presents a roadmap for developing inclusive and ethically grounded VCAs that support sustainable learning experiences for children.

Focusing on young adults' interactions with Voice Assistants (VAs), Bilal and Huang's article entitled, *Users' Voice Switching Behaviors, Embodiments, and Perceptions of Voice Assistants* brings to our attention voice-switching behavior as a new type of interaction that needs to be given attention in the literature. The authors investigated the nature of young adults' voice-switching behavior in VAs, their perceptions of trust in information accuracy, usefulness, and intelligence and preferences for inclusive embodiments. They addressed four research questions and grounded their study in four theoretical frameworks and conceptions. They argue that VAs should provide customization features beyond language, accent and gender to include embodied voice interfaces (EVIs) represented in images of people of various backgrounds, races, ethnicities, genders and ages to allow users to select their preferred EVIs to visualize voice interactions. The authors note that VAs still fall short of understanding user speech, finding relevant information on complex queries and returning relevant and accurate results, causing frustration and affecting students' trust in using them.

The authors advocate for developing innovative user-centered AI education and training that enables students to build adequate mental models of VAs, especially concerning judging information accuracy and formulating adequate queries. This study advances research on user voice-switching behavior, inclusive personification in VAs, and the Status Quo Theory. It confirms the notion of *Interface Mirroring* and the *Similarity-Attraction Theory* and highlights the important role of inclusive embodiments in VAs in making them more tangible beyond voice interactions. The authors suggest designing human-centered AI-powered VAs that are context-driven, better understand a user's speech and are capable of processing and returning relevant content on complex queries to enhance students' learning experiences and interactions and minimize negative emotional reactions.

The article by Hur, *Fostering AI Literacy: Overcoming Concerns and Nurturing Confidence Among Pre-Service Teachers*, addresses the critical challenge of equipping future educators with the necessary skills and knowledge to effectively integrate AI into educational settings. The authors identify and clarify the pressing need to address the ethical concerns, growing technological anxieties and potential resistance that often accompany AI adoption, particularly among those new to the technology in education-related settings. The author proposes targeted educational interventions and outlines strategies to build confidence and competence in AI literacy among pre-service teachers. These interventions are designed not only to enhance educators' understanding of the technical aspects of AI, but also to prepare them to navigate and address the broader ethical, social and pedagogical implications of its use in the classroom, including issues regarding equity, fairness, privacy and algorithmic bias in practices.

This article highlights the potential of hands-on AI literacy programs in preparing pre-service teachers to confidently and responsibly integrate AI tools and systems into education. Practical activities, such as exploring GenAI tools and addressing ethical concerns behind AI applications, significantly improved participants' skills and awareness in this domain. However, persistent concerns about AI's impact on teaching roles and student learning underscore the need for long-term and more inclusive initiatives on AI in learning and education. The author advocates for sustained literacy programs that balance technical training with ethical understanding, which can empower educators to harness AI's potential while navigating its ethical threats and challenges to drive meaningful and equitable learning outcomes for different communities and populations.

The rise of GenAI in education necessitates training teachers to navigate this evolving technological landscape. In their article, *ChatGPT and Imaginaries of the Future of Education: Insights of Finnish Teacher Educators*, Vartiainen, Valtonen, Kahila and Tedre explore the perceptions and future visions of Finnish teacher educators regarding the use of GenAI, specifically ChatGPT. Employing a research-creation approach, the authors

conducted a hands-on workshop where participants learned about the mechanisms of GenAI, engaged with ChatGPT and reflected on its potential applications and challenges in education. Educators view AI as a valuable tool that can support formative assessment practices and enhance the development of metacognition, self-regulation and student responsibility. They recommend nuanced views, balancing the potential benefits of AI with concerns about ethical issues, environmental impact and the need for critical AI education. They also emphasize the importance of aligning AI with existing pedagogical practices rather than adopting a purely techno-deterministic approach.

This article is timely and uniquely addresses the perspectives of Finnish educators. It contributes multifaceted insights to the AI debate in education by highlighting the importance of critical, ethical and sustainable integration of AI in educational practices.

Another article in the issue explores the transformative impact of GenAI on programming education. Boguslawski, Deer and Dawson's article, *Programming Education and Learner Motivation in the Age of Generative AI: student and Educator Perspectives*, presents an intriguing study that offers significant insights into this timely topic. By collecting data from students and faculty at a technology-focused university, the authors suggest that LLMs like ChatGPT and GitHub Copilot enhance learners' autonomy and competence. These tools provide personalized learning experiences, reduce negative emotions such as frustration and insecurity, and support bespoke learning tailored to individual needs. However, they also note that LLMs lack social support, which is important for learners' motivation. The authors integrate self-determination theory, offering a robust framework for understanding the impact of LLMs on students and providing valuable insights into how LLMs can be integrated into programming curricula to support students' learning experiences.

The study's implications reported in this article are important from educators' perspectives. The article offers recommendations for enhancing learners' motivation and outcomes in programming education. It contributes significantly to understanding the role of GenAI in shaping the future of programming education and learner motivation.

Examining faculty perspectives is crucial for effectively integrating GenAI into higher education. The article entitled, *The Desire Path: Unleashing Expectations, Discussing Apprehensions, and Proposing a Way Forward for GAI Use in Higher Education*, by Koroleva and Jogezai provides a comprehensive analysis of the potential, challenges and future directions of generative artificial intelligence (GAI), specifically focusing on ChatGPT, within the higher education setting. Utilizing the Technology Acceptance Model and the Social Construction of Technology as theoretical frameworks, the authors delve into university faculty members' expectations, apprehensions and proposed strategies for integrating GAI into teaching and learning practices. Through qualitative interviews with faculty from diverse disciplines, this article highlights the significance of perceived usefulness and ease of use in influencing the acceptance of GAI. In addition, it stresses the importance of addressing ethical concerns, cultural attitudes and institutional policies to foster a supportive environment for GAI adoption.

The authors state that moving forward involves flexible regulation, data-driven decision-making, professional development and active stakeholder engagement. The article offers valuable insights and implications for research, practice and society by linking theoretical models to practical analysis. They advocate for a bottom-up approach that considers diverse cultural orientations when integrating GAI into higher education.

Exploring Generative AI Literacy in Higher Education: *student Adoption, Interaction, Evaluation, and Ethical Perceptions*, by Chen, Tallant and Selig examines undergraduate students' usage of ChatGPT for academic work and evaluation of generated responses. Most

students used ChatGPT for assignments, study/learning and communications; very few used it for quizzes or examinations. This article highlights a positive correlation between the number of prompts the students entered in ChatGPT and their perceptions of potential biases in the generated responses. The students perceived the quality of the responses from ChatGPT as inferior in quality compared to their writing. They believed using ChatGPT and other AI tools for academic work violated the university's academic integrity policy. They wanted to learn about the university's acceptable use policy of GenAI tools and to have such a policy included in course syllabi.

This article contributes valuable insights into college students' interactions with and evaluation of responses ChatGPT generates for their questions. Interestingly, most students wanted to learn more about GenAI but did not want to take AI literacy training. The authors call upon educators and university administrators to provide AI literacy to college students to empower them with the knowledge and skills they will need in their future careers.

Jochim and Lenz-Kesekamp's article, *Teaching and Testing in the Era of ChatGPT: Exploring the Needs of students and Teachers*, investigates university students' adaptation process regarding text GenAI use in teaching and examinations. It explores teachers' needs, wants and attitudes toward GenAI, including ChatGPT and their intentions to use it in the future. The authors aimed to identify changes needed in higher education institutions to support the students' and teachers' use of GenAI tools. They employed a multi-tiered mixed-methods approach based on Domestication Theory to explore students' and teachers' adaptation to using GenAI. They designed and offered AI training to students and teachers (e.g. a Barcamp and four two-hour online workshops). They evaluated the training using a survey that collected quantitative and qualitative data. Students were more cautious about AI and concerned about its use than teachers. They expressed negative feelings, including fear, trepidation and concern about its impact on society and learning. Conversely, teachers were more open to integrating GenAI in teaching and student examinations.

This article brings to our attention the dire need to support students and teachers in using AI, including learning about its ethical use and impact on society, and clear rules regarding its application in teaching and learning. In addition, it highlights concerns about AI's social implications and the crucial role of AI literacy training for students and teachers to enable them to implement it in teaching and learning and use it effectively and responsibly. Utilizing the domestication theory to examine teachers' and students' adaptation process contributes to theory building on the use of AI in education.

In summary, this special issue includes eight scholarly articles that address themes described in the Call for Papers and the articles all represent empirical studies conducted by national and international scholars who provide varied perspectives on using AI in educational settings. They make significant contributions to the evolving discourse on AI-augmented educational technologies, which has the potential to promote a more holistic, inclusive and ethically grounded approach to various types of AI integration in education. The articles emphasize the dual necessity of designing AI tools that are both pedagogically robust, human-centered and accessible to young and adult learners while simultaneously fostering next-generation educators who are equipped with effective AI literacy and skills. Leveraging these technologies effectively and responsibly is crucial for facilitating innovative teaching and student learning.

By addressing both educators' and students' needs, opportunities, policies, issues and challenges in adopting various forms of AI in teaching and learning in higher education and K-12 schools and by focusing on the human dimensions, these articles provide a

comprehensive framing of early-stage research for advancing and continuing to study AI's role, as well as limitations, in supporting equitable, fair, ethical, effective, responsible, transparent and future-ready learning environments. AI is a broad field of study and GenAI has gained much attention and impact across varying fields of research and practices since 2023. We advocate for future research that investigates users' information behaviors and interactions with GenAI tools, builds new theories on using GenAI in various educational environments, designs and evaluates GenAI tools from both educators' and students' perspectives, and develops and tests human-centered innovative AI literacy programs. In addition, we recommend research that examines AI integration in iSchools curricula, explores multimodal AI applications in educational settings, delves deep into the societal impacts and ethical implications of applying AI in teaching and learning, and provides tangible solutions for addressing AI issues and challenges.

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References

Akgun, S. and Greenhow, C. (2022), "Artificial intelligence in education: addressing ethical challenges in K-12 settings", *AI and Ethics*, Vol. 2 No. 3, pp. 431-440, doi: 10.1007/s43681-021-00096-7.

Baidoo-Anu, D. and Ansah, L.O. (2023), "Education in the era of generative artificial intelligence (AI): understanding the potential benefits of ChatGPT in promoting teaching and learning", *SSRN Electronic Journal*, Vol. 7 No. 1, pp. 52-62, doi: 10.2139/ssrn.4337484.

Bates, T., Cobo, C., Mariño, O. and Wheeler, S. (2020), "Can artificial intelligence transform higher education?", *International Journal of Educational Technology in Higher Education*, Vol. 17 No. 1, pp. 1-12, doi: 10.1186/s41239-020-00218-x.

Cardona, M.A., Rodríguez, R.J. and Ishmael, K. (2023), "Artificial intelligence and the future of teaching and learning: insights and recommendations", U.S. Department of Education, Office of Educational Technology, Washington, DC, 2023, available at: https://tech.ed.gov/files/2023/05/ai-future-of-teaching-and-learning-report.pdf

Chiu, T.K.F. (2024), "Future research recommendations for transforming higher education with generative AI", *Computers in Education: Artificial Intelligence*, Vol. 6, p. 100197, doi: 10.1016/j.caeai.2023.100197.

Onesi-Ozigagun, O., Ololade, Y.J., Eyo-Udo, N.L. and Ogundipe, D.O. (2024), "Revolutionizing education through AI: a comprehensive review of enhancing learning experiences", *International Journal of Applied Research in Social Sciences*, Vol. 6 No. 4, pp. 589-607, doi: 10.51594/ijarss.v6i4.1011.

Pedro, F., Subosa, M., Rivas, A. and Valverde, P. (2019), *Artificial Intelligence in Education: Challenges and Opportunities for Sustainable Development*, The United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France.

Singh, V., Bilal, D., Cox, A., Chidziwisano, G.H. and Dinneen, J.D. (2023), "Global AI initiatives: from theory to practice", *Proceedings of the Association for Information Science and Technology*, Vol. 60 No. 1, pp. 836-840, doi: 10.1002/pra2.873.

Wu, Y. (2023), "Integrating generative AI in education: how ChatGPT brings challenges for future learning and teaching", *Journal of Advanced Research in Education*, Vol. 2 No. 4, pp. 6-10, doi: 10.56397/JARE.2023.07.02.

Further reading

Walter, Y. (2024), "Embracing the future of artificial intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education", *International Journal of Educational Technology in Higher Education*, Vol. 21 No. 1, pp. 15-29, doi: 10.1186/s41239-024-00448-3.