

# Editorial. Extended education in a technology augmented world

## Editoriale. Educazione estesa in un mondo tecnologicamente aumentato

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Extended Education is an evolving and dynamic concept that leverages advanced technologies to transcend traditional educational boundaries in terms of learning contexts, methods and geographical areas. In this technology-augmented world, education is no longer confined to formal education and traditional education settings and paths; instead, it encompasses various learning contexts, including informal learning environments, higher education and lifelong learning (LLL). Extended education promotes the creation of a borderless and inclusive educational landscape, particularly with the development of internationalisation through virtual mobility (BIP, COIL, etc.) and the emergence of micro-credentials. Technologies such as Virtual Reality (VR), Augmented Reality (AR), robotics, and Artificial Intelligence (AI) are key tools driving this transformation, offering new learning methods reinforcing flexibility for learners and new avenues for skills development and for personalised, inclusive, and accessible learning (Benkhalfallah et al., 2024; Samala et al., 2024). Technology enhances educational access and quality in marginalised and disadvantaged geographical areas, supporting equal educational opportunities everywhere.

However, the rise of extended education in an augmented world also brings significant challenges (Srivastava, 2023). Ensuring equitable access to advanced technologies remains a central concern, as disparities in connectivity, digital literacy, and institutional capacity risk deepening existing inequalities (Makda, 2025). Ethical and pedagogical questions arise around data privacy, algorithmic bias, and the role of AI in shaping learning trajectories (Alam & Mohanty, 2023). Educators and learners must balance automation with human agency, preserving the social and emotional dimensions of learning while leveraging AI as a knowledgeable peer. The promise of extended education needs to follow technological innovation in putting in the centre a responsible approach.

This issue of Italian Journal of Educational Technology is devoted to extended education. The number of submissions received in response to the call for papers was so large that we were able to select 10 papers on this topic. Hence, Italian Journal of Educational Technology will devote two issues to this theme: the third of 2025 and the first of 2026.

Together, these issues will contribute to a better understanding of extended education in an augmented world. At the heart of the discussion, AI is one of the main drivers of the augmented world (Alasadi & Baiz, 2023). AI seems able to act as a catalyst for continuous education and personal growth. By analysing learners' evolving needs, AI systems can recommend tailored learning paths, identify emerging skill gaps, and adapt content dynamically to support career transitions or personal development. This integration of intelligent technologies extends learning beyond formal institutions, connecting professional training, informal learning, and self-directed study into a seamless continuum. These challenges are echoed in this special issue with a multidisciplinary approach to learning from Health Sciences to History passing through Engineering.

These special issues were conceived by an international and multidisciplinary team with people coming from Education science, Educational Technology and the development of the academic policy in terms of education and Lifelong Learning. As the development of the question of Extended Education is shared worldwide, it is a general concern of the team to have points of view on the topic coming from different parts of the world. Three of the editors are involved in the European Alliance UNITA. In order to get contributions from different countries, the Alliance UNITA was one of the main ways to reach contributors.

The selection of the contributions aimed to present a broad overview on extended education from different perspectives and disciplines. The contributors of this issue question the use of AI on education in particular on the writing with AI, on the retention of information with AI-generated multimedia, on a methodology question using Mayer's principles in multimedia learning (Mayer, 2021), the use of AI tool and contribution to support medical radiography training, and virtual artefacts on learning of structural engineering.

The issue is opened by Luca Botturi, Luca Cignetti and Silvia Demartini, exposing a study on the pros and cons of the use of AI on writing competences of the high school students in the Italian-speaking part of Switzerland. The study compares some of the features from Human-writing, mixed-approach between Human and AI and pure AI. One of the main points is to show the beneficial use of the AI needs to be framed by an appropriate teaching and learning approach. In other words, AI literacy is central for teachers and students to avoid an unquestioned use of the answer that the AI gives to the students.

The second contribution by Elisabetta Tombolini, Luna Lembo and Francesco Peluso Cassese points on the learning and information retention with AI-generated multimedia. As in the first contribution, the analysis reaches the conclusion on the need to integrate pedagogical frameworks and appropriate teaching methodologies and the improvement of digital literacy. The study involves Italian university students from different disciplines. Based on the research project AVENGERS: "Artificial Video for Education: New Generation Empowerment Resource for Study", the methodology follows two main concepts, Cognitive Theory of Multimedia Learning from Richard E. Mayer and Mobile Learning considering the development of mobile learning platforms. The study suggested that the retention of information based on AI-Multimedia can be improved by better training on the AI tools.

The third article by Melenia Talarico explores the integration of digital technologies in education using the principles of Richard E. Mayer. One of the main findings of the study is on the improvement of learning by the segmentation of educational scenarios. The question of interactivity is quite central in the discussion of the contributor. Positive, neutral and negative effects are analysed and show, by example, that the use of multimedia content in an immersive environment will be more engaging for students. Nevertheless, the need to develop learning modules with focus themes and materials is one

of the keys to success in the integration of digital technologies for learners. As the previous papers, the contribution is underlining the success factors of the use of digital technologies. With this paper, the special issue focused on the basic principles of extended education: digital literacy of the teachers and the students. If this pre-condition is fulfilled, thus other points on the coherence and the meaning of the use in pedagogy need to be addressed in order to have the better use of AI tools supporting the students during their learning paths.

The fourth contribution by Ricardo Teresa Ribeiro, Lucas Mourot, Kevin Sprengers, Laurence Flaction, Claudio Sà dos Reis and Laura Elena Raileanu presents a study on the use of AI in the training of medical radiographers in Chest X-Ray Analysis. The platform introduces an innovative approach to medical imaging education. Results indicate positive perceptions of usability and learning outcomes, suggesting strong educational potential, though moderate trust and diagnostic performance ratings highlight scepticism towards AI reliability. Some limitations are pointed out by the contributors, in particular on the sample and on the long-term retention. Nevertheless, the next steps will require transparent communication, ethical awareness, and targeted training to integrate AI effectively into medical education.

The fifth contribution by Angela Spinelli and Gianluca Capurso relates the experiment made at the University of Rome Tor Vergata with students on the use of virtual reality and augmented reality on the teaching of History of Construction. Among the findings, they point to the fact that the experiment was more successful for mature students (last year of master's degree). The authors also raise the question of digital literacy, as some students report difficulties in using the AR and VR tools. As the first articles suggested in the theoretical framework, this case study suggests the need to introduce introductory modules or technical support at the beginning of the workshop or to include specific courses within the entire degree programme. Thus, high technical demands and time investment remain major challenges, highlighting the need for preparatory training in digital tools and better alignment with prior interdisciplinary knowledge. The authors suggest that future developments should focus on enhancing accessibility, teacher training, and formative evaluation systems, while exploring how scalable, customizable VR environments can be adapted to other disciplines to promote reflective, equitable, and interdisciplinary education.

These five articles demonstrate the potential for developing tools for extended education. They also point to the need to support the implementation of these tools by increasing the digital literacy of both teachers and students.

While this is reflected in the more theoretical articles rather than in the case studies, it is also clear that the question is not whether or not to use these tools. Indeed, the augmented world is a reality that is becoming increasingly prevalent in the educational environment. It is in this context that reading this special issue and the next is necessary in order to provide teachers, students and educational support services with the keys to taking into account the authors' main conclusions.

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