Enhancing Authentic Assessment in Higher Education: leveraging Digital Transformation and Artificial Intelligence

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Abstract

The COVID-19 pandemic necessitated universities to adopt online assessments, incorporate hybrid teaching methods, and diversify their evaluation tools. This transformation centered on principles of authenticity, accessibility, and responsible data management. Technology, artificial intelligence (AI), and assessment analytics have played pivotal roles in reshaping assessment practices. Automatic grading tools like Knowledge Tracing have proven valuable for both in-person and online learning. Nonetheless, ongoing debates revolve around issues of data literacy and striking a balance between humanistic and technocratic educational approaches. This proposal delves into the realm of e-assessment tools, the evolution of assessment objectives, and the challenge of establishing trust in online assessment processes. Universities are actively working to enhance assessment methods, with a strong emphasis on authenticity and robust student support. They are also integrating e-assessment technology to ensure genuine and effective evaluations. The proposal's overarching objective is to contribute to the ongoing discourse surrounding the promotion of authentic and continuous assessment within higher education. It aims to explore the opportunities presented by digital transformation, online learning, and artificial intelligence in this educational context. Additionally, we provide an overview of a pilot study aimed at investigating the potential application of a multimodal computer vision system to enhance assessment methods in the university setting and create a supportive learning environment.

1. Hybrid teaching and technological revolution in the assessment area

The COVID-19 pandemic has necessitated teachers to fundamentally reassess and restructure their pedagogical approach, entailing substantial infrastructural and instrumental adaptations, along with concomitant cultural shifts [1, 2]. In confronting this exigency and the attendant radical transformation, digitalization has assumed an indispensable role [3].

Nevertheless, it has also unveiled manifest challenges, resistance, and a palpable exigency for pedagogical support within the academic community [4, 5]. This paradigmatic shift has gradually reshaped the landscape of pedagogy, engendering a more hybrid and adaptable instructional modality, extending even to the realm of assessment methodologies.

Specifically, the advent of the COVID-19 pandemic compelled academic institutions to embrace online assessment solutions, resulting in a notable proliferation of hybrid teaching modalities [6]. UNESCO [7] provided a summary of the components of effective professional development for remote and hybrid mode teaching, deepening the foundational knowledge and

skills specific to the teaching profession, also in the field of assessment and self-assessment (Table 1).

Table 1
Foundational knowledge and skills specific to the teaching profession (Extracted and adapted from UNESCO 2023, p. 51)

Student Assessment	Self-assessment
Teachers must possess the following competencies: **Assessment Proficiency:** Teachers need to assess student learning, achieve objectives, monitor progress, and use assessment data to support students and adapt teaching methods and curriculum. **Adaptive Assessment:** Teachers should use appropriate assessments for in-person or remote learning to ensure reliable evidence of student progress. **Diverse Assessment Formats:** Teachers should be skilled in developing and implementing various formats for both formative and summative assessments, tailored to different teaching modes. **Technology Integration:** Proficiency in various assessment technologies and platforms enables students to demonstrate understanding through diverse methods like written work, videos, voice recordings, games, presentations, projects, and activities. **Student Self-Assessment:** Teachers should teach students how to self-assess their understanding and encourage them to seek support when needed. **In the context of hybrid and remote teaching, teachers must also:** **Technology-Enhanced Assessment:** Be adept at applying assessment techniques that leverage educational technology in all instructional modes. **Communication of Modes:** Teachers should help students understand various knowledge transmission modes for effective demonstration of lesson objectives, especially in remote and hybrid teaching. **Varied Assessment Methods:** Use various assessment methods to assess knowledge mastery, giving students flexibility in demonstrating their understanding without being limited to specific approaches.	Teachers should possess the following competencies: **Regular Self-Assessment:** Teachers should engage in consistent self-assessment by gathering feedback from students and colleagues. They should use this data to enhance their teaching and make necessary adjustments to facilitate students' satisfactory learning and development. **Seeking Support:** Teachers should be proactive in seeking support from colleagues and supervisors for areas they identify as needing improvement. **In the context of hybrid and remote teaching, teachers should also:** **Utilize New Teacher Resources:** They should be proficient in accessing and using new resources that aid in their professional development, such as recording their teaching sessions and reviewing these recordings either individually or collaboratively with peers.

This paradigm shifts also ushered in a greater degree of flexibility in the selection of pedagogical tools. Notable adaptations included an increased emphasis on formative evaluation, incorporation of oral presentations, peer assessment, and practical project-based assignments, facilitated through platforms/tools such as Teams, Canvas, Turnitin, and PowerPoint. Moreover, this period witnessed the widespread adoption of open-book examinations administered remotely and the implementation of continuous assessment methodologies.

Concomitantly, the exigencies of the pandemic engendered a requisite reevaluation of assessment design. This recalibration hinged on foundational principles centered on authenticity, accessibility, judicious automation, pedagogical continuity, and robust security considerations, as elucidated by Jisc [8].

The seminal report entitled "Assessment Rebooted" [9] underscored the imperative of personalized evaluation frameworks that are inherently student-centric. These frameworks, while ensuring the academic integrity, also espouse responsible data handling, equitable evaluation practices, inclusivity, and the amelioration of awarding disparities.

In the midst of this evolving cultural landscape, the proposal aims to contribute to the discourse surrounding the promotion of authentic and continuous assessment within the realm of higher education. It seeks to explore the opportunities afforded by digital transformation, online learning, and artificial intelligence in this context. Specifically, the proposal will delve into several key areas, including the utilization of e-assessment tools, the redefinition of assessment objectives, and the challenges associated with establishing trust in online assessment practices.

The ongoing dialogue underscores the pervasive influence of the technological revolution in the field of assessment. As evidenced by the EADTU Report edited by Rossade et al. [10], the development of online assessment strategies in educational institutions is intricately linked to technology. This includes the utilization of tools such as quizzes and video-based assessment, as well as the integration of AI and assessment analytics. These technological advancements are poised to drive innovation in assessment, particularly in areas like academic writing and grammar. The evolution of AI and assessment analytics promises to enhance existing practices and reshape the dynamics of teaching and learning within educational institutions.

Through a meticulous examination of the research landscape and a comprehensive literature review spanning from 2016 to 2021, del Gobbo et al. [11] shed light on the growing significance of automatic grading and feedback tools and methods (AGFTM) within online learning systems. These tools play a critical role, particularly in the assessment of short answers and essays.

One specific AI-supported strategy, as highlighted by Mollick and Mollick [12], involves the creation of low-stakes tests. These tests can be integrated into various educational contexts, such as discussions, lectures, individual exercises, homework assignments, or in-class group activities. When administered regularly, they have proven effective in aiding students in retaining information over the long term and identifying areas where their comprehension of the study material may be lacking. Additionally, low-stakes tests provide instructors with invaluable insights into students' knowledge and understanding, enabling them to adapt their teaching methods effectively. AI emerges as a valuable tool for educators in generating practice tests, quizzes, and short-answer questions, including those designed for assessing students' knowledge during lectures.

Casalino et al. [13] elucidate the application of deep learning techniques in the realm of Learning Analytics, with a particular focus on the Knowledge Tracing (KT) methodology. KT employs predictive modeling to ascertain a student's likelihood of successfully completing exercises based on their historical performance. This approach allows for the modeling of student behavior over time, offering actionable feedback for both students and educators. Moreover, KT has the capacity to promptly notify teachers if a student encounters difficulties in acquiring essential skills, enabling timely interventions. This methodology proves effective in both in-person and online learning contexts, particularly in blended instructional models.

In the realm of critical perspectives, it is worth noting the thematic series edited by Raffaghelli et al. [14], which delves into various aspects related to the research problem of data literacy in

Higher Education. This series explores the concept of "data culture" within the broader institutional context, shedding light on the growing tension between a neo-humanistic perspective and technocratic imperatives, particularly as artificial intelligence and the Internet of Things continue to advance as marketable innovations.

In addition, the utilization of AI in educational settings presents several notable risks. These include concerns related to confabulation, where the generation of plausible yet inaccurate responses can occur. Moreover, biases, encompassing gender, racial, or ideological biases, may also manifest within AI systems. Privacy considerations and legal complexities further add to the intricacies of AI integration. Lastly, there are instructional risks to consider, including the potential for AI to disrupt traditional learning methods [15]. These critical viewpoints underscore the multifaceted nature of AI incorporation in education, warranting a careful and vigilant approach to its implementation.

2. Pilot Study design: towards the Hybridization of Assessment

We present an overview of a pilot study encompassing teachers and students from two universities in Southern Italy, namely Bari and Foggia, conducted in collaboration with an international network of university partners. The primary aim of this project is to explore the application of a multimodal computer vision system to enhance assessment methods within the university context and foster a supportive learning environment. This transformation seeks to shift the role of assessment from merely evaluating learning achievement to actively promoting learning development.

Research hypothesis: the main hypothesis of this study is that the hybridization of assessment, using a multimodal computer vision system based on AI, will significantly improve the authenticity, personalization, and flexibility of assessment practices in higher education. Furthermore, it is hypothesized that this approach will foster a more supportive learning environment and promote learning development.

Participant selection: two groups of participants will be selected, one from the University of Bari and the other from the University of Foggia, both consisting of teachers and students using the AI-based multimodal computer vision learning environment. The sample size will be a minimum of 100 participants from each university. An international network of universities with specific expertise in AI application in educational systems, including the College of Computing at Georgia Tech, the Leibniz Institute for Research and Information in Education, the University of the West of England, and the Department of Education at the University of Salamanca, will be involved in the research and system design phase.

Implementation of the Multimodal System: the multimodal computer vision system will be implemented in collaboration with the Department of Educational Sciences, Psychology, Communication, and the Department of Computer Science at the University of Bari Aldo Moro. This system will include components such as Knowledge Tracing Systems, Sentiment Analysis techniques, formative assessment tools, profiling systems, personalized assessment methods, and the utilization of extensive language models.

Data collection: data will be collected through questionnaires, interviews, analysis of learning data generated by the system, and assessment data. The data will include student feedback, assessment results, knowledge tracking data, and sentiment analysis data.

Data analysis: the collected data will be analyzed to assess the effectiveness of the multimodal system in enhancing the authenticity, personalization, and flexibility of assessment practices. Advanced statistical techniques will be used to compare results across different universities and identify challenges and successes in implementation. Qualitative interviews will be conducted with teachers and students to gain a better understanding of the challenges and successes encountered while using the system, with a particular focus on cultural and organizational differences between the involved universities. These interviews will provide further insights into the factors influencing the effectiveness of AI-based online education.

Different forms of continuous and learning-based assessments will be experimented with in the pilot study, using platforms such as Moodle or Learning Management Systems (LMS). This component will focus on how these forms of assessment can be integrated into the AI-based online learning environment. Continuous assessment forms may include: student self-assessment: students will be encouraged to monitor their own learning progress using digital tools within Moodle or LMS platforms and reflect on their development; quizzes and periodic activities: online quizzes and periodic activities will be created within the Moodle or LMS platforms for students to assess their understanding and continuous learning; real-time feedback: real-time feedback tools within Moodle or LMS platforms, such as chatbots or comment systems, will be used to provide immediate feedback to students during their learning activities; personalized eportfolios: students will be encouraged to create and maintain personalized eportfolios within Moodle or LMS platforms to document their learning, reflections, and progress within the course. Data collected from various forms of continuous assessment within Moodle or LMS platforms will be analyzed to understand how these practices impact student learning, motivation, and participation. The effectiveness of continuous assessment forms in promoting active learning and student engagement will be evaluated.

Expected Results: A key outcome of this pilot project is to experiment and assess the efficacy of automated support tools for university educators. These tools aim to streamline the efficient and timely processing and comprehension of data from diverse sources, thereby providing a comprehensive understanding of student learning and engagement. It is expected that this pilot study will provide a clear understanding of the impact of the hybridization of assessment in higher education and the effectiveness of the multimodal AI-based system. It is hypothesized that the system will improve the effectiveness of assessment, promoting authentic and personalized learning. Additionally, the study may reveal specific challenges related to the implementation of this technology on an international scale and suggest possible solutions to address them. This pilot study will serve as a solid foundation for further extensive research and may contribute to the development of guidelines for implementing similar systems in other educational institutions.

The hybridization of traditional university assessment practices with online technologies and AI necessitates structural adjustments. These modifications encompass redefined roles for both teachers and students, alterations in the dynamics of time and space, and a heightened emphasis on feedback and error management, as summarized in Table 2.

Table 2
Technological Hybridization of Assessment

'Traditional' Learning Assessment	Technology-mediated formative assessment
Assessment of learning	Assessment for learning
Individual perspective	Self, peer, and co-assessment perspective
Final, summative moment, with few tools	Continuous assessment and through narrative and reflective tools
Teacher centrality	Student engagement and feedback
Wide margin of subjectivity and discretion	Automation in verification and reduction of subjectivity
Uniform and non-adaptive tools (tests)	Adaptivity, personalization, and progressive question complexity
Based on predominantly linguistic-symbolic communicative channels and mediators	Heterogeneity of communicative channels and visual, iconic, simulated, hypermedia mediation
Negatively perceived by students	Positively perceived (ease of use, interaction, error reversibility)

This transformative shift entails an augmentation of several key elements, including authenticity, personalization, choice, flexibility, and a reduction in high-stakes assessments.

These modifications are intended to bolster academic integrity and promote student well-being. Establishing trust in online assessment practices represents a multifaceted challenge, encompassing trust in the technology itself, its deployment, the organizational framework, privacy considerations, and the equitable treatment of individuals within the assessment process.

For instance, the Universidade Aberta in Portugal has pioneered a student-centric virtual pedagogical model that provides an array of flexible assessment methods, including options for continuous assessment or a single endpoint examination. Central to these innovative approaches is the integration of e-assessment technology, aligning with the overarching concept of authentic assessment [16].

Mas-Garcià and colleagues, within the EADTU *Envisioning report 2023* [17], also indicated 10 Methods and activities for learning and assessment with generative AI (in particular, AI text generators and Large Language Models such as ChatGPT) that can be applied individually or combined to improve assessment practices, including AI and gamification where appropriate:

1. Infographic Deliverables: require students to create infographics to communicate concepts effectively and meet specific requirements.
2. Utilize Tests: randomize questions in tests within Learning Management Systems (LMSs) to assess theoretical knowledge with time limits.
3. Leverage Portfolios: encourage metacognitive reflection through portfolios, where students explain their approaches, justify decisions, and self-evaluate their work.
4. Implement Co-Assessment: engage students in co-assessment with peers, including qualitative assessments in final deliverables.
5. Incorporate Oral Tests/Interviews: use oral tests and interviews, including presentation videos, to assess content and personalize the process.
6. Contextualized Questions: Avoid generic questions and frame them in real-world contexts related to the course.
7. Use of Chat (Text-Based AI): integrate chatbots or AI for gamified activities and encourage critical evaluation of responses.
8. Promote Collaborative Work: foster collaboration through discussions, debates, and shared working processes.
9. Increase Feedback: provide personalized feedback at multiple points during the learning process, linking it to assignments.
10. Synchronous Tests: consider synchronous tests, including collaborative elements and practical simulations, to assess applied or practical knowledge.

As elucidated by Cardona and colleagues [18], the infusion of AI into education has the potential to reshape assessment practices, particularly within the realm of formative assessment. This evolution necessitates a balanced approach that maintains human oversight, with a primary focus on students, teachers, and other stakeholders. AI has the capacity to enhance formative assessments by delivering real-time feedback, adapting to individual learner abilities, and seamlessly integrating assessments into the learning process. However, it remains paramount to retain human involvement to ensure fairness, address potential biases, and confront the practical implications of AI in education. Active participation of teachers and students in the design and evaluation of AI-augmented assessment tools is imperative to render them both valuable and user-friendly. Addressing issues related to bias and fairness in AI-enabled assessments is equally crucial, ensuring that feedback loops enhance the student learning experience while upholding the principles of privacy and trust within AI systems.

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