9th edition

EADTU

Funded by the European Union

2025 Envisioning Report

exploring **new modes of teaching & learning** for empowering universities

---

Generative AI
Hybrid Pedagogy
Redefining Assessment

Learner Engagement
Critical Thinking
Microcredentials

Adaptive Systems
Socratic Dialogue
Immersive Simulations

Co-funded by
the European Union

Editing, logistics and lay-out
George Ubachs and Stefan Meuleman
European Association of Distance Teaching Universities (EADTU)

Published by
European Association of Distance Teaching Universities (EADTU)
Parkweg 27, 6212 XN Maastricht, the Netherlands

Suggested citation
EADTU. (2025) The Envisioning Report for Empowering Universities. (nr. 9). DOI: 10.5281/zenodo.15908735

Disclaimer
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Contents

Student Engagement through Innovation and Flexible learning

Foreword

We are pleased to present to you the ninth edition of the Envisioning Report, developed by leading experts from the EMPOWER programme (empower.eadtu.eu). This annual publication by EADTU shares cutting-edge developments in digital teaching and learning across Europe, with the aim of empowering universities to innovate in response to technological, societal, and pedagogical change.

This year's report reflects the accelerating impact of generative AI on higher education, not only as a tool for automation but as a catalyst for transformation. Universities are rethinking pedagogical strategies, assessment methods, and student support services in ways that were unimaginable just a few years ago. At the same time, institutions continue to prioritise student engagement and flexible learning pathways, ensuring that innovation remains grounded in inclusion and educational purpose.

The report is structured around three core themes:

- **Generative AI's Influence on Pedagogy and Learning** examines how institutions are adapting to the opportunities and challenges of AI-enhanced education, with a special focus on hybrid learning and the redefinition of assessment practices.
- **Applying Generative AI in Practice** showcases emerging use cases, from intelligent tutoring systems and immersive simulations to AI-driven support in STEM labs and inclusive language education.
- **Student Engagement through Innovation and Flexible Learning** presents diverse approaches to engaging learners — including renewable assessment, community-based language education, hybrid tutoring models, and the implementation of microcredentials as a flexible learning response to evolving learner needs.

Each contribution offers hands-on insights, reflective commentary, and forward-looking strategies that can guide institutions through this time of rapid transition. As always, the report emphasises quality, inclusion, and learner-centred design — pillars that remain essential in a digital-first higher education landscape.

We trust that this edition will support university leaders, teaching staff, and support teams in shaping the future of education across Europe. In doing so, it continues the mission of the EMPOWER programme: to connect expertise, inspire innovation, and build institutional capacity for the digital transformation of higher education.

Enjoy the read,

George Ubachs
Managing Director EADTU

Generative AI's Influence on Pedagogy and Learning

How Higher Education is adapting to the Challenge and Opportunity of an AI centred World

Chris Edwards [1], Denise Whitelock[1]

[1] Open University

Abstract

This report provides an update on GenAI in education, to that in last year's Envisioning report. In it we highlight the results of several projects trailing the use of GenAI in both staff facing and student facing environments. Staff facing projects look to the aspects of curriculum development that we might do better or differently. Our work suggests ultimately almost all stages of creating and maintaining curriculum might benefit. Student facing GenAI is challenging because creating a tool that is flexible and reliable enough for output to be passed directly to students carries significant risk. It is also important to consider the pedagogy underlying an implementation, as we are not simply trying to solve a technical problem and want to have positive impact on learning. We find that the technology provides opportunities for enhancing learning for all, including improving accessibility. Our findings and cited papers show that a real and positive impact is possible. In our experience this can be achieved also with positive impacts on our roles as academics and educators. Although the impact on role is something we continue to monitor.

Keywords: AI, GenAI, Generative AI, higher education, ethics

Introduction

This paper provides an update to last year's Envisioning report on GenAI in education (Bidarra & Neves, 2024) based on the experience within the Institute of Educational Technology (IET) at the Open University in the UK. This unit was established with the creation of the university in 1969. Its explicit purpose was and is to find ways to teach at a distance using the lastest technology. Technology has advanced from broadcast television and radio, through audiocassette and VHS, and the internet to todays' AI and Generative AI (GenAI) and tomorrow's Extended Reality (XR). These developments will again transform education. It is not hyperbole to state that GenAI has brought about a paradigm shift within society and we are now beginning to lead lives infused with AI.

Last year's report identified several aspects of the impact of GenAI on education. These include that GenAI should be considered a challenging but positive development within education. Also, that we need to learn how to use it to enhance teaching and learning and the development of critical thinking.

In this report, we add to these understandings from our ongoing experience working on a number of institutional and international projects.

Risks and ethical considerations

In 2016 as he opened the Centre for the Future of Intelligence in Cambridge, Professor Stephen Hawking said, that AI was 'either the best, or the worst thing, ever to happen to humanity (Hawking, Stephen, 2016). We do not yet know which'. This was well before the release of ChatGPT.

AI had already been in development for many years and Hawking recognised it could ultimately become a threat to humanity. There continues to be no consensus on this across expert groups, to some extent epitomised by the publicly shared views of two central figures: the optimistic view of Eric Schmidt contrasting with the pessimistic one of Geoffrey Hinton. We have found that within the OU's body of students, comprising all ages from 18, there is a similar spread of attitude towards the technology (Rienties et al., 2025; Tessarolo et al., 2024) and that younger students tend to

have a more positive attitude to it (Bektik et al., 2024). The international Youth Talks report (Youth Talks, 2024), shows that whilst young people might be more likely to accept GenAI, they are not ready to forgo their human teachers. We therefore, may best consider GenAI an assistive technology.

Ignoring the technology is not an option as it continues to both be adopted and developed to the point of ubiquity. Therefore, we as a community of educators have a responsibility to learners, our colleagues, and society more widely to consider how best to use and support others in using it.

There are clear reputational risks to individuals and institutions from the misuse of this technology, and of simply misjudging our approach to it. We, like other academic organisations are very sensitive to issues of copyright, intellectual proporty, personal data, and good academic practice, and keep all of these in mind in everything we do. We also understand that students need to accept the technologies we use for them to be successful. We have created a secure area within our institutional platform that ensures no leakage of data beyond the intended users.

The choice of which LLMs to use is also, in part, an ethical one as sme evidence they are produced ethically. Though, this may be an institutional, rather than personal decision.

Another consideration is the environment. We know running GenAI is energy intensive due to the vast amount of data and calculation involved. Currently, there are likely to be more energy efficient ways to achieve almost anything than using GenAI. Although, this does appear to be improving with the option to use smaller LLMs where appropriate and with improved technology.

Overview of activity

Prior to the release of ChatGPT in November 2022 the OU, like other institutions, developed bespoke AI tools for specific uses. These were developed and managed by teams of experts comprising the knowledge and skill required. Two examples of this are OpenEssayist (Whitelock et al., 2014) and the Early Alerts Indicators dashboard (Herodotou et al., 2023).

ChatGPT brought AI firmly into the consciousness of the whole of society and put a tool in the hands of everyone that in some ways would allow them to perform a range of tasks as an expert. For example, some used it to create novels they then sold, others used it to create computer programmes they would not have been able to do before, and some used Large Language Models (LLMs) that could create art to produce an award winning picture (Pavia, Will, 2022).

We have demonstrated through producing new courses there is benefit from using GenAI to assist with several curriculum development tasks: creating personas (Rets et al., 2025), producing both new and reversioned course text, assessment, developing and mapping learning outcomes, triangulation of learning outcomes for constructive alignment (Edwards, 2024; Ullmann et al., 2024).

Creating student facing GenAI is more challenging and higher risk because results are passed straight to the student without any moderation by university staff. Over this last year we have led the OU project on developing an AI digital assistant (AIDA) for our students and trialing it in partnership with colleagues in the OU's Knowledge Media Institute. The project has ensured accessbility and pedagogy are built in.

Through the EC funded ADMIT project, we are working with ten other European universities on building a broad understanding of how GenAI is: being used in higher education, shaping policy, represented in ethical and environmental considerations. The first edition of the literature review is a valuable resource, and supports the statements made in this report (Bektik et al., 2024).

Conclusion

Our experiences working with AI over many years and now with GenAI, convince us this technology offers opportunities to improve teaching and learning both in terms of learner experience and outcomes but also for improving the creation of materials, their accessibility, and degree of personalisation to individual learners. It is best considered as a tool to enhance learning rather than replace teachers

When we consider that GenAI has introduced a new paradigm and where everything is becoming infused with AI, those in education have a responsibility to prepare their learners to be able to take a critical and reasoned approach and to be able to do this, they need to understand how and when to use it within their own specialisms. This will be an ongoing process as the technology is continuing to develop rapidly.

Whilst we, as a large distance learning institution, are making significant efforts to understand and explore the potential benefits for tens of thousands of learners, even if you only teach a single group of students, you may find GenAI provides opportunities to do things better, or in a new way that refreshes your teaching and motivates learners.

This work is ongoing and one important aspect we are carefully monitoring is the impact on role. How different do our roles become when we use GenAI? And what impact is this likely to have in the longer term?

References

Bektik, D., Edwards, C., Whitelock, D., & Antonaci, A. (2024, December). Use of LLM tools within higher education: Report 1 [Other]. Quality Enhancement and Innovation, The Institute of Educational Technology, The Open University. https://admit.eadtu.eu/outcomes

Bidarra, J., & Neves, C. (2024). Artificial intelligence in learning organisations: Reshaping roles and pedagogical processes. In Envisioning report 2024 (8th edition, pp. 7–9). EADTU. https://oro.open.ac.uk/98236/1/The%20Envisioning%20Report%20for%20Empowering%20Universities.%208th%20edition%202024.pdf

Edwards, C. (2024, November 11). Keeping AI generated course text on topic: A two stage approach to confirm subject focus. ICERI2024: Proceedings of the 17th Annual International Conference of Education, Research and Innovation, Seville, Spain. https://oro.open.ac.uk/100477/

Hawking, Stephen. (2016, October 19). Stephen Hawking launches Centre for the Future of Intelligence, University of Cambridge. Cambridge University. https://www.cam.ac.uk/research/news/the-best-or-worst-thing-to-happen-to-humanity-stephen-hawking-launches-centre-for-the-future-of

Herodotou, C., Maguire, C., Hlosta, M., & Mulholland, P. (2023). Predictive Learning Analytics and University Teachers: Usage and perceptions three years post implementation. LAK23: 13th International Learning Analytics and Knowledge Conference, 68–78. https://doi.org/10.1145/3576050.3576061

Pavia, Will. (2022, September 6). Leonardo da Vinci inspires AI artist to win prize. The Times.

Rets, I., Whitelock, D., Edwards, C., Perryman, L.-A., & Pitt, B. (2025, June 15). Co-creating with Generative AI (GenAI) for curriculum design: Learning personas. EDEN Bologna Annual Conference 2025 - Shaping the Future of Education in the age of AI, Bologna, Italy. https://oro.open.ac.uk/103436/

Rienties, B., Tessarolo, F., Coughlan, E., Coughlan, T., & Domingue, J. (2025). Students' Perceptions of AI Digital Assistants (AIDAs): Should Institutions Invest in Their Own AIDAs? Applied Sciences, 15(8), Article 8. https://oro.open.ac.uk/103773/

Tessarolo, F., Edwards, C., Bektik, D., & Whitelock, D. (2024). Comparing practical use and perceptions of GenAI in higher education with current published insights. EDEN 2024 Research Workshop & PhD Schools' Masterclass, Timosoara, Romania. https://oro.open.ac.uk/100463/

Ullmann, T. D., Edwards, C., Bektik, D., Herodotou, C., & Whitelock, D. (2024). Towards Generative AI for Course Content Production: Expert Reflections. European Journal of Open, Distance and E-Learning, 26(s1), 20–34. https://doi.org/10.2478/eurodl-2024-0013

Whitelock, D., Field, Debora, Pulman, Stephen, Richardson, John T. E., & Van Labeke, Nicolas. (2014). Designing and testing visual representations of draft essays for higher education students. 2nd International Workshop on Discourse-Centric Learning Analytics. 4th Conference on Learning Analytics and Knowledge (LAK2014).

Youth Talks. (2024). Youth Talks on AI - Final report (p. 109). Higher Education for Good foundation.

Redefining Assessment: A Necessity in the Age of Artificial Intelligence

Cathia Papi[1], Amélie Beaudoin[1] and Philippe Verville[2]

[1] TÉLUQ
[2] UQTR

Abstract

To better understand the role of artificial intelligence (AI) in assessment and evaluation in higher education, we conducted a systematic literature review in line with the University College London EPPI approach. We searched the ERIC, Education Source, Érudit, and Cairn databases in both French and English, yielding 430 results. Following an abstract screening and a full-text review, we selected 106 articles for a detailed analysis. We aimed to explore the impact of AI on the practices of students and teachers, as well as the changes affecting higher education institutions and the validity of the qualifications they confer. In this brief overview, we will discuss the influence of AI on the assessment of learning. We will highlight the various ways AI can be perceived and leveraged, from prohibiting its use by students to having it complete writing assignments, grading students' work, and even actively promoting the development of high cognitive competencies through its use.

Keywords: artificial intelligence, AI, assessment, examination, cheating, plagiarism, higher education, university

Introduction

Since ChatGPT was released to the public in late 2022, concerns about the evolving role of artificial intelligence in education have been well-documented. It has long been known that in the pursuit of academic excellence, students often feel pressure, and it can prompt them to resort to dishonest tactics. Plagiarism, cheating, and even outsourcing their work on assignments may come into play (Hollis, 2018; Kayisoglu & Temel, 2017). However, this phenomenon is likely to intensify with the development of generative AI (GenAI), which can deliver appropriate responses to a broad range of queries, compose long-form texts in natural language (Bouhali et al., 2024), and even pass exams (Carrasco et al., 2023).

Nevertheless, there remains limited understanding of what is being implemented in the field and how AI is being accepted and integrated (or not) into courses and assessment practices. While it seems unrealistic to prohibit all use of AI, higher education institutions appear to be reflecting on the stance they should take. Many tend to promote a reasoned and differentiated approach, granting instructors considerable autonomy—both in how they engage with AI and in how they guide, tolerate, or discourage its adoption by students. As this context evolves, it becomes essential to examine how AI is reshaping assessment practices in higher education.

To gain perspective into the impact of recent AI advancements on assessment and evaluation in higher education, we conducted a systematic review to offer a thorough overview of the issue. We explored both the institutional measures in place and the interactions between teachers and students with AI regarding learning assessments.

Methodology

The review was conducted between October 2024 and May 2025, following the systematic approach developed by the EPPI Centre at University College London (2010). Searches were carried out in the Education Source, ERIC, Cairn, and Érudit databases using keywords that generated the highest number of results related to higher education, artificial intelligence, learning assessment, plagiarism, or cheating.

Only peer-reviewed scientific articles published up to December 2024 were considered.

The initial search yielded 430 articles. After an abstract screening, an interrater reliability assessment, and a full-text review, 106 articles were retained for analysis. Although no publication window was imposed, most of the included studies were published in 2023 and 2024.

This synthesis presents the main findings regarding the use of AI in both formative and summative assessment in higher education. It highlights that while specific applications are well received and rapidly evolving, those directly related to summative assessment often provoke resistance, drive change and raise questions.

Main Results

Valued and Widening Uses of GenAI

Several studies highlight valued uses of GenAI, for example, to personalize learning materials, student learning experiences, academic support and exam preparation (Bhullar et al., 2024; Peláez-Sánchez et al., 2024; Vannaprathip et al., 2022). In this setting, where guidance sometimes takes the form of formative assessment, chatbots, also referred to as intelligent tutors, are primarily made available to students. Numerous studies describe chatbots that can provide tailored feedback to English learning students and generally demonstrate their effectiveness in improving language skills (Kohnke, 2023; Yildirim-Erbasli et al., 2023). For example, two articles about the TOEIC test preparation (Test of English for International Communication) emphasize that AI is helpful for exam practice. Additionally, students who benefit from an AI chatbot to study have higher success rates (Kim, 2022; Hsu et al., 2023).

Beyond student support and training, instructors also use GenAI as a valuable tool for designing a rich variety of learning assessment activities in different disciplines (Onal & Kulavuz-Onal, 2024). It is further employed for grading purposes and studies reveal that AI can perfectly substitute humans in that task; however, it is observed that its performance fluctuates depending on the type of work requested and the clarity of instructions provided (Geçkin et al., 2023; Han & Lu, 2023; Khalif et al., 2024).

Between Stepping Back and Changing Practices

One article highlights that while institutional policies do influence students' use of GenAI, their impact is less significant than that of teachers' instructional and assessment practises (Ateeq et al., 2024). While some instructors seek to harness the potential benefits of GenAI, others engage with it only minimally due to a lack of time, training, or clarity regarding what is accepted in their academic environment (Bannister et al., 2023; Giray et al., 2024).

Moreover, many teachers express concerns that students may cheat or plagiarize, that unauthorized reliance on GenAI will be challenging to detect and manage, and that overdependence on such resource could undermine students' ability to think autonomously, produce original work, and develop writing skills (Bannister et al., 2023; Xia et al., 2024). This sometimes leads institutions or authors to recommend prohibiting its use or to counter it through supervised in-person examinations (Cotton et al., 2024; Kortemeyer & Bauer, 2024), to implement proctoring systems in case of online assessments (Jia & He, 2022; Oravec, 2022), or to ask students to declare their interactions with AI (Perkins, 2023) and utilize tools to detect plagiarism (Chaudhry et al., 2023).

Other teachers adopt a more constructive approach, aiming to frame AI engagement and raise students' awareness of ethical considerations to promote responsible practices. Instructors could include specific rules in their course syllabi to define the contexts in which GenAI is permitted or restricted (Hyde et al., 2024). Finally, some teachers begin to actively encourage students to interact with GenAI as a means of fostering critical thinking and reflexivity. For example, Khlaif et al. (2024) describe a situation in which students must accompany their assignments with a reflective commentary on their AI usage, while Hyde et al. (2024) present an activity where students dialogue with a conversational agent (chatbot) and then examine the relevance of its responses.

New Challenges to Question

Studies published in 2023 and 2024 report that 20% to 50% of the students had already used GenAI to complete assessments and intend to continue doing so (Krecar et al., 2024; Yusuf et al., 2024). Furthermore, ChatGPT's proficiency was found to rival that of top-performing students when tasks were simple questions or when calculated or expected answers were standardized (Nikolic et al., 2023). GenAI is also highly efficient for designing and grading students' assessments as it delivers feedback that closely resembles human responses (Beseiso et al., 2021).

Several issues thus emerge, two of which are worth discussing here. Firstly, as applications multiply, it is increasingly essential to train both teachers and students on how AI can be advantageous or not in their work, as well as the nuances of various GenAI tools and how to engage with them in a critical and effective manner. Secondly, beyond

institutional policies, often limited to broad guidelines regarding student use, higher education establishments would benefit from offering clearer frameworks for faculty. For example, using GenAI to grade student work without their consent raises ethical concerns, particularly given that AI systems learn from the data they process. Moreover, learning involves emotional and metacognitive dimensions that remain inherently human, underscoring the students continued need for human feedback (Bhullar et al., 2024; Kortemeyer, 2023).

Conclusion

The analyzed articles reveal that GenAI has the potential to support student learning, provide continuous automated feedback, and assist teachers in designing learning or assessment activities as well as in grading. Although mixed results currently hinder specific applications, the quick pace of technological advancement is steadily reducing these limitations, suggesting that adoption will remain on the rise among both instructors and students.

Given that GenAI can now be harnessed to design, complete, and even grade assessment tasks, the very notion of assessment risks becoming disconnected from human learning. In other words, the rapid evolution of GenAI challenges the relevance of summative evaluation. It may offer an opportunity to rethink the diploma-driven logic of education, an approach already critiqued by sociologists since the 1980s for its inflationary tendencies and potential loss of meaning.

Might this be the moment to embrace the possibilities brought by technological change to refocus on what is uniquely human, namely, the joy of learning? In this light, the teacher, who since the rise of the internet has been encouraged to shift from "sage on the stage" to "guide on the side," now sees this role further expanded to that of critical mediator and ethical facilitator (Ateeq et al., 2024; Xia et al., 2024) not to mention the timeless mission of sparking and sustaining curiosity and the desire to learn.

References

Ateeq, A., Alzoraiki, M., Milhem, M., & Ateeq, R. A. (2024). Artificial Intelligence in Education: Implications for Academic Integrity and the Shift Toward Holistic Assessment. *Frontiers in Education*, 01-11. https://doi.org/10.3389/feduc.2024.1470979

Bannister, P., Santamaría-Urbieta, A., & Alcalde-Peñalver, E. (2023). A Delphi Study on Generative Artificial Intelligence and English Medium Instruction Assessment: Implications for Social Justice. *Iranian Journal of Language Teaching Research*, *11*(3), 5380.

Beseiso, M., Alzubi, O. A., & Rashaideh, H. (2021). A Novel Automated Essay Scoring Approach for Reliable Higher Educational Assessments. *Journal of Computing in Higher Education*, *33*(3), 727–746. https://doi.org/10.1007/s12528-021-09283-1

Bhullar, P. S., Joshi, M., & Chugh, R. (2024). ChatGPT in Higher Education—A Synthesis of the Literature and a Future Research Agenda. *Education and Information Technologies*, *29*(16), 2150121522. https://doi.org/10.1007/s10639-024-12723-x

Bouhali, K., Mohellebi, F., & Popotte, S. (2024). J'ai utilisé ChatGPT pour écrire mon mémoire. *Management & Datascience*. https://managementdatascience.org/articles/30807/

Carrasco, M., Silva, A. R., & Henriques, R. (2024). Detecting Fraudulent Student Communication in a Multiple Choice Online Test Environment. *IEEE Transactions on Computational Social Systems*, *11*(1), 11081120. https://doi.org/10.1109/TCSS.2023.3254504

Chaudhry, I. S., Sarwary, S. A. M., El Refae, G. A., & Chabchoub, H. (2023). Time to Revisit Existing Student's Performance Evaluation Approach in Higher Education Sector in a New Era of ChatGPT — A Case Study. *Cogent Education*, *10*(1), 1–30. https://doi.org/10.1080/2331186X.2023.2210461

Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2024). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education & Teaching International*, *61*(2), 228–239. https://doi.org/10.1080/14703297.2023.2190148

EPPI Centre. (2010). EPPI-Centre methods for conducting systematic reviews.

Geçkin, V., Kiziltas, E., & Çinar, Ç. (2023). Assessing Second-Language Academic Writing: AI vs. Human Raters. *Journal of Educational Technology and Online Learning*, *6*(4), 10961108.

Giray, L., De Silos, P. Y., Adornado, A., Buelo, R. J. V., Galas, E., Reyes-Chua, E., Santiago, C., & Ulanday, Ma. L. (2024). Use and Impact of Artificial Intelligence in Philippine Higher Education: Reflections from Instructors and Administrators.

Internet Reference Services Quarterly, *28*(3), 315338. https://doi.org/10.1080/10875301.2024.2352746

Han, C., & Lu, X. (2023). Can Automated Machine Translation Evaluation Metrics Be Used to Assess Students' Interpretation in the Language Learning Classroom? *Computer Assisted Language Learning*, *36*(5–6), 1064–1087. https://doi.org/10.1080/09588221.2021.1968915

Hollis, L. P. (2018). Ghost-Students and the New Wave of Online Cheating for Community College Students. *New Directions for Community Colleges*, *2018*(183), 2534. https://doi.org/10.1002/cc.20314

Hsu, H.-L., Chen, H. H.-J., & Todd, A. G. (2023). Investigating the Impact of the Amazon Alexa on the Development of L2 Listening and Speaking Skills. *Interactive Learning Environments*, *31*(9), 5732–5745. https://doi.org/10.1080/10494820.2021.2016864

Hyde, S. J., Busby, A., & Bonner, R. L. (2024). Tools or Fools: Are We Educating Managers or Creating Tool-Dependent Robots? *Journal of Management Education*, *48*(4), 708734. https://doi.org/10.1177/10525629241230357

Jia, J., & He, Y. (2022). The Design, Implementation and Pilot Application of an Intelligent Online Proctoring System for Online Exams. *Interactive Technology and Smart Education*, *19*(1), 112–120. https://doi.org/10.1108/ITSE-12-2020-0246

Kayisoglu, N. B., & Temel, C. (2017). An Examination of Attitudes towards Cheating in Exams by Physical Education and Sports High School Students. *Universal Journal of Educational Research*, *5*(8), 13961402.

Khlaif, Z. N., Ayyoub, A., Hamamra, B., Bensalem, E., Mitwally, M. A. A., Ayyoub, A., Hattab, M. K., & Shadid, F. (2024). University Teachers' Views on the Adoption and Integration of Generative AI Tools for Student Assessment in Higher Education. *Education Sciences*, *14*(10), 1090. https://doi.org/10.3390/educsci14101090

Kim, N.-Y. (2022). AI-Integrated Mobile-Assisted Language Learning: Is It an Effective Way of Preparing for the TOEIC Test in Classroom Environments? *English Teaching*, *77*(3), 79–102.

Kohnke, L. (2023). A Pedagogical Chatbot: A Supplemental Language Learning Tool. *RELC Journal: A Journal of Language Teaching and Research*, *54*(3), 828-838. https://doi.org/10.1177/00336882211067054

Kortemeyer, G., & Bauer, W. (2024). Cheat Sites and Artificial Intelligence Usage in Online Introductory Physics Courses: What Is the Extent and What Effect Does It Have on Assessments? *Physical Review Physics Education Research*, *20*(1). https://doi.org/10.1103/PhysRevPhysEducRes.20.010145

Krecar, I. M., Kolega, M., & Jurcec, L. (2024). Perception of ChatGPT Usage for Homework Assignments: Students' and Professors' Perspectives. *IAFOR Journal of Education*, *12*(2), 33–60.

Nikolic, S., Daniel, S., Haque, R., Belkina, M., Hassan, G. M., Grundy, S., Lyden, S., Neal, P., & Sandison, C. (2023). ChatGPT versus engineering education assessment: A multidisciplinary and multi-institutional benchmarking and analysis of this generative artificial intelligence tool to investigate assessment integrity. *European Journal of Engineering Education*, *48*(4), 559614. https://doi.org/10.1080/03043797.2023.2213169

Onal, S., & Kulavuz-Onal, D. (2024). A Cross-Disciplinary Examination of the Instructional Uses of ChatGPT in Higher Education. *Journal of Educational Technology Systems*, *52*(3), 301–324. https://doi.org/10.1177/00472395231196532

Oravec, J. A. (2022). AI, biometric analysis, and emerging cheating detection systems: The engineering of academic integrity?. *Education Policy Analysis Archives*, *30*, (175). https://doi.org/10.14507/epaa.30.5765

Peláez-Sánchez, I. C., Velarde-Camaqui, D., & Glasserman-Morales, L. D. (2024). The impact of large language models on higher education: Exploring the connection between AI and Education 4.0. *Frontiers in Education*, 121. https://doi.org/10.3389/feduc.2024.1392091

Perkins, M. (2023). Academic Integrity considerations of AI Large Language Models in the post-pandemic era: ChatGPT and beyond. *Journal of University Teaching & Learning Practice*, *20*(2), 1–24. https://doi.org/10.53761/1.20.02.07

Vannaprathip, N., Haddawy, P., Schultheis, H., & Suebnukarn, S. (2022). Intelligent Tutoring for Surgical Decision Making: A Planning-Based Approach. *International Journal of Artificial*

Intelligence in Education, *32*(2), 350381. https://doi.org/10.1007/s40593-021-00261-3

Xia, Q., Weng, X., Ouyang, F., Lin, T. J., & Chiu, T. K. F. (2024). A scoping review on how generative artificial intelligence transforms assessment in higher education. *International Journal of Educational Technology in Higher Education*, *21*(1), 1-22. https://doi.org/10.1186/s41239-024-00468-z

Yildirim-Erbasli, S. N., Bulut, O., Demmans Epp, C., & Cui, Y. (2023). Conversation-Based Assessments in Education: Design, Implementation, and Cognitive Walkthroughs for Usability Testing. *Journal of Educational Technology Systems*, *52*(1), 2751. https://doi.org/10.1177/00472395231178943

Yusuf, A., Pervin, N., & Román-González, M. (2024). Generative AI and the future of higher education: A threat to academic integrity or reformation? Evidence from multicultural perspectives. *International Journal of Educational Technology in Higher Education*, *21*(1), 129. https://doi.org/10.1186/s41239-024-00453-6

Hybrid Learning in the Age of Generative AI

José Bidarra[1,2], Vitor Rocio[1,3] and Nuno Sousa[1,4]

[1] Universidade Aberta, Portugal
[2] CIAC – Centro de Investigação em Artes e Comunicação
[3] INESC-TEC – Instituto de Engenharia de Sistemas e Computadores
[4] INESC-Coimbra – Instituto de Engenharia de Sistemas e Computadores de Coimbra

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-jcs.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

Applying Generative AI in Practice

Reviving the Socratic Method with AI: An Interdisciplinary Approach to Enhancing Critical Thinking in Distance Higher Education

Diamanto Tzanoulinou[1], Loukas Triantafyllopoulos[1], George Vorvilas[2], Evgenia Paxinou[1], Nikolaos Karousos[1], Emmanouil Koutouzis[2], Vassilios S. Verykios[1]

[1] School of Science and Technology, Hellenic Open University, Patras, Greece
[2] School of Humanities, Hellenic Open University, Patras, Greece

Abstract

This contribution presents a pedagogically grounded, interdisciplinary model that combines the classical Socratic method with Large Language Models (LLMs) to enhance critical thinking in distance higher education. Drawing on insights from education, artificial intelligence (AI), and cognitive science, it enables reflective, dialogue-based learning through adaptive Socratic questioning. The approach supports the development of critical thinking skills, metacognitive awareness, and deeper understanding while offering educators insights into learning progress. It illustrates how AI can enhance traditional pedagogy to improve engagement and personalization in online learning environments.

Keywords: Socratic method, Large Language Models (LLMs), Critical thinking, Distance higher education, SOLO taxonomy

Introduction

Critical thinking (CT) has emerged as an important asset for Europe's citizens in a rapidly evolving labor market (Dominguez et al., 2018a). It equips higher education graduates and the future workforce with the interdependent cognitive skills and dispositions necessary for effective problem-solving, decision making and lifelong learning (Dominguez et al., 2018b). CT also promotes adaptability, ethical awareness and cooperation, enhancing both personal and social development. By strengthening critical thinking in academic education, Europe can enhance innovation, and employability and better prepare its citizens for the complex demands of the 21st century (European Commission, 2018).

Effective CT education, however, requires explicit teaching, active learning strategies, and institutional support to ensure sustained development of both skills and dispositions. Moreover, the rapid changes in educational tools and strategies brought by AI present promising new opportunities for cultivating CT. Towards this direction, the Hellenic Open University (HOU) has undertaken an innovative initiative: applying the Socratic Dialogue (SD) method within Distance Education (DE), utilizing LLMs as pedagogical instruments (Karousos et al., 2024a; 2024b) to foster dialogue, critical questioning, and philosophical reflection (Etkin et al., 2025).

To establish an effective interdisciplinary research framework, HOU has brought together experienced scientific staff from two of its Faculties. More specifically, the School of Science and Technology contributes to the project by testing modern digital educational tools and technological infrastructures to enhance interactions between AI applications and students. At the same time, the School of Humanities proposes appropriate pedagogical frameworks for applying SD to improve the CT skills of HOU students.

As a result of this collaboration, an original and innovative online application has been developed to harness the capabilities of LLMs within a structured SD framework. Importantly, the project is being implemented with strict adherence to student privacy, ensuring complete anonymity

and preventing the collection of personal data through integrated protection mechanisms.

The Importance of CT in EU Policies

EU education policies set CT as a priority that contributes to democratic citizenship, social cohesion and employment. In particular, strategies such as the European University Strategy (2022) and the Blueprint for a European Degree (2024) emphasize student-centered, interdisciplinary approaches that promote CT, creativity and problem-solving (European Commission, 2022; 2024). Furthermore, recommendations such as the Key Competences for Lifelong Learning (2018) and Education for Democratic Citizenship (2023) emphasize the cultivation of CT as a prerequisite for civic participation and European values (Council of the EU, 2023).

Promises and Challenges of Cultivating CT in Distance Higher Education

DE is an environment in which CT can be effectively cultivated. Research has shown that adult learners in DE environments often outperform their colleagues from traditional face-to-face universities in problem - solving and decision-making, two fundamental aspects of CT (Dwyer & Walsh, 2020). In DE, adult learners engage with course material and learning activities independently and develop skills to control and self-regulate their study. In the case of HOU, DE occurs through multiple interactions (tutor-to-student, student-to-student, and student-to-tutor) supported in technologically mediated educational spaces (Moore & Kearsley, 2012). However, this implementation has been found to often pose several barriers to the cultivation of CT, mainly due to the physical distance that complicates the process of adult student engagement.

In HOU, for example, tutors commonly report communication barriers that make it difficult to attract and maintain adult student interest, cultivate trust and consequently enhance CT skills (Giannouli & Vorvilas, 2023), as well as feelings of loneliness and isolation that reduce interest and enthusiasm and might lead to drop out. In this context, the use of active learning techniques such as AI-guided Socratic dialogue can help to overcome the abovementioned barriers through its appropriate integration into the HOU DE methodology to enhance a crucial component for fostering CT in DE settings such as teaching presence (Garrison et al. 2000).

The SD and Its Contribution to Enhancing CT

SD is considered an active learning method, making it particularly suitable for cultivating CT in DE settings (Abrami et al., 2015). Unlike passive knowledge acquisition, SD engages students in exploring ideas and analyzing given beliefs, challenging common assumptions, recognizing biases, and synthesizing ideas from an interdisciplinary perspective (Asakavičiūtė et al., 2023). Additionally, it contributes to the cultivation of metacognitive skills since, when properly prepared, it can help students monitor and adapt their thought processes (Ho et al., 2023), elements essential in the context of promoting the self-regulated learning that DE advocates.

Besides the abovementioned cognitive benefits, SD can contribute to the cultivation of democratic values by promoting active listening, mutual understanding, and respectful disagreement (Altorf, 2019).

SD has been tested in a wide variety of educational contexts in which its effective contribution has been demonstrated, including applications in inquiry-based learning (Dickson & Stephens, 2015), group discussions (Bates et al., 2025) and problem-solving scenarios (Pitorini et al., 2024). Its adaptability across disciplines makes it widely applicable. In addition, Socratic tools with AI seem well-promising in providing scalable, personalized learning experiences and enhancing CT in DE (Kong et al., 2023; Liu et al., 2024).

Future Methodology

Need analysis, and HOU modules' selection

The research approach begins with a need analysis at the module level of the HOU to gather information on challenges encountered in teaching and learning - either in demanding subject areas or in foundation/supportive courses designed to address such difficulties. Special attention will also be paid to modules that cultivate or require essential academic skills and CT, such as modules on scientific research or those focused on the preparation of a Master's Thesis.

The need analysis will be conducted through focus groups with the participation of both faculty members and students (Bryman & Bell, 2019). The data collected from these discussions will inform targeted decisions regarding which modules are most suitable for applying AI-supported SD. For the modules selected, the proposed AI application will be implemented and tailored to the specific subject matter and learning objectives (see next section).

Developing the Socratic-AI Application

The web application integrates LLMs via API technology, adapting them to the intended pedagogical context through prompt engineering techniques (Figure 1; Stage 1). This approach is well-supported in recent literature, as demonstrated in studies by Shridhar et al. (2022), Hung et al. (2024), Westerlund and Shcherbakov (2024), Zhang et al. (2024), and Etkin et al. (2025).

The model under development considers both the student's cognitive level and year of study, adopting the role of a facilitator of thought rather than an authoritative source (see Figure 1; Stage 2). Based on the principles of Socratic Dialogue, the model poses questions that prompt critical reflection. It encourages students to challenge their assumptions, recognize flaws in their reasoning, revisit initial viewpoints, and develop arguments supported by sound logic.

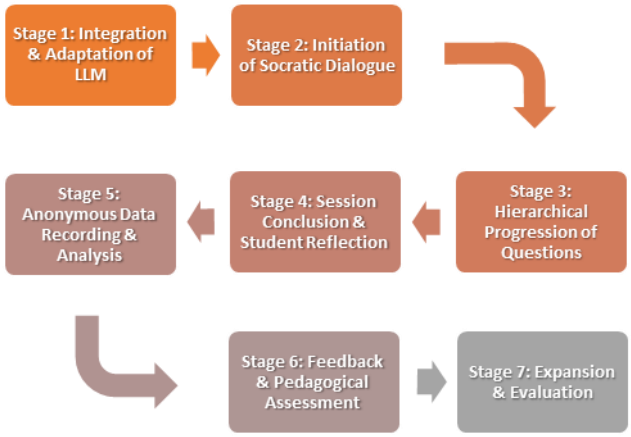

Figure 1: 'Socratic-AI Application Workflow'

The questions are structured hierarchically, progressing through increasing levels of cognitive complexity (Figure 1; Stage 3). Sessions begin with basic clarifications and gradually move toward questions involving higher-order abstraction, philosophical reflection, and conceptual depth. Each session concludes when the student either reinforces their position through more robust argumentation or revises their views, thus following a trajectory of cognitive and reflective development (see Figure 1; Stage 4).

All interactions throughout this process are anonymously saved in a dedicated database (see Figure 1, Stage 5), facilitating future analysis of student cognitive growth, argument quality, and conceptual development. After each session concludes, students receive brief feedback summarizing their cognitive progress. Simultaneously, the dialogue history is made available to tutors, allowing for meaningful assessment of learning outcomes using appropriate pedagogical taxonomies, such as the SOLO taxonomy (Biggs & Tang, 2011), as well as further learning analytics (Figure 1; Stage 6).

Following its pilot implementation within HOU's academic environment, the proposed approach is intended to be experimentally extended to broader educational contexts across Europe. The aim is to establish partnerships with institutional bodies specializing in DE, such as the European Association of Distance Teaching Universities (EADTU), as well as other organizations active in digital learning innovation (see Figure 1; Stage 7).

Conclusion

This envisioning report has outlined an innovative educational approach that integrates SD with LLMs to enhance CT in the context of DE. Through the collaboration of two faculties at the HOU, the proposed application establishes a strong foundation for the pedagogically informed use of AI. The initiative's aim to expand across Europe—potentially in collaboration with organizations like the EADTU—highlights the HOU's ability to play a meaningful role in the broader international conversation on digital innovation in education.

References

Altorf, H. M. (2019). Dialogue and discussion: Reflections on a Socratic method. *Arts and Humanities in Higher Education, 18*(1), 60–75. https://doi.org/10.1177/1474022216670607

Abrami, P. C., Bernard, R. M., Borokhovski, E., Waddington, D. I., Wade, C. A., & Persson, T. (2015). Strategies for Teaching Students to Think Critically: A Meta-Analysis. *Review of Educational Research, 85*(2), 275-314. https://doi.org/10.3102/0034654314551063

Asakavičiūtė, V., Valantinaitė, I., & Sederavičiūtė-Pačiauskienė, Ž. (2023). The space and role of discussion in university studies in the context of Socrates' philosophy of education. *Filosofija. Sociologija, 34*(3), 328–338. https://doi.org/10.6001/fil-soc.2023.34.3.13

Bates, J., Cheng, S., Ferris, M., & Wang, X.F. (2025). Cultivating critical thinking skills: A pedagogical study in a business statistics course. *Journal of Statistics and Data Science Education, 33*(2), 166-176. https://doi.org/10.1080/26939169.2024.2394534

Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university* (4th ed.). McGraw-Hill.

Bryman, A., & Bell, E. (2019). *Social research methods*. Canada: Oxford University Press.

Council of the European Union (2023). Council conclusions on the contribution of education and training to strengthening common European values and democratic citizenship (C/2023/1339). *Official Journal of the European Union, C 1339*, 1–11. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023XG01339

Dickson, K. A., & Stephens, B. W. (2015). Using celebrities and advertising campaigns to enhance learning of critical review and experimental design, within an inquiry-oriented biomedical curriculum. *International Journal of Innovation in Science and Mathematics Education, 23*(6) Retrieved from https://proxy.eap.gr/login?url=https://www.proquest.com/scholarly-journals/using-celebrities-advertising-campaigns-enhance/docview/2248368747/se-2

Dominguez, C. et. al (2018a). *A European collection of the Critical Thinking skills and dispositions needed in different professional fields for the 21st century.* Universidade de Trás-os-Montes e Alto Douro (UTAD). ISBN: 978-989-704-256-0. https://repositorio.utad.pt/bitstream/10348/8319/1/CRITHINKEDU%20O1%20%28ebook%29.pdf

Dominguez, C. et. al (2018b). *A European review on Critical Thinking educational practices in Higher Education Institutions*. Universidade de Trás-os-Montes e Alto Douro (UTAD). ISBN: 978-989-704-258-4. https://repositorio.utad.pt/bitstream/10348/8767/1/CRITHINKEDU_O2%20%28ebook%29pdf.pdf

Dwyer, C. P., & Walsh, A. (2020). An exploratory quantitative case study of critical thinking. *Educational Technology Research and Development, 68*, 17-35. https://doi.org/10.1007/s11423-019-09659-2

Etkin, H. K., Etkin, K. J., Carter, R. J., & Rolle, C. E. (2025). Differential effects of GPT-based tools on comprehension of standardized passages. *Frontiers in Education*, *10*, Article 1506752. https://doi.org/10.3389/feduc.2025.1506752

European Commission (2018). *Council Recommendation on Key Competences for Lifelong Learning.* Official Journal of the European Union, C 189, 4.6.2018, pp. 1–13. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018H0604(01)

European Commission (2022). *Communication: European strategy for universities (graphic version)*. https://education.ec.europa.eu/sites/default/files/2022-01/communication-european-strategy-for-universities-graphic-version.pdf

European Commission (2024). *Communication: A blueprint for a European degree (graphic version).* https://education.ec.europa.eu/sites/default/files/2024-03/European_Degree_Communication_Graphic_Version_EN.pdf

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2(2–3)*, 87–105. https://doi.org/10.1016/S1096-7516(00)00016-6

Giannouli, V., & Vorvilas, G. (2023). Barriers in fostering critical thinking in higher distance education: Faculty members' perceptions. *Mediterranean Journal of Education, 3*(1), 17–27. https://doi.org/10.26220/mje.4144

Ho, Y.-R., Chen, B.-Y., & Li, C.-M. (2023). Thinking more wisely: Using the Socratic method to develop critical thinking skills amongst healthcare students. *BMC Medical Education, 23*(1), 173. https://doi.org/10.1186/s12909-023-04134-2

Hung, J. T., Cui, C., Popescu, D. M., Chatterjee, S., & Starner, T. (2024, July). Socratic Mind: Scalable oral assessment powered by AI. In *Proceedings of the 11th ACM Conference on Learning@ Scale (L@S '24)* (pp. 340–345). Atlanta, GA, USA. https://doi.org/10.1145/3657604.3664661

Karousos, N., Vorvilas, G., Pantazi, D., & Verykios, V. S. (2024a). A Hybrid Text Summarization Technique of Student Open-Ended Responses to Online Educational Surveys. *Electronics*, *13*(18), 3722. https://doi.org/10.3390/electronics13183722

Karousos, N., Vorvilas, G., Pantazi, D., & Verykios, V. (2024b, December). Summarizing University Students? Qualitative Feedback on Online Exams: A Microservice-Oriented Approach. In *Proceedings of the 28th Pan-Hellenic Conference on Progress in Computing and Informatics* (pp. 51-56). https://doi.org/10.1145/3716554.3716562

Kong, C., Fan, Y., Wan, X., Jiang, F., & Wang, B. (2023). PlatoLM: Teaching LLMs in multi-round dialogue via a user simulator. arXiv. https://doi.org/10.48550/arXiv.2308.11534

Li, T. P., Slocum, S., Sahoo, A., Ochuba, A., Kolakowski, L., Henn, R. F., III, Johnson, A. A., & LaPorte, D. M. (2024). Socratic Artificial Intelligence Learning (SAIL): The role of a virtual voice assistant in learning orthopedic knowledge. *Journal of Surgical Education, 81*(11), 1655–1666. https://doi.org/10.1016/j.jsurg.2024.08.006

Moore, M. G., & Kearsley, G. (2012). *Distance education: A systems view of online learning.* Belmont, CA: Wadsworth.

Pitorini, D. E., Suciati, & Harlita. (2024). Students' critical thinking skills using an e-module based on problem-based learning combined with Socratic dialogue. *Journal of Learning for Development, 11*(1). https://doi.org/10.56059/jl4d.v11i1.1014

Shridhar, K., Macina, J., El-Assady, M., Sinha, T., Kapur, M., & Sachan, M. (2022). Automatic generation of Socratic subquestions for teaching math word problems. *arXiv preprint* arXiv:2211.12835. https://doi.org/10.48550/arXiv.2211.12835

Westerlund, M., & Shcherbakov, A. (2024, March). LLM integration in workbook design for teaching coding subjects. In *Proceedings of the International Conference on Smart Technologies in Education* (pp. 77–85). Cham, Switzerland: Springer Nature. https://doi.org/10.1007/978-3-031-61891-8_7

Zhang, L., Lin, J., Kuang, Z., Xu, S., & Hu, X. (2024). SPL: A Socratic Playground for Learning Powered by Large Language Model. *arXiv preprint* arXiv:2406.13919. https://doi.org/10.48550/arXiv.2406.13919

Training professional interactions in virtual educational environments through realistic simulations with generative AI

Calero Piña, Pilar[1]; Domènech Coll, Montserrat[1]; Gómez Cardosa, Desirée[1]; Mas Garcia, Xavier[1]; Angulo Valdearenas, Maria Jose[1]; Garcia Brustenga, Guillem[1].

[1]Universitat Oberta de Catalunya (UOC)

Abstract

Certain disciplines require training for human professional interaction, such as conversations in health, education, law, or job and business interviews. This article presents the initial results of proofs conducted after the creation of three patients that show how generative AI can be useful in e-learning, by offering realistic cases for practising professional interaction skills in Higher Education environments. It was first tested through a two-stage process: first, using a self-configured GPT to examine the characteristics it could provide for the generation of healthcare simulated patients; second, configuring another GPT to interact with these simulated characters so that professors can use them for role-playing features in the classroom with the students. The ideal long-term impact would be to perfect its configuration and integrate it into large cohort student classrooms.

Keywords: generative AI, ChatGPT, role-playing, simulations, e-learning, distance education

Introduction

In many professional fields, such as health, education, psychology, law, economics and business, it is essential to prepare future graduates to interact effectively with other people in a specific professional role. However, this skill is not acquired solely through theoretical knowledge; it must be practised in situations that are as realistic as humanly possible. Specifically in the health sciences, it is common to use actors who play simulated patients to train these types of skills (Moore et al, 2016; Buchholz et al, 2020). Online simulations can be added to the wide range of methods designed to promote professional development in the education field, by offering advantages in terms of economic efficiency and accessibility for populations that are geographically distant when compared to face-to-face simulations (Kasperski and Hemi, 2024).

In this sense, it is not surprising that since the emergence of GAI-based chats made available to the general public, numerous experiences and experiments have emerged involving the application of completely virtual patients, with fairly satisfactory results (Fernández-Alcántara et al., 2025; Barker, Moore & Cook, 2024; Benfatah et al, 2024; Holderried et al, 2024; Scherr et al, 2023).

At the Universitat Oberta de Catalunya (UOC), the teaching is designed based on situated learning, thus bringing students closer to real-life and professional situations with the aim of making the educational experience meaningful. In line with this pedagogical approach, generative artificial intelligence (GAI), such as Open AI's GPT models, is valued as a key technology for generating these interactions in e-learning training, with excellent prospects for the future.

This article presents the initial results of two innovative concept tests in which patients simulated using GAI were designed and created in the fields of nutrition and psychotherapy to help UOC students train in professional interaction.

As part of the tests, we created a GPT model to generate patient profiles with believable characteristics adapted to the context of therapeutic skills. A second model was then prepared, adapted to each of the selected disciplines and capable of interacting with these simulated patients, so that teachers could use them in the classroom for professional role-playing exercises with students.

The ultimate goal is to refine this system and make it scalable so that it can be applied to other disciplines, thereby offering a more realistic, flexible and personalised

educational experience within the context of each subject. The aim is not to replace real-life practices, but rather to prepare students for such practices.

Character profile creation with GAI

The first step of the project consisted of configuring a GPT model for character creation. This stage has been key to generating realistic and diverse profiles that can respond to different situations within the therapeutic professional environment, both for the subject of dietetics and nutrition and for psychology.

The objective was to obtain a solid base of simulated patients with distinctive characteristics, which would later be integrated into the second GPT model, specifically designed to act as an interactive role-playing simulator in the classroom. We began by generating an initial prompt to create profiles with different characteristics (gender, age, religion, origin), symptoms, and also different problems and therapeutic motivations, as well as three types of behaviour in relation to the therapist (psychological and emotional reactions, personal temperament, desire to collaborate).

The result has been the creation of patient profiles based on different case studies and behaviours. Below is an example of how the identity and profile of the characters are configured:

- Name and role: *Laura Martínez, final-year Law Degree student.*
- Context: *Visits the psychologist about anxiety issues.*
- Personality: *The student can choose between three different behaviour patterns: cooperative but insecure; resistant and defensive; or motivated but impatient.*

GAI simulator configuration

Next, we set up a second GPT to perform the simulation itself. The first step was to create the prompt and then feed it with the profiles of the characters created and a series of specific information from the medical discipline relevant to each case (nutrition and psychotherapy). Among the specifications provided to the GPT in the prompt to indicate how to act, we highlight the following:

- Objectives: *Ensure that the conversation remains clearly focused, while maintaining a positive emotional atmosphere*.
- Communication style: *Formal/informal, empathetic, neutral, assertive*...
- Historical record: *Memory capacity and recollection of previous interactions*.
- Context: *Generation of dynamic scenarios based on student responses*.
- Return: *Generation of feedback at the end of the intervention.*

Results

Despite using minimal resources, the tools used are widely available (although some, such as OpenAI's GPTs, require payment), and the result has been outstanding. A fluid and realistic conversation was achieved with the simulated character.

The results have shown a useful and engaging tool for conducting classroom exercises on therapeutic interactions with patients who, despite not being real, simulate human behaviour. The real-time feedback component aims to provide an added quality for students.

Subsequent validation by expert teachers in the disciplines covered has confirmed the potential of this type of simulation using generative AI.

Potential identified

From the tests carried out and subsequent feedback from teachers, some areas of potential have been identified. The many uses and potential benefits include training in professional communication skills in e-learning environments, training in specific skills for a particular profession, and bringing students closer to real professional environments.

Other opportunities identified include the scalability of uses in other areas of knowledge and the opportunity to offer students immersive experiences in a professional environment, which can increase the sense of authenticity that promotes professional identity among students, thereby better preparing them for the world of work.

Future actions

Although the logical progression of the results focuses on verifying these GPTs using animated avatars of virtual patients in real time, the same team has conducted a trial and temporarily rejected it because the technology does not have the necessary quality in relation to the results obtained with Chat GPT. The moment these tools are able to represent and interpret emotions, facilitate lip reading (SESN), etc., the potential could be extraordinary.

One action that may be carried out in the near future is the extrapolation of the GPT configured to other studies and with different levels of training. These types of tools could be extended to students or used in learning environments with the validation and involvement of

teachers, introducing greater refinement in accordance with different areas of knowledge.

Conclusion

The initial hypothesis was to verify whether the configured GPT was useful for training nutrition and psychotherapy professionals by playing the role of a patient. The result obtained has proven to be realistic, credible and plausible. In practice, and in view of future studies by the teaching staff, our hypothesis has been validated and has exceeded expectations.

This initial test demonstrates the usefulness of generative artificial intelligence, specifically GPT models, in creating realistic simulations to train professional interaction skills in virtual learning environments. The preliminary results, validated by expert teachers, suggest the potential of this technology to offer flexible, personalised and accessible practices, complementing existing methodologies and preparing students for real professional interactions. It is recommended to continue exploring and refining this approach, with the aim of integrating it into teaching practice and expanding its application to various disciplines.

References

Barker, L.A., Moore, J.D., & Cook, H.A. (2024). Generative Artificial Intelligence as a Tool for Teaching Communication in Nutrition and Dietetics Education—A Novel Education Innovation. *Nutrients*, 16(7), 914. https://doi.org/10.1080/02619768.2022.2134006.

Benfatah, M., Marfak, A., Saad, E., *et al.* (2024). Assessing the Efficacy of ChatGPT as a Virtual Patient in Nursing Simulation Training: A Study on Nursing Students' Experience. *Teaching and Learning in Nursing*, 19(3), e486–e493. https://doi.org/10.1016/j.teln.2024.02.005.

Buchholz, A.C. et al. (2020). Patient Simulations Improve Dietetics Students' and Interns' Communication and Nutrition-Care Competence. *Journal of Nutrition Education and Behavior*, 52(4), 377–384. https://doi.org/10.1016/j.jneb.2019.09.022.

Fernández-Alcántara, M., Escribano, S., Juliá-Sanchis, R., Castillo-López, A., & Pérez-Manzano, A. (2025). Virtual Simulation Tools for Communication Skills Training in Health Care Professionals: Literature Review. *JMIR Medical Education*, 11, e63082. https://doi.org/10.2196/63082.

Holderried, F., Stegemann-Philipps, C., Herschbach, L., *et al.* (2024). A Generative Pretrained Transformer (GPT)–Powered Chatbot as a Simulated Patient to Practice History Taking: Prospective, Mixed Methods Study. *JMIR Medical Education*, 10, e53961. https://doi.org/10.2196/53961.

Kasperski, R. & M. Hemi (2024) Promoting socio-emotional learning competencies in teacher education through online clinical simulations, *European Journal of Teacher Education*, 47:4, 805-820. https://doi.org/10.1080/02619768.2022.2134006

Moore, P., Leighton, M.I., Alvarado, C., & Bralic, C. (2016). Pacientes simulados en la formación de los profesionales de salud: el lado humano de la simulación. [Simulated patients in healthcare professional training: the human side of simulation.] *Chilean Medical Journal*, 144(5), 617–625. http://dx.doi.org/10.4067/S0034-98872016000500010

Scherr, R., Halaseh, F.F., Spina, A., Andalib, S., & Rivera, R. (2023). ChatGPT Interactive Medical Simulations for Early Clinical Education: Case Study. *JMIR Medical Education, 9,* e49877. https://doi.org/10.2196/49877.

Empowering Online STEM Labs with Generative AI: Real-Time Anomaly Detection and Adaptive Support Using LLMs

Dhouha Kbaier[1] and Andrew Mason[1]

[1] The Open University, Milton Keynes, UK

Abstract

OELAssist is a prototype AI-powered support system developed to enhance remote STEM education by providing real-time, personalised assistance through generative AI and large language models (LLMs). Designed for use within the Open Engineering Lab (OEL) at The Open University, the system monitors student interaction data during virtual lab sessions to identify signs of struggle or confusion. Using an anomaly detection model such as Isolation Forests, alongside classification models like Random Forests, the system identifies and classifies atypical behaviours and passes this information to a Retrieval-Augmented Generation (RAG) pipeline, which prompts an LLM to generate context-aware feedback for learners.

Currently in its pilot and testing phase, OELAssist is being trialled using historical and live experimental data from student engagement with pressure vessel activities. In the short term, the system aims to demonstrate the feasibility and potential impact of automated, AI-driven feedback to support learners in real-time, particularly in remote lab settings where instructor presence is limited.

In the longer term, if proven effective, the system could be scaled and integrated into remote STEM modules across disciplines, offering adaptive, data-informed support that helps reduce student frustration, close awarding gaps, and improve retention. This work highlights how generative AI, when combined with anomaly detection, can inform innovative, student-centred approaches to online lab education.

Keywords: remote STEM education, anomaly detection, generative AI, LLMs, adaptive feedback, online labs, learning analytics, OEL Assist, Open STEM Labs

Introduction

The growing reliance on online and remote learning in STEM disciplines has exposed challenges in delivering effective lab-based instruction without a physical presence. Remote labs, such as those operated by The Open University's Open STEM Labs, provide students with virtual access to real-world scientific instruments and data. However, the absence of immediate instructor guidance can leave students vulnerable when they encounter difficulties (Albert et al., 2022), which may go undetected until it is too late to intervene (Veletsianos & Houlden, 2020; Michel-Villarreal et al., 2023).

OELAssist is an exploratory system under development to address this gap. It builds on insights and methodologies from the Lab-Assist project (Kbaier, Lockett, & Kear, 2024; Kbaier *et al.*, 2024), which aimed to enhance student learning in remote lab environments through real-time support. Here, the tool aims to identify signs of student struggle in real time by analysing live experimental interaction data and delivering tailored feedback using large language models (LLMs). The system is currently being trialled with data from the Pressure Vessel experiment in the Open Engineering Lab. It employs machine learning techniques to classify behavioural anomalies and uses generative AI to offer feedback and guidance to students in the moment they need it.

This project represents an important step toward building intelligent, scalable support mechanisms for remote STEM education. Though still in its early stages, the potential implications for engagement, retention, and equity in online learning are significant.

Experiment context and data collection

The Pressure Vessel experiment, developed as part of an engineering module, enables students to perform real-time stress analysis remotely using physical apparatus located on campus. Students access the setup through a browser-based interface. The pressure vessel contains several embedded strain gauges, and oil is pumped into or out of the vessel via a remotely controlled motor to vary internal pressure. The resulting changes in strain gauge readings allow students to analyse stress and strain distribution within the vessel.

Student activity data is transmitted from the browser to the experiment in real-time via websocket connections, enabling immediate control of the physical setup. As experimental interactions stream through the websocket, the data is copied and compiled into a structured dataset. This process is supported by a multi-stage pipeline involving a reverse proxy and the LabVIEW architecture.

During a three-month period, approximately 400 students interacted with seven pressure vessels, generating over 400,000 datapoints.

To prepare the dataset for analysis, system-generated entries—such as hourly self-checks performed to verify equipment usability—were removed, as they do not reflect student activity. Records involving adjustments without motor engagement were also excluded. The dataset was further refined by discarding interaction intervals under 1 second and was augmented with calculated features such as motor engagement duration and average power.The final cleaned dataset retained ~27,000 valid interaction records across 490 student sessions.

System design and methodology

The OELAssist system operates in three key stages:

Data collection and cleaning

Student activity data from virtual lab sessions—such as motor activation, power levels, and response timing—is captured and processed. Irrelevant fields are removed, timestamps are standardised, and meaningful metrics like motor engagement duration are computed.

Anomaly detection

The cleaned data is first analysed using an unsupervised Isolation Forest algorithm to detect deviations from typical behavioural patterns (Liu et al., 2008). While this approach is fast and does not require labelled data, it offers limited interpretability. To address this, a supervised Random Forest classifier—trained on manually labelled anomalies from previous student interactions—is used to provide contextual information about the nature of the anomalous behaviours (Ahmed et al., 2016).

Early modelling experiments included sequential rule mining and Compact Prediction Tree (CPT) techniques. However, these approaches proved insufficient for the real-time, reactive context of lab-based interaction.

Isolation Forest was selected for its unsupervised operation, predictive speed, and effectiveness at detecting outliers in multidimensional data. It successfully identified outliers in behavioural patterns without needing pre-labelled data. A 2% contamination threshold applied to the final cleaned dataset yielded 554 anomalies. These included behaviours such as increasing the pressure beyond advised limits and failing to switch off the motor after reaching the lower pressure threshold.

The Random Forest classifier was trained using the anomalies identified by the Isolation Forest algorithm and labelled through expert analysis. It was designed to complement the unsupervised model by improving the interpretability of detected anomalies. This classification model provided contextual information that enabled the system to deliver targeted feedback to students. Both models were tested on a hold-out dataset of 40 student sessions to evaluate classification accuracy, interpretability and consistency.

Adaptive feedback generation

Once anomalies are detected and categorised into types based on behavioural patterns (e.g., prolonged motor use in reverse at high power), they are passed to a Retrieval-Augmented Generation (RAG) pipeline (Lewis et al., 2020). The RAG layer enriches the prompt with relevant contextual information, allowing the LLM to generate guidance specific to the student's situation (Zheng et al., 2024). The LLM returns natural-language guidance tailored to the specific issue, which can be shared with the student and, when necessary, flagged to an instructor for manual follow-up. Guidance returned includes prompts such as:

- "You seem to be running the motor at a very low power. You could run the motor at a higher power setting, in the forward direction to increase the pressure more rapidly."
- "You seem to be overcautious. It is okay to increase the power of the motor, to decrease the amount of

time the motor is running and enable you to complete the activity within the allotted time."

While still being tested, these outputs demonstrate the system's capacity for responsive, student-centred feedback.

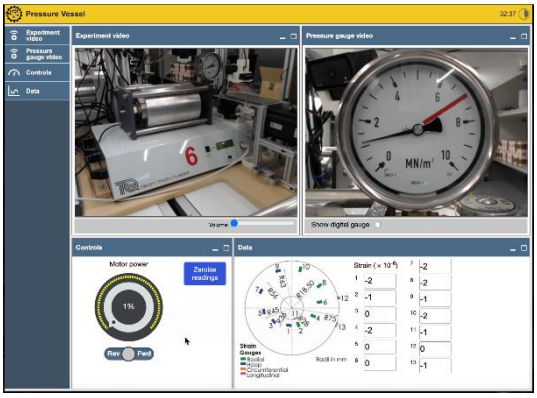

Figure 1: T272 Pressure Vessel Experiment

Pilot deployment and early observations

Preliminary trials involved analysing student activity data from historical sessions. Anomalies were defined based on thresholds of duration, direction, and power. For instance, increasing the pressure using prolonged motor engagement at 100% power for 20 seconds, or decreasing the pressure at 5% power for 60 seconds, was flagged as potentially problematic.

Initial results showed that students who generated multiple anomalies often struggled with task completion. These cases were used to refine the detection logic and form the basis of LLM prompts.

Challenges and limitations

While early results are promising, several challenges and limitations remain. The generalisability of the system is currently restricted, as it has only been trialled on a single experiment; applying it to other laboratories will necessitate the development of new models and retraining. Additionally, the system may produce false positives by misclassifying normal behaviour as anomalous, highlighting the need for ongoing refinement of thresholds and categorisation. Large Language Models (LLMs) also present limitations, as they often lack domain-specific knowledge and rely heavily on well-crafted prompts and relevant context—typically provided through Retrieval-Augmented Generation (RAG)—to deliver accurate advice. Furthermore, OELAssist has not yet been integrated into live modules and remains in the research and evaluation stage.

Conclusion

OELAssist illustrates a novel approach to supporting students in online STEM labs through AI-powered anomaly detection and real-time feedback using LLMs. Though still in development, early trials suggest that such systems could greatly enhance student experience, reduce attainment gaps, and increase retention in remote learning environments. This work expands on earlier initiatives, such as Lab-Assist, which sought to improve the experience of students using online labs by providing live support (Kbaier et al., 2024). Future work will focus on refining the model, reducing false positives, integrating with existing learning analytics, and scaling to other experimental contexts (Holstein et al., 2020; Roll & Wylie, 2016). Based on this pilot, future phases will explore integration into module-level dashboards and broader learning analytics frameworks to support early interventions.

Comparable examples

Comparable approaches include AI-enhanced tutoring systems in Massive Open Online Courses (MOOCs) and real-time dashboards for at-risk student identification in learning analytics platforms. However, few examples combine anomaly detection with generative AI for adaptive support in live remote labs. OELAssist aims to fill this gap, offering a more responsive, student-centred alternative to static digital resources.

References

Ahmed, M., Mahmood, A. N., & Hu, J. (2016). A survey of network anomaly detection techniques. *Journal of Network and Computer Applications*, *60*, 19-31. https://doi.org/10.1016/j.jnca.2015.11.016

Albert C.M. Yang, Irene Y.L. Chen, Brendan Flanagan, Hiroaki Ogata, How students' self-assessment behavior affects their online learning performance, Computers and Education: Artificial Intelligence, Volume 3, 2022, 100058, ISSN 2666-920X. https://doi.org/10.1016/j.caeai.2022.100058

Holstein, K., Wortman Vaughan, J., Daumé III, H., Dudik, M., & Wallach, H. (2019, May). Improving fairness in machine learning systems: What do industry practitioners need?. In *Proceedings of the 2019 CHI conference on human factors in computing systems* (pp. 1-16). https://dl.acm.org/doi/abs/10.1145/3290605.3300830

Kbaier, D., Lockett, H., & Kear, K. (2024). Lab-Assist: Enhancing STEM education through online laboratories with real-time support. In Empower Envisioning Report 2024 (8th

ed.). European Association of Distance Teaching Universities. Retrieved from https://zenodo.org/records/11653241 (DOI: 10.5281/zenodo.11653241)

Kbaier, D., Kear, K., Lockett, H., Sykes, P., Long, S. (2024). Enhancing Student Learning in OpenSTEM Labs Through Live Support: The Lab Assist Project. In: Hong, W., Kanaparan, G. (eds) Computer Science and Education. Educational Digitalization. ICCSE 2023. Communications in Computer and Information Science, vol 2025. Springer, Singapore. https://doi.org/10.1007/978-981-97-0737-9_29

Lewis, P., Perez, E., Piktus, A., Petroni, F., Karpukhin, V., Goyal, N., ... & Riedel, S. (2020). Retrieval-augmented generation for knowledge-intensive NLP tasks. *Advances in Neural Information Processing Systems*, *33*, 9459–9474. https://proceedings.neurips.cc/paper/2020/hash/6b493230205f780e1bc26945df7481e5-Abstract.html

Liu, F. T., Ting, K. M., & Zhou, Z.-H. (2008). Isolation forest. *2008 Eighth IEEE International Conference on Data Mining*, 413–422. https://doi.org/10.1109/ICDM.2008.17

Michel-Villarreal, R., Vilalta-Perdomo, E., Salinas-Navarro, D. E., Thierry-Aguilera, R., & Gerardou, F. S. (2023). Challenges and Opportunities of Generative AI for Higher Education as Explained by ChatGPT. *Education Sciences*, *13*(9), 856. https://doi.org/10.3390/educsci13090856

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. *International Journal of Artificial Intelligence in Education*, *26*(2), 582–599. https://doi.org/10.1007/s40593-016-0110-3

Veletsianos, G., & Houlden, S. (2020). Radical flexibility and relationality as responses to education in times of crisis. *Postdigital Science and Education*, *2*(3), 849–862. https://link.springer.com/article/10.1007/s42438-020-00196-3

Zheng, L., Fan, Y., Chen, B., Huang, Z., LeiGao, & Long, M. (2024). An AI-enabled feedback-feedforward approach to promoting online collaborative learning. *Education and Information Technologies*, *29*(9), 11385-11406. https://link.springer.com/article/10.1007/s10639-023-12292-5

UNINETTUNO International Telematic University gets its own artificial intelligence: SOCRATES AI

"I am Socrates AI, your guide in the digital universe of UNINETTUNO,
I will accompany you in your quest for knowledge..."

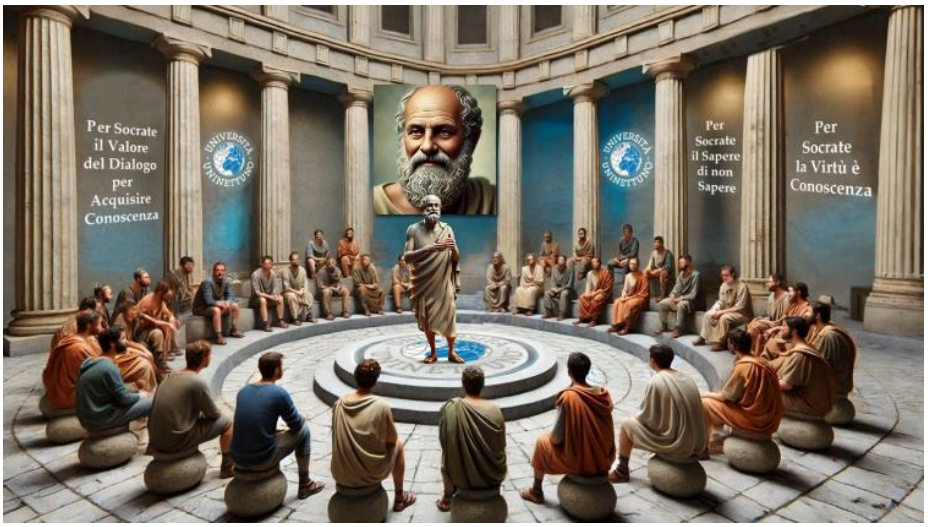

Figure 1: 'Main screen of Socrates AI'

Prof. Maria Amata Garito[1]

Emeritus Professor of Psycotechnologies, President/Rector of UNINETTUNO International Telematic University

[1]International Telematic University UNINETTUNO

Abstract

Socrates AI is the artificial intelligence model developed by the UNINETTUNO International Telematic University as a synthesis between wisdom of the past and innovation of the present: it is not a simple virtual assistant, but a real digital training model designed to stimulate critical thinking and offer answers based on scientifically verified content, coming from the educational cyberspace of the digital platform of UNINETTUNO and developed following advanced psycho-pedagogical models inspired by the latest cognitive and connectionist theories. Its training takes place on certified academic sources drawn from more than 100,000 hours of video lectures and millions of pages: scientific articles, books, forums, bibliographies and reasoned sitographies, exercises and interactive classes etc., created by teachers from many prestigious Italian universities and several countries around the world. Socrates AI does not represent only a technological achievement, but a real vision that becomes a method and helps to develop a correct use of artificial intelligence, transferring to the younger generations the skills necessary to make them capable of mastering technology, rather than being mastered by it.

Keywords: Socrates AI, Artificial intelligence, Critical thinking, Technological innovation, Socratic dialogues, Maieutics

Introduction

The International Telematic University UNINETTUNO is among the first academic institutions in the world to have developed its artificial intelligence, Socrates AI, confirming itself at the forefront in the application of technological innovations within its University model. This system is in continous evolution and has been developed over many years of research that I started already in 1991, when I was Director of CATTID (Center for Applications of Television and Technologies of Distance Education) at the University of Rome "La Sapienza", with the publication of the article "Artificial Intelligence in Education: Evolution of the Teaching-Learning Relationship" in the *British Journal of Educational Technology*[1], and carried on with the creation of the Artificial Intelligence Research and Development Center of the UNINETTUNO University.

Socrates AI: a generative AI inspired by Socratic maieutics and based on a database of scientifically verified academic sources

Socrates AI was created on the basis of a unique model, inspired by the Socratic method, which places the dialogic interaction between the human mind and artificial intelligence at the centre. It is not a search engine, and it does not merely provide automatic answers: Socrates AI was created to critically interrogate knowledge, offering answers based on scientifically verified content from the educational cyberspace of the University's digital platform and developed following advanced psycho-pedagogical models inspired by the latest cognitive and connectionist theories.

Thus, the training of Socrates AI takes place on certified academic sources drawn from more than 100,000 hours of video lectures and millions and millions of pages: scientific articles, books, forums, bibliographies and annotated sitographies, exercises and interactive classes etc., made by the professors of many prestigious Italian universities and several countries of the world, already from the experience of Consorzio Nettuno born in 1992[2], a network of 41 Italian public universities and 31 foreign universities, evolved in 2005 into the International Telematic University UNINETTUNO. Today, this content is linked to the curricula of the 31 bachelor's and many master's degree programs of the University's 5 Faculties of Cultural Heritage, Economics and Law, Engineering, Psychology and Communication Sciences.

The most profound value of UNINETTUNO's Socrates AI lies in its ability to stimulate critical thinking in students through targeted questions and dialogic strategies that transform artificial intelligence into a conscious educational ally, placing the student at the center of its educational process[4]. The goal of Socrates AI is not to provide pre-packaged answers, to be passively assimilated, but to accompany the student on a learning journey that, through proper questioning of the system, just as in the Socratic maieutics from which it takes its name, develops active and dialogic reflection. We are living through a profound anthropological transformation[3], in which artificial intelligence should not replace thinking, but stimulate students to ask questions, establish connections between areas of knowledge, and maintain a constant and critical dialogue with AI tools.

Conclusion

The adoption of Socrates AI is part of the broader vision of UNINETTUNO, a University that has revolutionized access to knowledge by overcoming geographic and temporal barriers. With an academic community composed of students and faculty from 167 countries, the University has built a global and intercultural educational ecosystem, supported by a model founded on five key values: education, research and innovation, internationalization, inclusion and passion.

Socrates AI is the encounter between the wisdom of the past and the innovation of the present: with this in mind, we would like to emphasize that Socrates AI does not only represent a technological achievement, but a real vision that becomes a method and helps develop the proper use of artificial intelligence, transferring to the younger generations those skills necessary to make them capable of dominating technology, rather than being dominated by it.

References

[1]Garito, M.A. (1991). Artificial Intelligence in Education: Evolution of the Teaching - Learning Relationship. *British Journal of Educational Technology*, 22 (1), 41-47**.**

[2,3]Garito, M.A. (2024). New Models of University for the Digital Society. In E. Vendrell Vidal, U.R. Cukierman, M.E. Auer (eds.), *Advanced Technology and the University of the Future*, 259-280. Springer Nature.

[4]Garito, M.A., Breda, M. (2025). Generative AI, a New Model for Knowledge Memorization. The Specific Case of the International Telematic University UNINETTUNO. In M.E. Auer, D. May (eds.), 2024 Yearbook Emerging Technologies in Learning, 85-110. Springer Nature.

Bridging the Language Divide: Harnessing Generative AI for Inclusive, Immersive Education

Hanna Kristín Skaftadóttir [1] Galena Pisoni[2]

[1] Bifröst University
[1] York St. John University

Abstract
Roughly 40% of learners worldwide study in a language they do not fully understand, which undermines equity and outcomes. This paper outlines a rapid workflow that pairs large language models (LLMs) with avatar-video tools to deliver multilingual, culturally tuned instruction. Instructors feed course outlines into standardized ChatGPT prompts, which automatically yield structured scripts that can be translated into the target language. Scripts are then uploaded to Synthesia, where lifelike avatars voice the lessons in 120 + languages, creating polished videos in minutes—no studio or dubbing required.

Keywords: Generative AI, Multilingual Education, Inclusive Learning, Synthesia, Avatar-Based Instruction, Digital Inclusion, Global Access to Education

Introduction

Global education faces a persistent language divide that limits access to learning for millions. UNESCO estimates that approximately 40% of the world's population lacks access to education in a language they speak or understand (UNESCO, 2024). This linguistic barrier can alienate learners and undermine educational equity. Generative artificial intelligence (GenAI) offers a new opportunity to bridge this gap by rapidly creating content in multiple languages and formats. Tools like large language models (e.g., ChatGPT) and AI-driven video platforms (e.g., Synthesia) are emerging as powerful aids to generate multilingual educational materials at scale. These technologies can be used for more inclusive and immersive learning experiences by delivering content in learners' native languages and engaging modalities. This paper examines how generative AI and avatar-led videos can be leveraged to enhance access in higher education and online schooling, while discussing the benefits, challenges, and ethical implications of this approach. Ultimately, leveraging generative AI for multilingual education could catalyze greater global inclusion, aligning with the vision of equitable, quality education for all.

Generative AI for Multilingual Content Creation

Generative AI tools, such as ChatGPT, have demonstrated a remarkable ability to generate human-like text in multiple languages, making them valuable for producing educational content that transcends linguistic boundaries. These models are trained on vast multilingual datasets, enabling them to output text in languages ranging from major world languages to some low-resource languages. In educational contexts, this means instructors or designers can use standardized prompts to create lesson materials, explanations, or assessments in multiple languages with consistent quality and pedagogy. For example, a faculty member could craft a well-structured prompt in English asking for an explanation of a scientific concept, then instruct ChatGPT to produce that explanation in Spanish, Arabic, or Hindi, thereby yielding parallel learning resources for different student groups. By using carefully designed prompt templates, educators ensure that core content remains aligned with learning objectives across all languages while allowing the AI to handle nuances related to

translation and cultural adaptation. Early research suggests that large language models can facilitate rapid multilingual content generation and personalization, thereby enhancing accessibility for non-English-speaking learners (Kohnke et al., 2023). Moreover, generative AI can be used to create glossaries, summaries, and quiz questions in a target language, helping to standardize the depth and coverage of material students receive (Stefaniak & Moore, 2024). This capability addresses the historical disparity where educational resources have been overwhelmingly available in a few dominant languages. By lowering the barrier to produce high-quality translations or original content in local languages, generative AI tools hold promise for democratizing knowledge and narrowing language-based inequities in education. However, realizing this potential requires careful prompt engineering and review to ensure accuracy and appropriateness of AI-generated content in each language.

From Text to Avatar: AI Video Platforms for Immersive Learning

While text-based materials are essential, not all learners thrive solely on text, especially in online and distance education. This is where AI-powered video generation platforms, such as Synthesia, come into play, converting written content into spoken-word multimedia presentations led by lifelike virtual avatars. These platforms allow educators to take a script (for instance, a lecture or explanation generated by ChatGPT) and quickly produce a video of a realistic presenter delivering the content in any of over 120 languages and accents (Synthesia, 2023). The result is a more immersive learning resource: students can hear and see an instructor figure explaining concepts, which can improve engagement and comprehension compared to static text. Crucially, the avatar can be chosen or customized to reflect diverse genders, ages, or ethnic backgrounds, helping students feel represented and culturally comfortable. The accessibility advantages are significant— videos can include subtitles in multiple languages or AI- generated captions for learners with hearing impairments, creating a multimodal educational experience.

A notable example of this approach is the case of IU International University of Applied Sciences in Germany, which adopted AI video generation to enhance its online courses. With over 100,000 students worldwide, IU needed to produce thousands of consistent, high-quality lecture videos without the cost and delays associated with traditional filming (Dang et al., 2024). By implementing a generative AI pipeline, the university can generate lecture summaries via language models and then use Synthesia to create instructor-led videos from these summaries. This approach has enabled IU to integrate AI-generated videos into approximately 100 courses in under a year (Synthesia, 2023). In practice, what once took months of studio recording and editing can now be done in a matter of days. The university reports that video production time was reduced from several months to about two weeks, allowing for much faster updates and iteration of course content (Synthesia, 2023). This agility is instrumental in rapidly evolving fields or when curriculum changes—an AI- generated avatar video can be updated almost on the fly, ensuring students always have up-to-date information.

Benefits for Inclusion and Access

Generative AI text paired with avatar-based video can markedly widen inclusion and access in higher education and online learning. Its chief advantage is linguistic: course materials appear in each learner's mother tongue, sparing international or non-English-speaking students the cognitive load of a second language. Native-language instruction enhances comprehension, confidence, and participation (UNESCO, 2024), allowing multilingual AI content to re- engage students who language barriers have previously sidelined.

AI also slashes the cost and effort of localisation—conventional translation, combined with studio recording, limits multilingual offerings to high-demand courses. By contrast, instructors can now translate and voice even niche subjects into several languages at negligible marginal cost, extending specialised knowledge to smaller language communities and letting modest institutions compete on equal footing. The modality itself boosts inclusion. Many learners—especially those with disabilities or limited literacy—grasp material more easily through audiovisual resources than dense text. A Synthesia-style avatar speaking clearly in the student's language, supported by slides and captions, makes complex concepts digestible and can be paused or replayed at will. Asynchronous videos also suit working adults and low-bandwidth settings. Early pilots show higher engagement when content is delivered in interactive, personalised formats (Fitas, 2025).

AI-generated multilingual, multi-format content can greatly expand equitable access to higher education and online schooling, accommodating diverse languages, regions, and learner needs while keeping production practical and affordable.

Several challenges temper the promise of Generative AI for inclusive education. Foremost is content quality: large language models sometimes "hallucinate," creating inaccurate or misleading explanations. Without rigorous human review, students could receive flawed information. Automated translations also err—missing nuance or cultural

context—and may reinforce biases if left unchecked (Stefaniak & Moore, 2024).

Bias itself is a second concern. Because AI is trained on internet data, it can inherit stereotypes or underperform in minority languages, thereby widening rather than closing the digital language gap (Ta & Turner Lee, 2023).

Diversifying training data, refining prompts, and engaging native-language reviewers are essential, as is global governance to ensure linguistic equity. Authenticity and trust pose additional issues. Learners may question AI- generated avatars or materials; transparent disclosure is vital. Institutions must also safeguard student data when AI systems personalize content, ensuring compliance with relevant privacy regulations.

Finally, the rapid adoption of AI raises questions of intellectual property and academic integrity—who owns AI outputs, and how can plagiarism or deepfakes be prevented? UNESCO emphasizes that realizing AI's educational benefits requires robust ethical oversight, clear quality control policies, and a well-defined balance between AI tools and the irreplaceable role of human teachers (UNESCO, 2023).

Conclusion

Generative AI text tools coupled with AI-driven video platforms signal a pivotal shift in global education. Used wisely, they can bridge the language divide, delivering inclusive, immersive learning to students anywhere. Courses once limited to English can now appear through lifelike avatar instructors in dozens of languages, giving non-English speakers equal footing. A rural learner with only a smartphone can access high-quality lectures in their native language, a prospect that brings education closer to Sustainable Development Goal 4 on equity and inclusion.

To realize this potential, institutions should launch pilot projects, track learning and engagement data, and share best practices on multilingual prompt design and ethical safeguards. Faculty need training to utilize AI as an assistant, thereby freeing up time for interactive teaching and mentoring. IU International University's rapid rollout of AI-generated videos demonstrates that thoughtful integration can expand access without compromising quality. Accuracy, bias, and privacy challenges remain, yet diligent oversight and inclusive design can mitigate them.

Ultimately, generative AI can dissolve barriers of language and distance, creating a learning ecosystem where knowledge knows no borders. With ongoing collaboration and ethical vigilance, it can help fulfil the promise of education for everyone, everywhere.

References

Fitas, R. (2025). *Inclusive education with AI: Supporting special needs and tackling language barriers* [Preprint]. arXiv. https://arxiv.org/abs/2504.14120

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *RELC Journal, 54*(2), 537–550. https://doi.org/10.1177/00336882231162868

Stefaniak, J. E., & Moore, S. L. (2024). The use of generative AI to support inclusivity and design deliberation for online instruction. *Online Learning, 28*(3), 181–205. https://doi.org/10.24059/olj.v28i3.4458

Synthesia. (n.d.). *How IU teaches 100,000 students with AI generated videos* [Case study]. Retrieved June 16, 2025, from https://www.synthesia.io/case-studies/iu-university

Ta, R., & Turner Lee, N. (2023, October 24). How language gaps constrain generative AI development. *The Brookings Institution*. https://www.brookings.edu/articles/how-language-gaps-constrain-generative-ai-development/

UNESCO. (2023). *If you don't understand, how can you learn?* (Policy Paper 24). Paris, France: UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000243713

UNESCO. (2024). *Multilingualism and language diversity for inclusion in education: Brief on inclusion in education*. Paris, France: UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000389960

CIBERPROXY: Immersive Tech to Combat and prevent (Cyber) Bullying in Educational Contexts

Cristina Sánchez Romero[1], Javier Gil Quintana[1] and Miguel Romero Hortelano[3]

[1] National Distance Education University, Faculty of Education
[2] National Distance Education University, ETSI. Informatic

Abstract

The National Distance Education University (UNED) leads a groundbreaking initiative to prevent bullying and cyberbullying through the immersive platform developed under the project Proximity Cyberbullying: How to Prevent It through Gamification with the Metaverse?. This innovative approach introduces the Metaverse as a transformative educational tool to promote empathy, civic-mindedness, and responsible digital behavior.

At the heart of the project is CIBERPROXY, a platform that combines gamification, Virtual Reality (VR), and Artificial Intelligence (AI) to simulate real-life bullying and cyberbullying situations. Aimed at primary and secondary students, the experience unfolds through educational escape rooms—immersive, multisensory environments where users collaborate, make decisions, and reflect on the consequences of their actions. AI-generated dialogues and dynamic, emotionally charged scenarios enhance realism and engagement.

A key innovation is the partnership with the Spanish National Police, who are integrating CIBERPROXY into their school-based prevention workshops. This collaboration amplifies the emotional and cognitive impact of anti-bullying messages, especially among vulnerable groups, including those at risk due to disability, gender, ethnicity, or sexual orientation.

By merging immersive technology with social education, CIBERPROXY not only supports prevention but also develops students' digital and socio-emotional skills, reinforcing UNED's leadership in the ethical use of emerging technologies to foster safer and more inclusive school environments.

Keywords: Metaverse, Immersive education, cyber-bullying, innovation, prevention, Vulnerability groups.

Introduction

Since its inception, the phenomenon of cyberbullying has been addressed in the school context from multiple perspectives, encompassing educational policies, gender differences, legal frameworks, and the analysis of individual and emotional factors involved (Shariff, 2007). Experts and institutions have emphasized the need to promote digital and media literacy as key tools to confront this issue (Mishna et al., 2009). In line with this approach, UNESCO (2017) defines school bullying as a set of intimidating behaviors that may manifest physically —such as hitting, kicking, or property damage— verbally —through threats, insults, or teasing— or relationally —via social exclusion or rumor-spreading. These behaviors are characterized by repetition, a deliberate intent to cause harm, and a negative impact on the victim, who often feels helpless and vulnerable in the face of an aggressor, within a context marked by a real or perceived power imbalance.

School bullying is a prevalent problem among school-age children and adolescents (Juvonen & Graham, 2014), distinguished by the repetition of aggressive behaviors and

the existence of power disparity (Smith, 2016). Within this framework, educational institutions play a fundamental role in prevention and intervention, taking responsibility for detecting subtle signs of intimidation, establishing clear definitions, and implementing effective mechanisms to manage these behaviors within the school environment.

A comprehensive study by Wang, Iannotti, and Nansel (2009) revealed that the prevalence of bullying in different school contexts was 20.8% in the physical domain, 53.6% verbal, 51.4% social, and 13.6% electronic. Moreover, the data showed that boys tended to engage more in physical or verbal bullying, while girls predominantly participated in relational forms. Additionally, boys were more likely to be cyberbullies, whereas girls were more prone to being victims of cyberbullying. These findings indicate that cyberbullying exhibits distinct characteristics and dynamics compared to traditional bullying.

Furthermore, the importance of designing and implementing specific Internet safety and cyber-risk prevention programs has been highlighted (Kowalski & Fedina, 2011; Wang et.al., 2009). In this context, the platform we have developed—based on gamified scenarios within the metaverse—aligns with current strategies for preventing school bullying and cyberbullying. Gamification—understood as the application of game design elements and mechanics in non-game contexts to motivate participation and learning.

Schawtz, Mayeux, and Harper (2011) examined patterns of engagement in cyberbullying and four types of traditional bullying (physical, verbal, social exclusion, and rumor spreading) using latent class analysis (LCA) with data from the 2005–2006 Health Behavior in School-aged Survey, involving 7,508 U.S. adolescents in grades 6 through 10. The study identified three latent classes for each gender: All-Types Bullies, Verbal/Social Bullies, and Non-Involved. Boys were more likely to be All-Types Bullies, with bullying behaviors peaking in grades 6-8. The All-Types Bullies showed the highest risk for externalizing problems such as substance use and carrying weapons, while Non-Involved adolescents showed the lowest risk. The findings highlight that cyberbullies are often part of a broader group of highly aggressive adolescents engaging in all types of bullying, suggesting that interventions should focus on this high-risk group.

This finding does not only improve our understanding of the relation between cyber bullying and traditional bullying, but it also suggests that prevention and intervention efforts could target cyber bullies as a high-risk group for elevated externalizing problems.)—has consolidated as an innovative tool for teaching.

Basten (2017) defines gamification as the use of video game dynamics to structure environments that foster active participation. From the perspective of innovative learning environments, gamification emerges as an effective educational resource to address diverse topics, as Huang and Soman (2013) question: what can be learned through play? Our work applies this same philosophy to integrate gamification into educational processes aimed at bullying prevention.

Regarding the metaverse, Bolger (2021) describes it as an omnipresent manifestation of technological culture with a global impact that unfolds first in knowledge, then in social interactions, and finally in the geospatial dimension. Artificial intelligence, the technological foundation of the metaverse, will digitally connect all entities on the planet, creating a three-dimensional layer of information and experiences that constitute the metaverse.

In this regard, Siyaev and Jo (2021) explain how metaverses integrated into everyday life generate immersive virtual experiences that overlay the physical world. These three-dimensional environments allow people to interact as avatars with each other and with software agents, using real-world metaphors but without the inherent physical limitations (Davis et al., 2009). These authors also highlight the metaverse's potential as a platform for virtual team collaboration and global cooperation, providing an interactive experience that replicates real environments. Kumar (2024) emphasize that the metaverse constitutes a continuous and persistent virtual world where users can move freely without predefined objectives.

We have chosen to leverage this disruptive technology to address a key yet often invisible dimension of school bullying and cyberbullying: the role of the Observer. This concept, developed within the CIBERPROXY platform in the Metaverse by Sánchez Romero (2025), highlights the critical importance of this actor in bullying dynamics—an unresolved challenge. According to the author, "Observers hold significant power within bullying and cyberbullying dynamics. Their actions can prevent greater harm or, conversely, through inaction, facilitate the continuation of violence. While some intervene to stop bullying, others remain passive, which can exacerbate the victim's experience." To address this issue, we have designed gamified sessions aimed at raising awareness and empowering students to become active defenders. Through immersive experiences—such as the use of Oculus headsets

in metaverse environments that enable adopting the victim's perspective—participants develop empathy by firsthand experiencing the emotional impact of bullying and cyberbullying. This first-person immersion deepens their understanding and fosters responsible actions, such as reporting incidents and seeking support from trusted adults or peers. Ultimately, these experiences aim to transform passive observers into proactive agents of change, playing a vital role in building safer and more inclusive school communities.

CIBERPROXY: Immersive Tech to Combat Bullyin

CIBERPROXY: An Innovative Virtual Reality and Gamification Platform for Raising Awareness on School Bullying and Cyberbullying is a cutting-edge tool developed to address the urgent need for effective prevention and education in the fight against bullying and cyberbullying in schools. By leveraging immersive virtual reality experiences and gamified learning, CIBERPROXY empowers students and educators to recognize, understand, and actively respond to bullying behaviors, fostering safer and more inclusive educational environments.

CIBERPROXY is a platform developed by the National University of Distance Education (UNED) that combines immersive virtual reality and gamification technologies with the aim of raising awareness among students, educators, and educational communities about school bullying and cyberbullying. Through this tool, participants embody avatars in simulated school violence scenarios, where interactions and realistic dialogues are generated by artificial intelligence, providing an immersive and reflective experience that facilitates understanding of bullying dynamics.

The metaverse is a relatively new disruptive technology, and there has been little research on its use for creating gamified learning content aimed at preventing and intervening in situations of (cyber)bullying. According to Kumar (2024), the metaverse is a continuous and persistent virtual world that allows users to freely navigate without predefined goals. This potential offers the possibility to mediate direct educational experiences related to bullying and gender-based violence. Through Virtual Reality, users can fully immerse themselves in the simulated environment, adopting a first-person perspective that elicits emotional and cognitive responses similar to those experienced in real-life situations.

In this context, the use of digital platforms like CIBERPROXY, which integrates gamified scenarios such as escape rooms, enables teachers to work collaboratively with students to address bullying and cyberbullying in an interactive and experiential manner. Guided by an intelligent chatbot, students engage in conflict resolution and decision-making processes, fostering critical and collaborative reflection that enhances prevention and positive coexistence in the classroom.

Therefore, an innovative and gamified platform is presented that addresses a social and educational problem that remains unresolved, generating a significant impact.

Materials and Methods

This section details the requirements according to the various aspects that affect the choice of technological tools, hardware and software, for developing the work.

Requirements

This section describes the fundamental requirements that guided the development of the system, which are listed in the following:

- Use of open and royalty-free standards.
- Minimize cost and hardware requirements for execution, enabling replicability.
- Extensible design that allows the integration of new resources within the immersive environment.
- Minimize the need for additional software (plug-ins) to ensure ease of portability.

Technology selection

This section describes and analyses the selection of technologies in accordance with the specific requirements for developing the system.

Hardware: The metaverse application under consideration, along with the immersive technologies that support it, aims to fully immerse the user within a digital environment, thereby eliciting a sense of presence and direct engagement with that environment. Achieving this objective necessitates the use of hardware capable of rendering a fully simulated Virtual Reality (VR) space that effectively isolates the user from the physical world. Therefore, it is necessary to have a computer with graphics card (GPU) capable of rendering a realistic 3D environment in real time.

Moreover, to ensure a fully immersive experience, it is essential to equip the student with a virtual reality headset.

This device allows the user to perceive metaverse-generated visuals projected directly onto their eyes, accompanied by ambient audio. The headset is outfitted with the necessary sensor systems to accurately track head movements, thereby translating them into corresponding movements within the metaverse's three-dimensional virtual environment. In order to complete the immersion within the metaverse environment, the student is also equipped with haptic sensors that can be held in the hands, allowing them to navigate through the three-dimensional environment and receive tactile feedback in the form of vibrations.

Finally, our system includes a screen of sufficient size to allow the rest of the students in the classroom to observe the actions and interactions with the metaverse elements performed by the student engaged in the immersive experience.

Figure 1 shows the hardware components of our system deployed on a testbench conducted in a real classroom in collaboration with the Spanish police.

Figure 1: System hardware components. (1) Computer with 3D graphics card, (2) Virtual reality headset, (3) haptic sensors and (4) TV screen.

Software: Our metaverse is based on a virtual environment that enables the immersion of one or more users into a digital reality within a school setting. This environment must be generated in three-dimensional space using a 3D engine capable of rendering scenes compatible with WebGL technology. WebGL is an open, cross-platform, and royalty-free web standard based on the well-known 3D graphics API OpenGL ES (Open Graphics Library for Embedded Systems).

The 3D scene is rendered within an HTML5 canvas, making it executable in any web browser without the need for additional plug-ins, as long as the platform supports OpenGL 2.0 or OpenGL ES 2.0.

WebGL is developed and maintained by the non-profit technology consortium known as the Kronos Group (2025)

OpenGL runs on the 3D graphics card (GPU) of the computer where the browser is executed. The management of other client-side resources, such as memory, is handled using other standard components like the JavaScript language, which is also natively implemented as part of the web browser.

The scene is rendered in such a way that the student participating in the immersive experience is represented through an avatar that interacts with and responds to the surrounding environment. As it is shown in *Figure 2*, the avatar of the student can be observed approaching a group of individuals who may be engaging in bullying behaviour towards another person.

Figure 2: Student avatar approaching a group of individuals engaging in bullying.

Gamification: is an educational technique that incorporates game design elements and mechanics using Information and Communication Technologies (ICT). This trend, extensively analyzed by various authors, has already been established in the educational field. In this regard, Su and Cheng (2015) explain how gamified learning, through a series of activities based on gamified mobile systems, can positively influence the educational process. The results indicate that integrating mobile devices into learning helps improve academic performance and increase student motivation.

For this project, structured scenes will be developed to foster participants' engagement and self-direction in problem-solving, as proposed by Basten (2017).

This project incorporates gamified escape rooms as interactive scenarios that encourage collaboration, critical thinking, and active problem-solving in a dynamic and engaging learning environment (Figure 3)

Figure 3. Use of the CIBERPROXY in the classroom. A student acts as a bystander to bullying on the playground.

Furthermore, the design of the bullying problem will be addressed through realistic scenes set in the metaverse, thus facilitating an immersive and contextualized experience.

Implemented:

The platform has been implemented in six high schools in Spain, involving approximately 150 students, and in educational centers in Paraguay, with around 180 participants, all between the ages of 14 and 16. The data collected confirms that students show high motivation to engage with this immersive technology. When viewing the scenes, they clearly identify bullying situations, observe how a person is being harassed, and hear the insults, which creates a realistic and meaningful experience. Furthermore, when interacting with the chatbot tool, they are given the opportunity to make decisions and receive guidance on how to report the problem. This gives a central role to the bystander, turning them into an active agent for the prevention and intervention of school bullying.

In addition, the platform has been presented to international experts from Portugal, Bulgaria, Bristol, Turkey Paraguay, Mexico, and Spain, who have positively evaluated and shown interest in this innovative approach to addressing a social and educational issue. They recognized the potential of using immersive technology to raise awareness and promote sensitivity toward the problem of (cyber)-bullying.

It has also been presented to parent associations and groups, as well as to early childhood care professionals who work in the prevention of risk situations, all of whom have positively evaluated this innovation. They highlighted the platform's potential as an effective educational tool for raising awareness, fostering empathy, and promoting early intervention in situations of bullying and digital risk.

Conclusion

CIBERPROXY is an innovative platform developed by UNED that combines immersive virtual reality, artificial intelligence (AI), and educational gamification to raise awareness and promote understanding of bullying and cyberbullying in schools. Through simulated environments, participants take on the role of avatars involved in school violence scenarios, allowing them to experience, from an empathetic and reflective perspective, the different roles within the bullying triangle (aggressor, victim, and bystander). The integration of AI enables the generation of realistic and context-based dialogues, enhancing the emotional realism and educational impact of the experience.

As part of the CIBERPROXY project, we have explored the use of the Metaverse as an innovative educational environment for the prevention of bullying and cyberbullying. To this end, we designed and developed immersive gamified experiences within a virtual reality platform that simulates realistic school violence scenarios. These experiences are structured through educational escape rooms, interactive simulations, and virtual assistants powered by artificial intelligence. Participants, through avatars, face dilemmas and conflicts typical of school settings and are guided in conflict resolution, decision-making, and critical reflection on their actions. Its realistic scenarios, combined with decision-making via chatbot, foster student engagement, promote empathy, and empower bystanders to take an active role in preventing and intervening in bullying situations. This methodology promotes experiential learning, the development of social and emotional competencies, and active awareness of bullying, fostering a culture of prevention and peaceful coexistence from an early age.

Additionally, through the use of QR codes, teachers can continue the work in the classroom by analyzing the scenes experienced in the Metaverse as a group and encouraging students to make decisions from the bystander's perspective (Sánchez-Romero, 2025), thus reinforcing critical thinking and ethical reflection on school coexistence.

CIBERPROXY platform is designed for diverse audiences, including students, teachers, families, and education and security professionals. This variety of users significantly enriches bullying and cyberbullying prevention strategies, as each group contributes unique and complementary perspectives. While students experience and reflect on violence situations from an empathetic standpoint, teachers and professionals can use the platform as a training and intervention tool. Additionally, family involvement

strengthens the support and awareness environment, creating a comprehensive approach that enhances the effectiveness of preventive actions.

Funding

Research project TED2021-129132B-I00_PROXIMITY CYBERBULLYING: HOW TO AVOID IT THROUGH GAMIFICATION WITH THE METAVERSE? Funded by MCIN/AEI/10.13039/501100011033 and by the European Union NextGenerationEU/PRTR.

Acknowledgments for participation: School (Spain-Paraguay). Citizen Participation Unit - National Police and CIBERPROXY by Six3D. Research anc Tecnic team: TED2021-129132B-I00

References

Basten, D. (2017) Gamification. *IEEE Software,* 34, 76-81. https://doi.org/10.1109/MS.2017.3571581

Bolger, R.K. (2011). Finding wholes in the metaverse: Posthuman mystics as agents of evolutionary contextualization. *Religions* 12(9). https://doi.org/10.3390/rel12090768

Davis, A., Murphy, J. D., Owens, D., Khazanchi, D., & Zigurs, I. (2009). Avatars, People, and Virtual Worlds: Foundations for Research in Metaverses. *Information Systems and Quantitative Analysis Faculty Publications*, 25. https://digitalcommons.unomaha.edu/isqafacpub/25

Juvonen, J., Graham S. (2014). Bullying in schools: the power of bullies and the plight of victims. Annu Rev Psychol, 65. https://doi.org/10.1146/annurev-psych-010213-115030

Kowalski, R. M., & Fedina, C. (2011). Cyber bullying in ADHD and Asperger Syndrome populations. *Research in Autism Spectrum Disorders, 5*(3), 1201–1208. https://doi.org/10.1016/j.rasd.2011.01.007

Kumar, H. (2024). Virtual worlds, real opportunities: A review of marketing in the metaverse. *Acta Psychologica*, 250, 104517. https://doi.org/10.1016/j.actpsy.2024.104517

Huang, W.H.-Y., & Soman, D. (2013) Gamification of Education. Research Report Series: Behavioural Economics in Action. *Rotman School of Management*, University of Toronto.

Mishna, F., Saini, M., & Solomon, S. (2009). Ongoing and online: Children and youth's perceptions of cyber bullying. *Children and Youth Services Review, 31*(12), 1222–1228. https://doi.org/10.1016/j.childyouth.2009.05.004

Schawrtz, D., Mayeux, L., & Harper, J (2011). Bully/Victim Problems during Adolesce. *Encyclopedia of Adolescence*, 25-34. https://doi.org/10.1016/B978-0-12-373951-3.00045-4

Sánchez Romero, C. (2025). The Bystander's Role in Cyberbullying Prevention: Immersive Learning through Gamification and the Metaverse. *Trends in Computer Science and Information Technology*. https://doi.org/10.17352/tcsit.000096

Shariff, S. (2007). Cyber-dilemmas in the new millennium: School obligations to provide student safety in a virtual school environment. *McGill Journal of Education / Revue Des Sciences De l'éducation De McGill*, *40*(3). https://mje.mcgill.ca/article/view/586

Siyaev, A. & Jo, G.-S. (2021). Neuro-Symbolic Speech Understanding in Aircraft Maintenance Metaverse. *IEEE Access*, 9, 154484-154499. https://doi.org/10.1109/ACCESS.2021.3128616

Smith, P (2016) Bullying: Definition, Types, Causes, Consecuences and Intervention. *Social and Personality Psychology Compass*. https://doi.org/10.1111/spc3.12266

Su, C-H. & Cheng, C-H. (2015). A mobile gamification learning system for improving the learning motivation and achievements. *Journal of Computer Assisted Learning*, 31(3), 268–286. https://doi.org/10.1111/jcal.12088

UNESCO (2017). *School violence and bullying: global status report*. https://doi.org/10.54675/POIV1573

Wang, J., Iannotti, R.J., & Nansel, T.R. (2009). School bullying among adolescents in the United States: physical, verbal, relational, and cyber. *Journal Adolesc Health*, 45(4), 368-75. https://doi.org/10.1016/j.jadohealth.2009.03.021

Student Engagement through Innovation and Flexible learning

From traditional to renewable Assignments in Distance Education: promoting Students' Engagement

Inés Gil-Jaurena[1, 2], Sergio López-Ronda[1] and Daniel Domínguez-Figaredo [1, 2]

[1] Universidad Nacional de Educación a Distancia (UNED), Spain. CO-Lab teaching innovation group
[2] UNESCO Chair in Distance Education (CUED)

Abstract

In 2024-25, a group of teachers at the UNED Faculty of Education have worked in a teaching innovation project focused on converting our traditional or disposable assignments into renewable assignments in two Master level courses about socio-community intervention (one per semester), with the same cohort of distance education students. `Renewable´ assignments –unlike `disposable´ or traditional assignments– are 'assignments which both support an individual student's learning and result in new or improved OER that provide a lasting benefit to the broader community of learners' (Wiley & Hilton, 2018). Our aims are to promote students' participation and engagement with the course content and to facilitate students' agency in the learning process as content producers. In the long term, the products (a collaborative glossary and a collaborative map, in our case) can be reused and renewed with future group of students. In this report we describe the assignments, explore the students' perspectives about the experience, and reflect about the lessons learned.

Keywords: open education, distance education, renewable assignments, engagement, assessment

Introduction

In 2024-25, we have worked in a teaching innovation project focused on converting our traditional or disposable assignments into renewable assignments in two Master courses about socio-community intervention (one per semester), delivered in distance mode. Our purposes are to promote students' engagement with the course content and to facilitate students' agency in the learning process as content producers.

Traditional vs renewable assignments

Renewable assignments –unlike disposable assignments– are 'assignments which both support an individual student's learning and result in new or improved open educational resources that provide a lasting benefit to the broader community of learners' (Wiley & Hilton, 2018). This way, students share their work openly, they generate open educational resources (OER), the artifact developed has value beyond the student's own learning (Wiley, 2013). This is aligned with open educational practices (OEP) that, according to Paskevicius' (2017) conceptualization through the lens of constructive alignment, include the following aspects:

- Learning outcomes are made explicit and openly accessible to students.
- Selection, adaptation, and creation of open learning resources.
- Use of OER to inspire the design of more engaging teaching and learning activities.
- Openness in the design of assessment and evaluation: active participation and production of knowledge by students.

On the one hand, traditional assignments `are often (…) seen only by the instructor for the purpose of demonstrating content mastery and achievement of learning objectives´ (Clinton-Lisell & Gwozdz, 2023, p. 125). These assignments are labelled as `disposable´ due to their non-existent life span after completion, disconnection from other course content

or assignments, and lack of student agency. On the other hand, `renewable´ assignments `provide students with opportunities to engage in meaningful work, add value to the world, and provide a foundation for future students to learn from and build upon´ (Larson, 2023, cited in Grey, 2023). The assignment is `designed to be reused and revisited by more than just the student and their instructor´ (Capilano University Library, 2022).

Description and results of the innovative practice

Changes in the course design and implementation

The authors of this report are involved in two Master courses: `*Socio-community intervention: rationale and contexts*´, taught in the first semester (October-February), and `*Community development and socio-community intervention*´, taught in the second semester (February-June). The 45 students are the same in both courses. In 2024-25, following Katz & Van Allen's (2020) framework, we have converted our traditional or disposable assignments into renewable ones in the first semester course (table 1).

Table 1: From traditional to renewable assigments in 'Socio-community intervention: rationale and contexts' course

Assignment	Traditional (2023-24)	Renewable (2024-25)
Glossary: Each student selects two relevant concepts, defines and comments them	Each student submits the assignment to the teacher	Each student submits the concepts to the Collaborative glossary –using the 'glossary' resource in Moodle–, which is published in the online course (figure 1). Also, they comment other students' concepts
Map of resources: each student selects and describes 4 local socio-community intervention resources (projects, organisations, services, etc.)	Each student submits the assignment to the teacher	Each student submits the resources to the Collaborative map–using Google Maps–which is published in the online course (figure 2)

In the second semester course, we have reused the collaborative map (figure 2) as an OER; the students have to choose one of the resources on the map (either one they had already contributed in the first semester course; or other resource contributed by another student), and deepen on the analysis of the selected resource in relation to one out of nine topics from the course content.

Figure 1: Screenshoot of the collaborative glossary

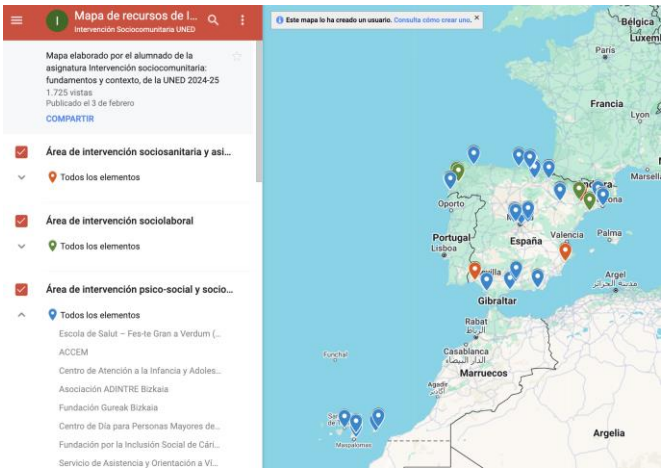

Figure 2: Screenshoot of the collaborative map

Overall, the redesign of the assignments implies a more active and public participation of learners in the courses, and both the learning process and the product generated by the learners are valued.

Students' perceptions about renewable assignments

Using a Likert type online survey, we have explored the students' perceptions about the experience. Only 11% of the students responded, so the results are not statistically significant; still, they provide us some interesting feedback about the changes in the assignments design.

In relation to the first semester course, the students' opinions are positive and highlight that the collaborative glossary and map were useful for learning; that reading other students' contribution to the glossary and map was enriching; or that contributing to the glossary and map engaged them

more with the activities. Also, the learners report that the fact that the assignments were collaborative and public has increased their motivation and improved their agency, collaborative learning skills and achievement. Also, when comparing traditional vs renewable assignments, they declare that they prefer renewable assignments and that they have learned more with this type of assignment.

In the second semester course, where the map was reused, the results are equally positive and similar to those from the first semester in terms of preferences and benefits of renewable assignments. Specifically about the collaborative map, the students say that it can be of interest beyond the courses, as future workers in the field.

In the open-ended questions in the survey, students state positive comments such as the following, that highlight motivation, usefulness, learning: "*I really liked this activity [map] and I think it is totally meaningful and coherent with the course because it connects everything learned and brings into play collaboration and service to something common. (…) It is also very stimulating to investigate what there is in our communities*"; "*I really enjoyed this course (…) Self-learning has been constant and the activities have not been tedious (…), I have enjoyed them*"; "*Comparing the contributions of colleagues is also a good reference to guide whether we are doing things correctly*"; or "*The teachers have done an extraordinary job to capture my interest. They make innovative proposals that are not always found in other courses*".

Conclusion

After this exploratory experience with renewable assignments in our distance education Master courses, we can be optimistic about the interest and relevance of this type of activities for different reasons. First, they are adequate to promote students' engagement as producers and, subsequently, for enriching the course content. Second, the activities being collaborative and public has increased students' motivation and agency. Finally, those that have expressed themselves in the survey show a clear preference for renewable vs traditional assignments.

Despite these positive aspects, further research is needed to reach more significant conclusions. Also, as teachers, we have experienced an increase in our workload (in the design, implementation and assessment phases). For instance, we had to make decisions about practical aspects –such as the degree of openness of the generated products; or the automatization of the submission of each contribution vs the monitoring of the content before going public–. This makes us reflect about how to consider this type of renewable assignments to be more cost-effective.

In the next iteration of the innovation project in 2025-26, we plan to refine our renewable assignments and build upon the products generated this year. Also, we are going to extend the experience to other Bachelor and Master courses at UNED and increase the collection of research data about students' perception and academic rates, to further analyse the impact of renewable assignments on students' engagement, motivation and performance.

Acknowledgments

This report is framed within the innovation project PID 2024-25 "Renewable assignments: proposals of use for improving students' participation and agency" from the CO-Lab teaching innocation group (GID2016-30), funded by the IUED-Vicerrectorate for Innovation, UNED.

References

Capilano University Library. (2022, August 19). *What is Open Pedagogy and Open Assignments?* Open Educational Resources Library Guide. https://libguides.capilanou.ca/c.php?g=720956&p=5187701

Clinton-Lisell, V. & Gwozdz, L. (2023). Understanding Student Experiences of Renewable and Traditional Assignments. *College Teaching, 71*(2), 125-134. https://doi.org/10.1080/87567555.2023.2179591

Grey, A. (2023). *Building-in Student Buy-in: Disposable vs Renewable Assignments*. https://wordpress.kpu.ca/tlcommons/building-in-student-buy-in-disposable-vs-renewable-assignments/

Katz, S. & Van Allen, J. (2020). Evolving Into the Open: A Framework for Collaborative Design of Renewable Assignments. I n A. Clifton & K. Davies Hoffman (eds.). *Open Pedagogy Approaches. Faculty, Library, and Student Collaborations*. Milne Library.

Paskevicius, M. (2017). Conceptualizing Open Educational Practices through the Lens of Constructive Alignment. *Open Praxis, 9*(2), 125–140. http://doi.org/10.5944/openpraxis.9.2.519

Wiley, D. (2013). *What is open pedagogy?* https://opencontent.org/blog/archives/2975

Wiley, D., & Hilton III, J.L. (2018). Defining OER-enabled pedagogy. *The International Review of Research in Open and Distributed Learning, 19*(4). https://doi.org/10.19173/irrodl.v19i4.3601

Implementing Micro-credentials in Higher Education: Challenges, Opportunities and Lessons Learned

Lore Van Melkebeke[1], Ilse Op de Beeck [,2]

[1] KU Leuven
[2] KU Leuven

Abstract

The concept of micro-credentials has been promoted by the European Commission to address the skills gap in the 21st-century workforce and, more broadly, to respond to current societal, individual and labour market needs. Higher education institutions are increasingly exploring micro-credentials as flexible and targeted learning opportunities. This paper reflects on the challenges and opportunities encountered by higher education institutions in implementing micro-credentials, and highlights good practices both within individual institutions and across Una Europa, one of the European Universities alliances.

Keywords: micro-credentials, flexible learning pathways

Introduction

In a rapidly changing world, continuously developing new skills and acquiring up-to-date expertise is essential. People need to constantly refine and expand their knowledge and skills in order to fill the gap between formal education and the evolving demands of society and the labour market (see for example World Economic Forum, 2025). Recognising this need, the European Union and its member states are focusing on the promotion of transversal skills and fostering lifelong learning. In this context, the Council of the European Union adopted a Recommendation on a European approach to micro-credentials for lifelong learning and employability. (Council of the European Union, 2022).

Following the Recommendation, micro-credentials have gained significant traction. Within the higher education sector, institutions have begun exploring both the concept of micro-credentials and the broader topic of lifelong learning. Learners as well are becoming more familiar with the concept of micro-credentials and their potential within higher education (Bruguera et al., 2022).

In this context, the Erasmus+ funded Modular Continuing Higher Education by Micro-credentials (MCE) project aimed to further conceptualise micro-credentials and empower higher education institutions in organising and creating the conditions for developing modular education and implementing micro-credentials. This article highlights the potential of micro-credentials and proposes a set of guidelines and practices for embedding micro-credentials within the university landscape.

The added value of micro-credentials

Following the Council Recommendation, universities began actively exploring the implementation of micro-credentials. Despite the relatively recent adoption of the term, micro-credentials represent a strategic evolution in higher education. Micro-credentials hold value in serving various purposes for both higher education institutions and learners, extending the institutions' reach to non-traditional learners and improving alignment with evolving labour market needs. They are designed to provide learners in a flexible way with specific and targeted knowledge, skills and competences that

respond to personal, employment, societal or cultural needs (Van Melkebeke et al., 2025).

Challenges in implementation

The MCE-project fostered dialogue among stakeholders and piloted practical implementations. Fifteen institutional seminars were conducted across the partner institutions, involving academic as well as support services staff and external stakeholders. These engagements revealed growing enthusiasm for micro-credentials, but also surfaced critical implementation barriers and challenges.

A primary challenge was the lack of comprehensive national policy frameworks. Various member states adressed that the lack of national frameworks led to issues with terminology, recognition, and quality assurance.

Another frequently cited obstacle was institutional clarity regarding the concept of micro-credentials. While the definition in the Council Recommendation can serve as a key reference, it remains crucial to establish a common understanding within national and institutional contexts. Furthermore, it is important that higher education institutions discuss the added value of micro-credentials and clarify how they can be integrated into existing institution's educational offerings.

Stakeholder engagement proved equally challenging. For higher education institutions it is essential to engage with employers and industry, to raise awareness and strengthen the credibility of micro-credentials and their relevance for the labour market.

Similarly, financial sustainability emerged as a concern. Although some institutions have secured project-based or European, national or institutional funding, most lack structured fee systems and diversified revenue models.

Finally, administrative systems are also struggling to accommodate the flexibility and modularity that micro-credentials demand. From admissions and enrolment to assessment and certification, existing procedures are often too rigid, creating friction in the implementation process.

Guidelines for the implementation

Based on insights gathered from the MCE seminars, a series of recommendations for higher education institutions developing micro-credentials were formulated (Van Melkebeke et al., 2025). Effective implementation begins with building institutional capacity. Cross-departmental collaboration is essential, and several institutions have established internal taskforces that include representatives from a.o. policy, quality assurance, digital learning, and student services. These integrated teams facilitate coordinated decision-making and policy development.

Defining the purpose, learning objectives and learning outcomes is the first step in the development of a micro-credential. It is recommended to include the consultation of the labour market and other stakeholders in the design process in order to be able to define and align the learning outcomes with the needs of the labour market and society.

Assigning an EQF level enhances the transparency of micro-credentials Clear identification of target audiences and admission requirements is equally important, particularly given the diversity of lifelong learners engaging in these programmes.

Robust and proportionate assessment and certification practices are crucial. Whether delivered online or in-person, assessment methods must be valid, reliable, and appropriate to the learning outcomes. Certificates should conform to European guidelines and support digital verification and portability.

Stackability - the ability for micro-credentials to be combined or accumulated towards larger qualifications - is another vital feature. It is a way to provide learners with flexible lifelong learning pathways. Higher education institutions should clearly communicate to learners whether and how their micro-credentials can contribute to broader academic awards.

Higher education institutions hold primary responsibility for quality assurance processes which should be integrated into existing institutional frameworks. External quality assurance systems should preferably remain proportionate, avoiding to overburden higher education institutions.

In order to successfully implement a micro-credential, it is crucial to have a solid and sustainable financial model. Institutions can adopt diversified business models, including fee-based enrolment, sponsorships, corporate partnerships, government funding, etc.

Finally, clear and targeted marketing strategies are key. Transparency around course content, outcomes, admission requirements, duration, and fees is essential to ensure that potential learners have all the information they need to identify appropriate courses and make an informed decision on whether or not to enroll.

Innovative practice in the Una Europa alliance

Micro-credentials can be organised in collaboration with multiple parties. In this case, it will be necessary to formalise legal agreements in which the essential commitments and responsibilities from all partners are outlined (e.g.

governance structure, financial models, intellectual property, …).

Within the Una Europa European university alliance, member institutions have proactively explored the potential of joint international micro-credentials. A dedicated project team - comprising representatives from different partner universities and informed by consultations with experts in student administration, academic policy, and digital learning - developed a comprehensive framework to support this initiative (Van Melkebeke & Vanelven, 2024). The framework aims to foster a shared understanding and align the development and implementation of new courses leading to joint Una Europa micro-credentials. It sets the definition of Una Europa micro-credentials, details processes and workflows, outlines key implementation steps and identifies the responsible actors and stakeholders. While still evolving, the framework marks a significant step towards cross-border micro-credential offerings in Europe.

Conclusion

Micro-credentials represent a strategic evolution in higher education, enabling institutions to respond more dynamically to labour market and societal needs. Partner institutions of the MCE project as well as the Una Europa alliance have demonstrated that they are willing and able to embrace these new formats - provided that challenges such as e.g. awareness, policy and finances are addressed.

The institutional guidelines developed in both projects serve as a foundation for embedding micro-credentials as credible, quality-assured, and learner-centred offerings. Moving forward, alignment with EU-standards, national policies, and robust internal strategies will be essential for realising the full potential of micro-credentials across Europe.

References

Bruguera, C., Fitó, A., Pagés, C. & Antonaci, A. (2022). Meta-research on the learner perspective on micro-credential formats and learning services for continuing education and professional development (Research Report No. 2.1). https://doi.org/10.5281/zenodo.7356761

Council of the European Union (2022). Recommendation on a European approach to microcredentials for lifelong learning and employability. https://education.ec.europa.eu/education-levels/higher-education/micro-credentials

MCE - Modular Continuing Higher Education by Micro-credentials (2022-2025). Erasmus+ project funded by the European Union. https://mce.eadtu.eu

Una Europa. https://www.una-europa.eu

Van Melkebeke, L., Op de Beeck, I. & Antonaci, A. (2025). Models and Guidelines for the Institutional Development of CEPD and the Design, Implementation and Recognition of Micro-credentials. (Research Report No.4.2). https://doi.org/10.5281/zenodo.15101731

Van Melkebeke, L. & Vanelven K. (2024). Framework for joint Una Europa micro-credentials. Task 10.3 Una.Futura Work Package 10 'Building the Backbone of the European Campus'. https://una-europa.imgix.net/resources/Una-Europa-Framework-for-Joint-Microcredentials.pdf

World Economic Forum. (2025). The future of jobs report 2025. World Economic Forum. https://www.weforum.org/publications/the-future-of-jobs-report-2025

Integrating Online Community Projects in Modern Foreign Language Teacher Education

Lesley June Fearn

[1] Open University

Abstract

Integrating Online Community Projects (OCPs), such as eTwinning, into modern foreign language) Initial teacher education programmes offer a valuable opportunity to enrich teacher preparation through innovative and collaborative pedagogy. This approach immerses preservice teachers in learner-centred methodologies and equips them with the digital and intercultural competencies needed to support active, inclusive learning environments. Through authentic project work across borders, future educators gain practical experience in learner-centred methods that encourage peer collaboration while using the target language in meaningful contexts and fostering intrinsic motivation among learners.

By engaging in real-time communication and problem-solving with international peers, both learners and teachers develop a stronger sense of ownership, responsibility, and engagement. For preservice teachers, these experiences often lead to increased confidence in using educational technology, greater openness to pedagogical innovation, and a broader understanding of classroom diversity. Notably, OCPs are already embedded in teacher training curricula across several European contexts. However, there are still numerous institutional and curricular difficulties that must be resolved before OCPs can be mainstreamed and normalised. This study debates the value of integrating OCPs in ITE programmes to preservice MFL teachers. It adopts an analytical autoethnographic approach, combining the author's professional experience as a modern foreign language teacher and academic researcher with current scholarship on OCPs.

Keywords: Initial teacher education, Online community projects, Modern Foreign Languages, eTwinning, learner-centred pedagogy.

Introduction

Digital technology and global connectivity are valuable tools that teachers can use to empower their learners to access information and collaborate with peers beyond geographical boundaries (Emir & Yangın-Ekşi, 2024). At the same time, Modern Foreign Language (MFL) Initial Teacher Education (ITE) programmes have recognised that international digital collaboration can enhance intercultural competence and pedagogical innovation and are searching for ways to incorporate them into their programmes (Emir & Yangın-Ekşi, 2024). This study suggests that Community Projects (OCPs) could be incorporated into Initial Teacher Education (ITE) as powerful platforms for connecting educators and students across borders while experiencing learner-centred methods, digital technology, and international skills in their teaching (Fearn, 2023).

OCPs, such as eTwinning, the International Education and Resource Network (iEARN), Connecting Classrooms, and PenPal Schools, are collaborative school projects that connect at least two teachers and their students in different cities or countries, often using the target language and digital platforms to communicate and co-create content (Fearn, 2022). In Europe, eTwinning has become so widely adopted that its name is often used generically to refer to these types of projects. The primary focus of this study is the value of participating in OCPs during ITE for preservice

MFL teachers. It draws on an analytical autoethnographic perspective, combining the author's reflective experience as a practitioner and researcher with relevant literature on OCP integration in teacher education.

Pedagogical Value

One of the key pedagogical advantages of OCPs is that they are grounded in social-constructivist, learner-centred methodologies, positioning students as active collaborators in authentic tasks rather than passive recipients of knowledge. This approach immerses trainee teachers in the practice of facilitating student-driven learning, enabling them to experience firsthand the advantages of participatory teaching techniques (Fearn, 2022). There are several ways in which OCP-based learning enriches the classroom experience.

Authentic Learning Experiences

Firstly, although OCPs are useful for teachers of any subject and grade, they are beneficial for MFL teachers because they offer an opportunity for their learners to connect with real peers in other countries, making language use meaningful and contextual. Students communicate for genuine purposes, such as co-creating presentations or stories, which adds relevance to their tasks and mirrors real-world language use. Such authenticity has been linked to deeper engagement and more effective skill development (Cinganotto, 2017). By working together on cross-border projects, learners also practice collaboration and problem-solving skills, embodying 21st-century competencies.

Intrinsic Student Motivation

Secondly, using the target language as an authentic form of communication and creative exchange motivates learners intrinsically. Students often feel a sense of ownership and excitement when their work is shared with international partners, fuelling their motivation to participate and excel. Studies indicate that eTwinning projects spark higher student enthusiasm and willingness to use the target language, as learners are driven by curiosity and the novelty of intercultural interaction (Gajek, 2018). This intrinsic motivation contrasts with extrinsic grade-oriented incentives common in traditional teaching methods and can sustain greater effort and persistence in learning (Ryan & Deci, 2017).

Enhanced Classroom Relationships

Thirdly, collaborative project-based language learning tends to blur conventional hierarchies and foster a more supportive classroom climate. Indeed, teachers in OCP-enabled classes step back from being the sole source of knowledge and adopt a facilitator role, working alongside students to achieve project goals (Akdemir, 2017). This shift can strengthen teacher-student relationships as instructors engage with learners more informally, support their ideas, and provide them with feedback (Nortcliffe, 2012). Likewise, students develop closer peer relationships through teamwork with classmates and partners living in different sociocultural contexts (Crișan, 2013; Kitade, 2014).

Professional Growth

Finally, engaging in OCPs is not only advantageous for students but also serves as a form of authentic professional development for teachers (Mouratoglou et al., 2023). Trainee teachers are exposed to new teaching strategies, digital tools, and multicultural perspectives, leading to improvements in teachers' MFL teaching approaches and increased confidence in using technology (Fearn, 2021). In essence, teachers learn as they facilitate, and their professional growth translates into richer learning environments for students.

ITE Integration

Due to these pedagogical advantages, many ITE programmes in Europe have begun embedding OCPs into their curricula. ETwinning, in particular, has transitioned from a voluntary in-service teacher network to a structured component of ITE in several countries (Mouratoglou et al., 2021). Through the 'eTwinning for Future Teachers' initiative, launched under the Erasmus+ programme, universities and teacher training institutes collaborate with eTwinning's National Support Organisations (NSOs) to incorporate OCPs into coursework. Since then, education systems in countries such as Finland, France, Greece, Italy, Poland, Portugal, Slovenia, Spain and Turkey have encouraged universities to include eTwinning in their ITE programmes, resulting in varied forms of integration (Mouratoglou et al., 2021). (INDIRE, 2021).

In some institutions, an 'introduction to eTwinning' module is included in the curriculum, familiarising student teachers with the platform's tools and pedagogical concepts. Elsewhere, teacher educators design collaborative projects that pair their student teachers with peers in other countries or even engage student teachers in eTwinning projects with actual school pupils during workshop placements (Mouratoglou et al., 2023). These approaches allow future teachers to practice planning and facilitating OCPs in a supervised setting. For example, at the University of Molise (UniMol) in Italy, primary school ITE students participate in international eTwinning OCPs as part of their methodology training. Italy alone has over twenty universities actively involved in eTwinning-based training, with thousands of

student teachers benefitting from this experience annually (INDIRE, 2021).

Additionally, the Faculty of Teacher Education at the University of Zagreb in Croatia has made eTwinning OCPs a core element of its program (Mouratoglou et al., 2023). Initially, a handful of motivated faculty staff and students experimented with small projects, which even led some student teachers to write their theses on the impact of eTwinning. Over time, these efforts evolved into systematic integration, and eTwinning is now embedded across various courses, connecting Zagreb's student teachers with peers and schools across Europe for joint OCPs (Mouratoglou et al., 2023). However, despite eTwinning being successfully adopted in many ITE programmes, some national education systems have encountered issues when attempting to implement it on a national scale. Difficulties were primarily linked to misconceptions about eTwinning and a lack of funding for dissemination (Mouratoglou et al., 2021).

Implications

Promotional reports by the EU (Mouratoglou et al., 2021, 2023) have demonstrated that incorporating OCPs into teacher training has significant implications for educational practices. Firstly, preservice teachers who engage with OCPs during their training are more likely to adopt participatory, learner-centred practices in their own classrooms. Secondly, participation in OCPs equips future teachers with digital pedagogical competencies and intercultural communication skills that are increasingly required, enabling them to handle diversity and technology-rich classrooms better. However, despite the many advantages of integrating OCPs into ITE, national education agencies often encounter significant challenges in their implementation. One major obstacle is the lack of alignment between university curricula and the flexible, project-based nature of OCPs, which can make it difficult to embed such initiatives within rigid academic structures and assessment frameworks (European Commission, 2023).

Additionally, not all teacher educators are familiar with or confident using digital collaboration tools, leading to inconsistent uptake and limited modelling of OCP methodologies for student teachers (Tosi, 2023). Institutional resistance may also stem from concerns about workload, a lack of administrative support, or insufficient time allocated to collaborative project planning within overloaded ITE programs (Gregory & Lodge, 2015). Furthermore, disparities in digital infrastructure and access between institutions and regions can exacerbate inequalities in participation, especially in rural or under-resourced areas (European Commission, 2023). As a result, while policy frameworks increasingly advocate for OCP integration, practical implementation often lags behind, requiring targeted support, training, and strategic curriculum adaptation to ensure sustained and equitable adoption (Ahuja, 2023).

Conclusion

In conclusion, this study has debated the value of integrating OCPs, such as eTwinning, into MFL ITE programmes. The results show that OCPs immerse preservice teachers in learner-centred, collaborative environments that nurture intrinsic motivation and intercultural engagement. To maximise their impact, institutions must provide support structures, including access to training and international partners through institutions such as eTwinning NSOs. Ministries and accreditation bodies might also consider recognising OCPs as a valuable tool in ITE curricula. By doing so, they will enhance preservice MFL teachers' training experiences and enrich their future practices by equipping them with skills to build vibrant, engaging learning environments that connect classrooms across cultures.

References

Ahuja, V. (2023). Contemporary Challenges in Education. *Advances in Educational Technologies and Instructional Design*, 45–59. https://doi.org/10.4018/979-8-3693-1826-3.ch005

Akdemir, A. S. (2017). eTwinning in Language Learning: The Perspectives of Successful Teachers*. *Journal of Education and Practice*, *8*(10), 182–190.

Crișan, G. I. (2013). The Impact of Teachers' Participation in eTwinning on Their Teaching and Training. *Acta Didactica Napocensia*, *6*(4), 19–28.

Emir, G., & Yangın-Ekşi, G. (2024). The role of telecollaboration in English language teacher education: a systematic review. *Smart Learning Environments*, *11*(1), 3. https://doi.org/10.1186/s40561-024-00290-0

European Commission. (2023). *The impact of eTwinning on initial teacher education : placing teacher educators and student teachers in the spotlight: full monitoring report.* Publications Office of the European Union. https://doi.org/10.2797/908466

Fearn, L. J. (2021). *An Enquiry into English as a Foreign Language and Online Community Projects in Secondary School Education*. The Open University.

Fearn, L. J. (2022). EFL teachers' perceptions of online community projects in secondary school education. *The JALT CALL Journal*, *18*(3), 360–381. https://doi.org/10.29140/jaltcall.v18n3.600

Fearn, L. J. (2023). Online Community Projects: Learner-Centred Digital Mediation Tools For Secondary-School English as a Foreign Language Curricula. *Teaching English With Technology*, *2023*(2). https://doi.org/10.56297/buka4060/epgi2711

Gajek, E. (2018). Curriculum Integration in Distance Learning at Primary and Secondary Educational Levels on the Example of eTwinning Projects. *Education Sciences*, *8*(1), 1–15. https://doi.org/10.3390/educsci8010001

Gregory, M. S. J., & Lodge, J. M. (2015). Academic workload: the silent barrier to the implementation of technology-enhanced learning strategies in higher education. Distance Education. *Distance Education*, *36*(2), 210–230. https://doi.org/10.1080/01587919.2015.1055056

Kitade, K. (2014). Second Language Teachers' Identity Development through Online Collaboration with L2 Learners. *CALICO Journal*, *31*(1), 57–77. https://doi.org/10.11139/cj.31.1.57-77

Mouratoglou, N., Pateraki, I., & Scimeca, S. (2023). *Erasmus+ School education*. Publications Office of the European Union. https://doi.org/10.2797/653103

Nortcliffe, A. (2012). Can Students Assess Themselves and Their Peers? - A Five Year Study. *Student Engagement and Experience Journal*, *1*(2), 1–17. https://doi.org/10.7190/seej.v1i2.29

Ryan, & Deci, E. L. (2017). *Self-determination theory : Basic psychological needs in motivation, development, and wellness.* Guilford Publications.

Tosi, A. (Ed.). (2023). *Empowering future teachers for a sustainable intercultural and inclusive education The impact of eTwinning on Initial Teacher Education*. Carocci editore. https://doi.org/10.36174/0000008

Good Practices in Tutoring for Hybrid and Distance Education in Modern Times

Ana Martínez Ortiz de Zárate[1], Noemi Laforgue Bullido[1] and Belén Ballesteros Velázquez[1]

[1] Universidad Nacional de Educación a Distancia (UNED), Spain.
Members of CO-Lab Teaching Innovation Group and UNESCO Chair in Distance Education (CUED)

Abstract

Student participation in tutoring, both face-to-face and online, has declined significantly in our distance education model. In addition, the study by Sánchez Díaz et al. (2022) reveals different student profiles. A first profile, made up of students with professional aspirations and a high number of enrolled credits, expresses institutional detachment and disinterest in learning support activities and resources. Another, smaller profile is made up of students who have dependents and value interaction spaces more highly. All of this leads us to consider the need to identify and learn from good tutoring practices that facilitate the achievement of learning and good results in assessment.

Our frame of reference is the pedagogical model of the COI (Community of Inquiry), defined as the interaction of three components: teaching, cognitive and social presence. From this theoretical perspective, we developed the protocols for collecting information used in the focus group dynamics. We worked with 9 focus groups (3 with students; 3 with teaching; 3 with teacher-tutors). A total of 47 participants took part.

The results of focus groups with teaching teams, students and tutors highlight the importance of active and collaborative activities, the link with the territory and the professional experience of the teacher-tutor, together with dialogic dynamics of relationship and proximity with the students, key in times of AI. It also reflects on hybrid systems, analyzing their possibilities and limitations.

Keywords: good tutoring practices, methodologies, student participation

Introduction

The reduced presence and participation of students in institutional resources and activities, including tutoring, is a notorious reality in our distance learning model. Instead, they prefer social networks and spaces self-managed by the students themselves, as shown in figure 1. Students use these spaces to exchange notes, ask questions to classmates, access materials, summaries and assignments. In addition, they allow them to communicate spontaneously and closely, omitting academic fomality (Izquierdo-Montero et al., 2022).

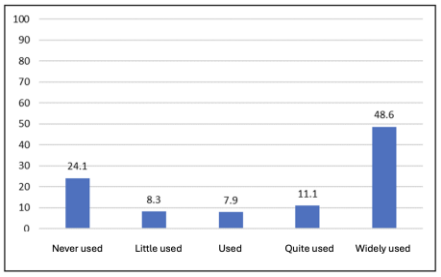

Figure 1. Use of whatsapp in 2022

The study by Sánchez Díaz et al. (2022) confirms the existence of an important conglomerate of students, characterised by their professional expectations and the high volume of credits enrolled, who express institutional detachment and disinterest in study support resources. The

same study identifies, however, a smaller group, including people with dependents, who value the video lecture recordings and interactive spaces positively.

The minority participation of students in tutorial and teaching spaces raises the need to open a reflection on our methodological identity and the role of tutorials as support for study. According to Pagano (2008) and Massuga et al. (2021) , we recognise that the role of the tutor is fundamental in distance education, as it is through them that education is personalised, providing a trustworthy environment and stimulating interaction in the construction of learning.

To this end, we decided to start by finding out what is being done well, what is recognised and valued in tutorial action. The interest of this project is to identify good practices carried out by the teacher-tutor to reactivate tutorial spaces and facilitate better learning and good results in the evaluation of students.

Our frame of reference is the pedagogical model of the COI (Community of Inquiry) (Garrison, 2011; Ballesteros et al. 2019), according to which teaching-learning processes are defined as the interaction of three components: teaching presence (planning, communication and activities carried out by the teaching staff to facilitate the achievement of learning outcomes), cognitive presence (processes and tasks carried out by the students) and social presence (feeling of belonging to the group and learning capacity based on interactions with teaching staff and classmates). From this theoretical perspective, we developed the protocols for collecting information used in the focus group dynamics

Project and methodology

The teaching innovation project "Matricularse: + que un derecho a examen" (Enrolling: More than just a right to take exams) was created with the main objective of gaining in-depth knowledge of teaching and tutorial experiences that have been positively evaluated by the university community and that can be considered benchmarks of good practice.

The concept of good practices has been a subject of reflection and debate throughout this research. It has been understood as those pedagogical actions that have encouraged active student involvement, facilitated their learning, and contributed to the achievement of satisfactory academic outcomes by students.

A total of 47 participants were involved in this study. Nine focus groups of between three and five people were carried out, with the following profiles: 1) three focus groups made up of students and graduates with a high level of involvement in forums and activities; 2) three focus groups made up of teaching teams from subjects that were most highly rated by students; and 3) three focus groups made up of tutors who were in contact with the teachers collaborating on this project and who were willing to participate in the research.

Main results

Firstly, a very positive assessment of tutorials was identified when they are understood as spaces for support focused on study guidance, resolving doubts, and developing practical activities that allow for the illustration, expansion, and deepening of knowledge. In this sense, students recognize the creativity of the tutor in taking advantage of the possibilities of the environment to design activities related to the subject, encouraging the active and participatory role of the students. This is how a student in the Early Childhood Education degree program expresses it:

In tutoring classes, we are in the same situation: the tutor and us, and everything is done without participating and without moving from our chairs. But well, the tutors also play a part in this, as there are many who... To be honest, I have to say that some are super creative... I can tell you that we have even visited schools. And I think it is also important that tutors want to participate and want to create that enthusiasm and commitment among the students.

Likewise, the importance of incorporating the professional experience of the tutoring teacher as a key aspect for contextualizing the content is highlighted. This is how a participant in Social Education expresses it: "It has helped me a lot when there have been teachers who have brought their own professional experience into the classroom and transferred it through the subject itself, even if it was... very theoretical."

Another fundamental aspect is to conceive of tutorials as meeting places that contribute to revitalizing the centers by organizing welcome days, spaces for dialogue, exhibitions, cafés, etc. This participant in the Computer Science degree program illustrates it this way:

Ultimately, it's about doing something worthwhile at the center, something that people will attend, such as the development of a model escape room or game. [...] What we really want is to encourage at least one group of students to see attending the center as an added value.

To promote this type of good practice, the importance of fostering coordination between the teaching team and the tutoring staff is highlighted. Among the proposals put forward are visits by the teaching team to partner centers, invitations to tutors to events or conferences at different universities, the teaching team facilitating the acquisition of basic content, and the design of a continuous assessment test with a significant weighting in the final grade.

A participant from the Valdepeñas Associated Center sums it up this way: "The possibility of meeting with the teaching staff and being able to compare hypotheses that I am thinking

about in my head, right? By talking about it, I might find meaning and be able to convey it to the students.

Finally, the need to promote activities that encourage active and collaborative learning, such as collaborative glossaries and infographics, is highlighted. In this regard, renewable assignments (Wiley & Hilton, 2018) play an important role. These are materials and resources generated and shared by the students themselves that facilitate learning and help them achieve good results in assessments, offering a lasting benefit to the student community in general.

Conclusion

The results lead us to consider some interesting reflections by way of conclusion. On the one hand, we highlight as a preliminary condition the necessary harmony and coordination between teaching teams and tutor-teaching staff through meetings, seminars, participation in teaching innovation projects, collaborative work... Without a clear articulation of teaching tasks and functions, it is easy to fall into overlaps and/or gaps, depriving the tutoring staff of the possibility of focusing tutoring on interactive, practical and complementary tasks.

A second line of reflection has to do with the role of tutoring in times of Artificial Intelligence, where learning based on relationships and proximity to students becomes even more important. It is in direct interaction that students have a place to demonstrate their communicative competences, their capacity for argumentation, their internalisation of the subject matter and the development of key skills and abilities.

Finally, we would like to add our questioning on hybrid methodologies, those that allow the simultaneity of face-to-face and online participation and, in turn, both synchronous and asynchronous. This tutorial model provides flexibility of connection, but, in exchange, it is reducing tutorials to lectures with little or no student participation.

Comparable examples:

Mata Benito, P. y Laforgue Bullido, N. (2025). Algunas buenas prácticas en la educación a distancia según equipos docentes, profesorado tutor y estudiantes de la UNED. https://blogs.uned.es/cued/blog-cued-algunas-buenas-practicas-en-la-educacion-a-distancia-segun-equipos-docentes-profesorado-tutor-y-estudiantes-de-la-uned/

Ballesteros Velázquez, B., Izquierdo Montero, A. y Porta Antón, Mª.A. (2025) Ejemplos de buenas prácticas de equipos docentes para promover el aprendizaje desde un enfoque social en Educación a Distancia. https://blogs.uned.es/cued/blog-cued-ejemplos-de-buenas-practicas-de-equipos-docentes-para-promover-el-aprendizaje-desde-un-enfoque-social-en-educacion-a-distancia/

References

Ballesteros, B., Gil-Jaurena, I. & Morentin, J. (2019). Validación de la versión en castellano del cuestionario 'Community of Inquiry'. RED-Revista de Educación a Distancia, 59, 1–26. Art, 4. http://dx.doi.org/10.6018/red/59/04

Garrison, D. R. (2011). About the Framework. An introduction to the Community Of Inquiry. The Community of Inquiry. http://www.thecommunityofinquiry.org/coi

Grady, J. S., Her, M., Moreno, G., Perez, C., & Yelinek, J. (2019). Emotions in storybooks: A comparison of storybooks that represent ethnic and racial groups in the United States. *Psychology of Popular Media Culture*, *8*(3), 207–217. https://doi.org/10.1037/ppm0000185

Izquierdo-Montero, A., Ballesteros-Velázquez, B., Morentin-Encina, J., Melero, H. y Kiczkowski-Yankelevich, A. N. (2022). "En red2": tirar del hilo para mejorar la docencia en educación superior a distancia. En A. Mª. Porto Castro, J.M. Muñoz Cantero, C.I. Ocampo Gómez, (eds.). Educación Inclusiva y Equitativa de Calidad. XX Congreso Internacional de Investigación Educativa. Universidad de Santiago de Compostela. https://dx.doi.org/10.15304/9788419679543

Massuga, F., Soares, S., y Doliveira, S. L. D. (2021). El papel del tutor en la enseñanza de la educación a distancia: una revisión sistemática sobre el enfoque de habilidades. *RED. Revista Educación a Distancia*, 21(66). http://dx.doi.org/10.6018/red.435871

Pagano, C. M. (2007). Los tutores en la educación a distancia. Un aporte teórico. *Revista de Universidad y Sociedad del Conocimiento (RUSC)*, 4(2). https://rusc.uoc.edu/rusc/ca/index.php/rusc/article/download/v4n2-pagano/304-1220-2-PB.pdf

Engagement beyond success rate: Evidence from an adaptive learning system

Baillifard Ambroise[1], Belardi Angelo[1] and Martarelli Corinna S.[2]

[1] Edudl+, UniDistance Suisse
[2] Faculty of Psychology, UniDistance Suisse

Abstract

Adaptive learning systems often aim to maintain learners within a "Goldilocks zone" of challenge—neither too hard nor too easy—to sustain motivation and optimize performance. Wilson et al. (2019) proposed an "optimal" success rate around 85% for artificial neural network and animal brains. Using log data from 413 students enrolled in a digital skills course, we investigated how success rate relates not only to performance, but also to persistence (number of answered questions) and course type (exam vs. no exam). Performance was maximized around an 80.7% success rate. However, success rate varied widely even among the most persistent and high-performing learners, suggesting heterogeneous strategies. We argue that the results reflect strategic differences (between reactive and deliberate learners). We suggest that adaptive learning systems which explicitly aim to foster and maintain learner motivation—by adjusting to different learning rhythms—may better capture the complexity of human learning than approaches based on fixed success targets.

Keywords: adaptative learning systems, success rate, learner persistence

Introduction

Adaptive learning systems, like Duolingo, aim to maintain learner engagement by calibrating an appropriate balance between challenge and success. An optimal success rate around 85% was proposed to maximize learning efficiency for machines and animal brains (Wilson et al., 2019).

However, a single magic number oversimplifies the complexity of human learning. The brain adjusts its learning based on reward history and perceived uncertainty (Farashahi et al., 2017), and the optimal difficulty level — the "Goldilocks zone" — should be seen as a dynamic range, not a fixed point. This range depends on multiple aspects, including individual differences (e.g., failure tolerance), goals, psychological states (e.g., boredom), task complexity (e.g., repetitive vs. complex), and contextual factors (e.g., environmental distractions). In our view, this range could reasonably start at 60%, echoing the threshold for sufficiency in the Swiss grading system. It could extend toward different higher values, depending on individual and contextual factors.

Drawing on behavioral data from an adaptative learning system named *Kaïros,* we explored how **success rate**– measured as the number of correct answers divided by the total number of answers – is associated with:

1. **Performance** (an algorithm-based estimate of knowledge mastery, reflecting actual learning),
2. **Persistence** (defined by the number of questions answered, reflecting the learner's engagement or overall effort),
3. **Course type** (formal learners with an exam vs. open learners without an exam).

Method

Study context

Our analysis draws on 413 learners enrolled in a digital skills course delivered through the adaptive learning platform *Kaïros*. Among them, 338 learners followed a formal ECTS-accredited track (with exam), while 75 participated in an open version of the course (no exam). The original *no exam* group included 127 participants, but 52 of them were excluded for answering fewer than 10 questions.

Kaïros adjusts task difficulty in real time, based on learner performance (Bonvin et al., 2022; Baillifard et al., 2023). A correct answer prompts a more challenging question; an incorrect answer leads to a simpler one.

The digital course includes 1,909 unique questions, making full completion unrealistic and encouraging personalized learning trajectories. *Kaïros* allows learners to consult course materials at any point, either before answering a question or after receiving feedback. This flexibility allows for different strategies: some learners may consult materials before answering, while others answer first and revise later. Additionally, learners' approaches can vary not only between learners but also within the same learner, for example depending on the specific materials themselves.

Results

Associations between performance and success rate

Performance exhibited a significant quadratic relationship with success rate, consistent with the Goldilocks zone, where performance peaks at intermediate difficulty. The regression model was significant ($F(2, 410) = 49.89$, $p < .001$), explaining 19% of the variance in performance (adjusted $R^2 = .192$). Both the linear term ($\beta = 1.66$, $p < .001$) and the quadratic term ($\beta = -1.25$, $p < .001$) were significant, indicating an inverted-U curve (see Figure 1).

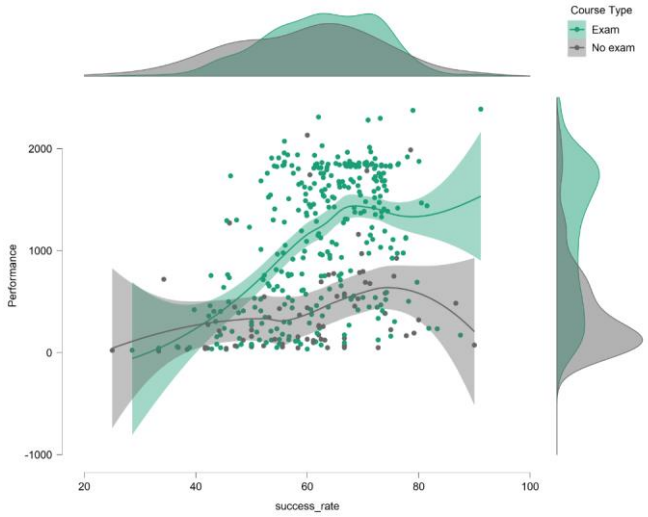

Figure 1: Scatterplot of success rate (x-axis) versus performance (y-axis, learning mastery), comparing learners with and without an exam. Exam-takers show higher performance.

Associations between persistence and success rate

We further examined whether success rate varies as a function of persistence. A quadratic regression revealed a statistically significant model ($F(2, 410) = 12.58$, $p < .001$), accounting for a modest portion of variance ($R^2 = .058$, adjusted $R^2 = .053$). The linear term was positive and significant ($\beta = 0.41$, $p < .001$), and the quadratic term was negative and significant ($\beta = -0.22$, $p = .027$), indicating a non-linear, inverted-U relationship. This suggests that the more learners engage, the more their success rate grows—until it levels off.

Variability in success rates

Performance peaked at a success rate of 80.7%, close to Wilson's 85% benchmark. As learners become more proficient, their success rates tend to cluster more narrowly, with a concentration around 67% (SD = 7.9) (figure 2). However, even among the 25% highest-performing students (Q4), success rates still range widely (from 46% to 91%). This indicates that high levels of performance can be reached across a broad spectrum of success rates.

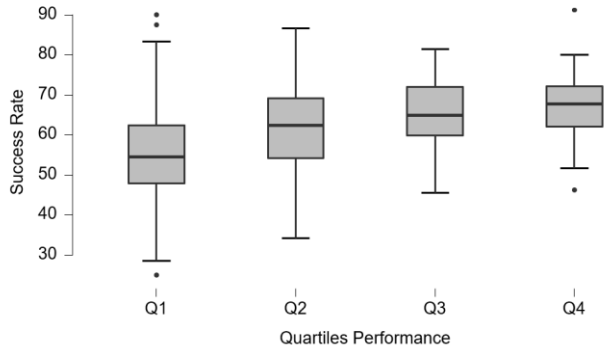

Figure 2: Mean and standard deviation of success rate by performance quartile (Q1- Q4), showing that success rate variability remains regardless of performance level.

A similar analysis by **persistence** quartiles shows a similar trend. Success rate variability remains substantial, even among the most persistent learners. The top 25% most persistent learners (more than 315 answered questions, Q4) displayed a wide range of success rates (from 46% to 91%), challenging the assumption that sustained practice leads to convergence around an "optimal" success rate. Figure 3 shows variability of success rate for each quartile of persistence.

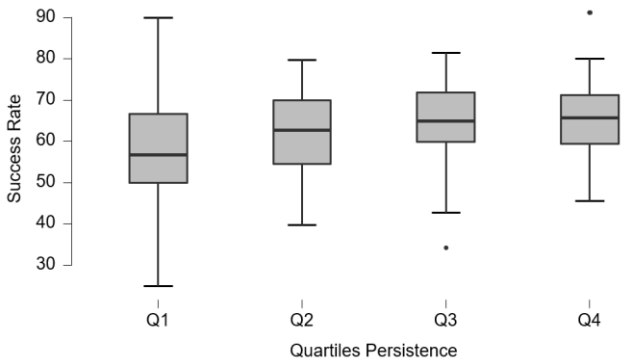

Figure 3: Mean and standard deviation of success rate by persistence quartile (Q1, Q2, Q3 and Q4), showing that success rate variability persists across all levels of persistence. Intra-quartile variability in success rate exceeds inter-quartile differences, reinforcing the idea that learner strategies remain highly heterogeneous—even among learners with similar levels of persistence.

Interpreting learner behavior: Strategies over scores

The results show that while a success rate of 80 to 85% may help maximize learning, it does not indicate how much effort a learner is willing to invest or how long they will keep practicing. We propose that success rate reflects strategic variation rather than consistent differences in knowledge mastery or persistence. These strategies move along a continuum, which can be roughly illustrated by two poles:

- **Reactive responders** answer quickly, guess often, and learn retrospectively through feedback or by consulting the course material afterward. They tend to have lower success rates but could have high persistence and performance. Like Epimetheus, they reflect after acting.

- **Deliberate responders**, by contrast, proceed with caution. They answer only when confident and tend to engage with fewer problems overall, resulting in higher success rates. Like Prometheus, they plan before acting.

A single learner may frequently shift between strategies depending on factors such as personal goals, boredom, or context. Success rate thus emerges from a complex interplay between individual differences and contextual factors. It may provide only a partial reflection of competence, and its association with persistence appears even more uncertain. .

Designing motivation-oriented adaptive systems

Rather than aiming for a uniform success rate, adaptive platforms should account for the dynamic nature of learner behavior. These systems should go beyond serving as exercise delivery tools to function as "designers", facilitating meaningful learning experiences aligned with learners' psychological states and goals. This includes alternating between moments of fluency (e.g., reviewing with ease on the go) and productive disequilibrium (e.g., deeper engagement during focused sessions).

We propose three key design principles:

- First, rather than imposing a single "optimal" behavior on all learners, adaptive systems should adjust to each learner.
- Second, systems should give learners the possibility to choose between challenge modes—for instance, selecting between "easy" and "hard" modes—according to their current needs and availability. This supports learner autonomy and allows the system to refine its understanding of everyone over time.
- Third, systems should actively foster failure tolerance by recognizing errors as an integral part of the learning process and providing constructive feedback after incorrect answers.

Conclusion

What optimizes machine learning performance does not automatically translate into effective human learning (Baillifard, 2025). Learning in biological systems is not the result of blank-slate optimization, but of structured interactions between innate predispositions and adaptive strategies (Zador, 2019). In this view, optimization of learning is not about maximizing raw performance, but about scaffolding learning rhythms that promote both mastery and engagement. What matters is personalized progression—supporting each learner's trajectory through challenge, timing, and meaningful choice.

References.

Baillifard, A. (2025). L'intelligence artificielle : miroir de l'apprentissage humain ? *Formation et profession*. *33*(1), 1-5.

Baillifard, A., Bonvin, M., & Guiard, N. (2023). AMUQquiz et Kaïros : Regards croisés sur la création et le développement de deux plateformes d'apprentissage adaptatives. *Revue internationale des technologies en pédagogie universitaire*, *20*(2), 139-153. https://doi.org/10.18162/ritpu-2023-v20n2-11

Bonvin, M., Baillifard, A., & Thurre, A. (2022). Kaïros: the why, what and how of a digital learning platform. In G. Ubachs, S. Meuleman et A. Antonaci (Eds), *Proceedings of the Innovating Higher Education Conference* (I-HE2022) (p. 730-743). https://doi.org/10.5281/zenodo.7330857

Farashahi, S., Donahue, C. H., Khorsand, P., Seo, H., Lee, D., & Soltani, A. (2017). Metaplasticity as a neural substrate for adaptive learning and choice under uncertainty. *Neuron*, *94*(2), 401-414.e6. https://doi.org/10.1016/j.neuron.2017.03.044

Wilson, R. C., Shenhav, A., Straccia, M., & Cohen, J. D. (2019). The Eighty Five Percent Rule for optimal learning. *Nature Communications*, *10*(1). https://doi.org/10.1038/s41467-019-12552-4

Zador, A. M. (2019). A critique of pure learning and what artificial neural networks can learn from animal brains. *Nature Communications*, *10*(1), 3770. https://doi.org/10.1038/s41467-019-11786-6

Contributing Institutions

Bifröst University | Iceland
CIAC | Portugal
EADTU | The Netherlands
Hellenic Open University | Greece
INESC | Portugal
International Telematic University UNINETTUNO | Italy
KU Leuven | Belgium
TÉLUQ | Canada
The Open University | The United Kingdom
Unidistance Suisse | Switzerland
Universidad Nacional de Educación a Distancia (UNED) | Spain
Universidade Aberta | Portugal
Université du Québec à Montréal | Canada
Universitat Oberta de Catalunya | Spain
Université du Québec à Trois-Rivières | Canada
York St. John University | United Kingdom

Published by:
European Association of Distance Teaching Universities (EADTU)
DOI: 10.5281/zenodo.15908735