
Hybrid Learning in the Age of Generative AI

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Abstract

Universities must have the aspiration to become key institutions in this new era of Artificial Intelligence (AI), as generators of knowledge, science and research, promoting the democratisation of knowledge. Also, management in Higher Education must increase faculty readiness for e-learning changes, particularly since e-learning remains essential to maintaining curriculum delivery during emergencies and crises. To fully realize this vision, research should focus on optimal design features of learning processes, and find effective strategies to facilitate interaction and communication, to a large extent supported by generative AI tools (chatbots, virtual tutors, assistants). Furthermore, many recent studies and findings point towards the development of programmes that foster digital literacy and encourage inclusive lifelong learning to successfully navigate the complexities of the online world.

Keywords: hybrid learning, generative AI, higher education

Introduction

The recent COVID-19 pandemic, and the manifestation of emergencies and crises in Europe, has brought a number of challenges to higher education. These include the sudden shift to remote learning, the need to adapt to new technologies, and the loss of in-person interactions and community. Universities and colleges may have to rapidly transition from traditional in-person instruction to remote learning formats. This sudden shift implies adjustments in teaching methodologies, technology infrastructure, and student support services. Institutions may have to adapt their curricula, learning management systems and assessment methods to accommodate online education.

Our findings during the COVID-19 pandemic (Bidarra *et al.*, 2024) clearly indicate that the implementation of a hybrid learning experience has consequences in two broad areas. One dealing with innovation policy, and the ways to develop higher education institutions and faculty, and the other, connected with this one, regarding the advancement of digital transformation. These are interlinked and require a number of innovative strategies and adaptations to be made: exploiting video conferencing platforms like Zoom, Google Meet, and Microsoft Teams to facilitate synchronous (real-

time) classes and meetings, developing and implementing online course materials and modules, such as pre-recorded lectures, tutorials, quizzes, and assignments, creating virtual office hours and student support services, such as tutoring and counselling. The goal is to keep students connected and engaged, while providing training and support for faculty members to help them adapt to teaching online.

But the willingness of an institution to work online using hybrid formats is not enough, even if the necessary infrastructure is in place. It is necessary to change the whole organisation to support governance and management (Bidarra *et al.*, 2024). So, the first thing is to check which type of students fits the model the university wants to adopt (e.g., younger or elder students?). The second aspect is to boost the digital competencies of all those involved in the process. So, it is essential to raise levels of digital literacy and to develop digital competencies in the students. But also, more advanced training is needed for the education professionals (faculty and staff) responsible for implementing the digital transformation. The third aspect is the one that promotes quality assurance mechanisms, with the collaboration of all the agents involved in the regulation of distance higher education. And the fourth is innovation, encompassing the integration of Artificial Intelligence (AI), based on joint research and collaborative work by the various stakeholders.

The Challenge of Change

As we enter the age of generative AI, higher education institutions find themselves at a transformative crossroads. The rapid integration of advanced technologies, especially generative AI, is reshaping how universities teach, learn, and operate. This technological revolution brings immense promise, namely, personalized learning, enhanced research, and operational efficiency, but it also presents significant challenges, particularly as universities confront an increasingly volatile global landscape marked by crises and emergencies.

Generative AI is already making higher education more accessible and engaging. AI-powered tutors and adaptive learning platforms offer personalized support, breaking down barriers for diverse learners and making education more inclusive. Automated grading and content creation free up faculty time, allowing for deeper student engagement and innovative teaching in the context of hybrid learning programmes. In research, AI accelerates discovery and collaboration, empowering scholars to tackle complex global issues.

Yet, the path forward is far from straightforward. Many universities struggle with legacy infrastructure, limited funding, and the need to upskill faculty and staff. The digital divide threatens to leave some students behind, and the proliferation of digital platforms raises new concerns about cybersecurity and data privacy. Implementing these technologies equitably and sustainably requires careful planning and ongoing investment.

Compounding these technological challenges are the realities of global crises, such as pandemics, conflicts, natural disasters, and other events that can disrupt education overnight. Universities must be agile, providing robust online platforms and flexible curricula to ensure continuity of learning through hybrid strategies. They are increasingly called upon to support displaced and at-risk students, requiring international collaboration and innovative support systems. Effective crisis management, transparent communication, and strong partnerships with governments and NGOs are now essential components of institutional resilience.

In this era of rapid change and uncertainty, universities must balance innovation with responsibility. By investing in technology, fostering inclusive policies, and building resilient systems, higher education can not only weather the storms of global crisis but also lead the way in shaping a more equitable and connected world.

A challenge universities need to deal with is the fact that they are no longer the only actors to provide e-learning when necessary. Platforms such as Google or LinkedIn, and large

companies like Microsoft, are making a strong beat for lifelong learning, with the provision of micro-certification of short-term training for upskilling professional profiles. So, there is an obvious risk for universities, and to avoid becoming obsolete they must differentiate themselves from these other actors.

The Age of Generative AI

The year 2025 marks a pivotal moment for higher education: the dawn of the generative AI age. In just a year, the adoption of generative AI tools among students has surged dramatically – 92% now use AI in some form, with 88% leveraging it for assessments (Freeman, 2025). This rapid uptake is not merely a technological trend but a signal of a fundamental transformation in how universities teach, learn, and operate.

Generative AI's emergence is reshaping the educational landscape in several profound ways (Hoernig *et al.*, 2024). First, it is driving personalized and inclusive learning at scale. Adaptive AI tutors and AI-powered assistants can now provide tailored feedback, explain complex concepts, and offer 24/7 support, meeting the diverse needs of students and reducing barriers related to language or learning style. This personalization is already evident in courses where textbooks, assignments, and teaching resources are AI-generated, freeing educators to focus on fostering critical thinking and deeper engagement with primary materials.

Second, generative AI is enhancing efficiency and creativity. By automating administrative tasks, grading, feedback and content creation, it allows faculty to devote more time to meaningful student interactions and innovative teaching approaches. AI also supports research by accelerating literature reviews, synthesizing complex information, and even reconstructing knowledge in scholarly fields.

However, the integration of generative AI is not without challenges. Concerns about academic integrity, the risk of bias, and the digital divide persist. Institutions are responding by developing clear policies, investing in staff literacy, and fostering a culture of responsible, ethical AI use. The sector is also grappling with questions of equity, transparency, and sustainability, recognizing that the choices made now will shape the future of research and learning.

But to achieve optimal results, training of students in AI use must go beyond ethical considerations: they should also learn to interact with chatbots, ask AI the right questions and critically assess the obtained answers, in any particular learning context. This leads to improved and personalized feedback, fully realizing the potential of AI as a learning companion. In a hybrid learning context, face-to-face

sessions then offer a key opportunity to assess whether AI interaction actually translated to real progress in students' knowledge and skills, rather than being used as a mere shortcut to obtain results.

What is clear is that ignoring AI is no longer an option. Universities are beginning to treat AI as critical infrastructure, essential for both educational and operational success. The most forward-thinking institutions are not only adopting AI but also recalibrating their expectations, focusing on maximizing its value while upholding academic integrity and inclusivity (Christ-Brendemühl, 2025; Jin *et al.*, 2025).

Conclusion

Generative AI offers higher education a transformative opportunity if institutions act swiftly, strategically, and collaboratively to harness its full potential while upholding core educational values. As AI becomes embedded in the fabric of higher education, it is catalyzing a shift towards more personalized, efficient, and equitable hybrid learning experiences. Some key benefits and opportunities may be summarised as follows:

Generative AI benefits	Opportunities for action
1. Personalized Learning and Support	Build infrastructure for AI-powered virtual tutors to provide 24/7 support
2. Efficiency and Automation	Streamline administrative and academic tasks, including grading, feedback, assessment, and course development
3. Improved Research and Discovery	Implement fast content discovery, literature reviews, data analysis, research drafting
4. Collaboration and Global Learning	Facilitate collaborative learning, allowing students to brainstorm, discuss, and work on projects with peers from around the world
5. Accessibility and Inclusivity	Make the institution more efficient and responsive to student needs (language support, adaptive learning, accessible resources)

Embracing hybrid learning and generative AI thoughtfully will unlock new possibilities for learning, research, and academic success in the years ahead. To fully realize these benefits, institutions must adopt thoughtful strategies that empower both educators and students, ensure ethical use, and foster ongoing collaboration. The age of generative AI is here, and the decisions made today will define the contours of higher education for decades to come.

References

Bidarra, J., Rocio, V., Sousa, N., & Coutinho-Rodrigues, J. (2024). Problems and prospects of hybrid learning in higher education. *Open Learning: The Journal of Open, Distance and e-Learning*, 1–20. <https://doi.org/10.1080/02680513.2024.2404036>

Christ-Brendemühl, S. (2025). Leveraging Generative AI in Higher Education: An Analysis of Opportunities and Challenges Addressed in University Guidelines. *European Journal of Education*, 60, e12891. <https://doi.org/10.1111/ejed.12891>

Freeman, J. (2025). *Student Generative AI Survey 2025*. HEPI Policy Note 61. Higher Education Policy Institute. <https://www.hepi.ac.uk/wp-content/uploads/2025/02/HEPI-Policy-Note-61-2.pdf>

Hoernig, S., Ilharco, A., Trigo Pereira, P., & Pereira, R. (2024). *Generative AI and Higher Education: Challenges and Opportunities*. Lisbon: Institute of Public Policy. <https://www.ipp-ics.org/wp-content/uploads/2024/09/Report-AI-in-Higher-Education-IPP-1.pdf>

Jin Y., Yan L., Echeverria, V., Gašević, D., & Martinez-Maldonado, R. (2025). Generative AI in higher education: A global perspective of institutional adoption policies and guidelines. *Computers and Education: Artificial Intelligence*, 8, 100348. <https://doi.org/10.1016/j.caeai.2024.100348>