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Encouraging human-AI collaboration in interactive learning environments

AI-empowered applications such as ChatGPT and other intelligent tutorial systems can bring opportunities for collaboration to interactive learning environments. Students and teachers can collaborate with AI for more engaging learning and teaching experiences. Such applications can provide personalised learning experiences, generate content, and offer immediate feedback, ensuring that each student and teacher receives the support they need. Such collaboration enhances interactive learning environments by bringing together the strengths of teachers, students, and AI to more fully develop the capacity of students to demonstrate their willingness and ability to learn. It leverages AI's ability to process vast amounts of data and provide personalised responses; while humans bring questions, creativity, empathy, and critical thinking to the table (Chiu, 2025).

In human–AI collaborative learning environments, teachers are transitioning from being the primary source of knowledge to becoming facilitators and mentors who guide students through personalised learning paths. This shift allows teachers to focus more on fostering students' critical thinking, creativity, and emotional intelligence, rather than primarily delivering content. Students can develop from learning task receivers to challenges seekers, from examinees to feedback users and from content receivers to knowledge inquirers (Chiu et al., 2024). As they develop such collaborations they could have ever more tailored and engaging learning experiences, helping them stay motivated and achieve better learning outcomes, and develop a new vocationalism; their lifelong disposition and capacity for learning (Bourner et al., 2011).

In this editorial, we would like to share some of our ideas on how students and teachers, students with AI, and teachers and AI can all collaborate using interactive learning environments.

Human–AI collaborative learning environments

Student–teacher collaboration

- **Learning partners:** Both students and teachers act as learning partners, generating and critically reviewing knowledge from AI-generated outputs. They learn together from AI's responses and recommendations. For example, they can discuss if videos or content recommended by AI-driven websites are appropriate for learning.
- **Navigators and guides:** Teachers guide students in navigating AI-generated content, helping them critically evaluate and validate the information. This guidance is crucial throughout student learning with AI.
- **Responsible users and ethical guides:** Teachers challenge students about the ethical use of AI, emphasising the importance of digital citizenship and responsible technology use. Teachers work with students, emphasising critical, ethical and responsible AI use.
- **Motivators and supporters:** Teachers provide emotional and academic support, helping students stay motivated and confident in their learning journey.
- **Reflective learners:** Students reflect on their learning processes, using AI feedback to identify strengths and areas for improvement. Teachers reflect on their teaching practices, using

AI-generated data to evaluate the effectiveness of their methods and to critically evaluate their impact on student learning.

Student–AI collaboration

- **Information seekers and reviewers:** Students actively seek suggestions from AI, using it to plan and evaluate their learning. AI provides personalised recommendations, which students critically review.
- **Self-learners and tutors:** Students take advantage of AI tutoring to deepen their understanding through personal assistance. AI provides personalised tutoring sessions, offering explanations, answering questions, and providing additional resources to support learning.
- **Researchers and resource providers:** Students review AI recommendations such as articles, images, and videos to discover and learn about new subjects, while refining their critical capacity.
- **Communicators and language assistants:** Students use AI language tools to review their communication skills, both in their native language and in learning new languages. AI provides language translation, grammar correction, and vocabulary enhancement tools to support students in their language learning.
- **Experimenters and simulators:** Students engage with AI simulations to test hypotheses, explore concepts, and gain practical insights. AI provides virtual simulations and interactive environments where students can experiment and critically review scenarios developing their capacity to identify hallucinations and biases.

Teacher–AI collaboration

- **Reviewers and facilitators:** Teachers critically review students' interactions with AI to initiate discussions highlighting risks, assumptions and hallucinations. These interactions could facilitate a deeper mutual understanding of the strengths and weaknesses of AI through student-teacher discussions.
- **Learning designers and enhancers:** Teachers use AI-generated resources and suggestions to enhance their learning designs, helping to widen learning goals and cater to students' diverse interests.
- **Classroom organisers and managers:** Teachers use AI-based learning management systems to organise classroom activities, streamline administrative tasks such as attendance tracking and scheduling, and create a structured learning environment.
- **Strategists and data analysts:** Teachers use AI-generated data to identify their students' learning trends, strengths, and areas for improvement, i.e. AI systems could provide actionable insights.

However, the integration of AI in education will bring many challenges, such as over-reliance, academic integrity, reduced human interaction and educational inequity. In an earlier editorial we raised some of the ethical risks and proposed that when adopting AI in education we need to consider purpose, transparency and autonomy (Rospigliosi, 2021). Building here on the recent AI Competency Framework for Students proposed by UNESCO we want to highlight the importance of human-centric mindsets (UNESCO et al., 2024). These mindsets refer to an educational approach that prioritises the needs, experiences, and well-being of students and teachers. Human-centric mindsets can help in addressing the challenges such as the balance between global perspective and local insights or how to foster meaningful learning.

A call for papers on artificial intelligence and education

Human–AI collaboration can transform interactive learning environments by combining the analytical power of AI with the human touch of teachers (Chiu, 2024). Such collaborations have the potential to facilitate a more engaging learning experience for all students. However, we must place students and teachers at the centre of the educational experience (human-centric mindsets) to create a healthy, ethical and productive learning environment. The importance of human-centric mindsets is a subject we expect to raise again in future editorials, but here we aim to kick off a conversation about AI in education. This is an important topic for authors, readers and reviewers at Interactive Learning Environments to critically collaborate and contribute to.

We invite papers to select our new section: **Artificial Intelligence and Education**. This section aims at providing an inclusive global forum for a range of research from educators and learners, policymakers and regulators, designers and developers to share findings and concerns about the role of artificial intelligence and education. This role is evolving rapidly, and we are guided by a belief that if society is to realise the beneficial potential of artificial intelligence and education there is need for a global critical voice analysing the complex practical, ethical and moral interplay between innovation and regulation, technological determinism and inclusion.

We welcome qualitative and quantitative empirical studies, review and position papers addressing themes relevant to AI and Education.

Artificial Intelligence and Education will celebrate the enormous potential benefits including:

- Personalised learning and tutoring, feedback and assessment
- Responsive and adaptive environments such as the metaverse
- Enhanced efficiency and effectiveness for teachers and learners
- Realising education's lifelong contribution to human and economic growth, global justice and universal wellbeing from the cradle to the grave


Artificial Intelligence and Education will also highlight the many risks and concerns such as:

- Exclusion, inclusion and appropriation of the works of others
- Hallucination, fakes and the perpetuation of historic injustices
- Plagiarism, misrepresentation and intellectual honesty
- Loss of capacity and critique, control and transparency, employability and purpose
- Sustainability
- Educational Equity and academic integrity

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