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# SIMULATION-BASED ASSESSMENT IN HIGHER EDUCATION: ADAPTING TO THE ERA OF ARTIFICIAL INTELLIGENCE

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**Abstract:** This qualitative study explores the integration of artificial intelligence (AI) in education, focusing on a simulation-based assessment methodology implemented in a Master's course in Valencia, Spain. The research addresses the growing challenges of AI in academic settings, including concerns about academic integrity, the limitations of traditional assessment methods, and the need for authentic evaluation of student competencies. By employing simulation and virtual exchange as pedagogical strategies, the study examines how pre-service teachers from nine universities engage in professional role-playing scenarios across four synchronous sessions. The research investigates the use of AI as a tool for brainstorming and organising information during these simulations. Through observations of dialogic interactions made by academic observers, the study aims to understand the potential of simulation-based learning in developing professional competencies, fostering authentic assessment, and navigating the ethical considerations surrounding AI use in education. This approach offers insights into alternative assessment methodologies that can effectively evaluate student authorship and knowledge while harnessing the advantages of AI in educational settings.

***Keywords****:* Artificial Intelligence (AI), assessment; simulation, teacher education, virtual exchange

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## 1. Introduction

The landscape of simulation applied to teacher education has evolved significantly, particularly with the integration of artificial intelligence (AI) tools. This evolution presents both opportunities and challenges for educators and students alike. As AI technologies advance, they offer innovative solutions that can enhance the learning experience, such as personalised feedback, adaptive learning environments, and immersive simulations that better prepare pre-service teachers for real-world classroom scenarios. However, these advancements also raise critical ethical considerations regarding academic integrity, reliance on technology, and the potential erosion of essential cognitive skills like critical thinking and creativity. The shift towards AI-enhanced simulations necessitates a re-evaluation of traditional assessment methods, prompting educators to explore new pedagogical strategies that not only benefit AI's capabilities but also address the inherent risks of over-reliance on automated systems. This paper aims to investigate the dual impact of AI in teacher education simulations, examining how these tools can foster effective learning while exploring the ethical challenges that accompany their use. Through qualitative analysis of academic-observers feedback notes of the participants' performances in simulated environments, this study seeks to illuminate the balance between embracing technological advancements and maintaining the integrity of educational practices.

The state of the art in simulation for teacher education has evolved significantly, particularly with the integration of artificial intelligence (AI). This evolution has led to more sophisticated and effective training methods for student-teachers (Adams et al., 2023; Lehmann, 2022). These challenges have spurred innovations in teacher education, with simulation emerging as a key methodological strategy for preparing educators to adjust to complex classroom environments.

Kasperski et al (2025) have made significant contributions to the field of teacher education by identifying five distinct types of simulations. These range from case studies, which involve analysing video clips of educational scenarios followed by reflective discussions, to virtual simulations that offer computer-based environments with predefined response options. The spectrum also includes immersive (mixed-reality) simulations, where participants interact with AI-controlled avatars in realistic scenarios, and role-play simulations that allow for experiential learning through assuming different predefined roles. At the highest level of authenticity are clinical simulations, which provide hands-on, experiential learning in controlled environments with standardized participants. Each of these simulation types offers unique benefits: case studies foster critical analysis skills, virtual simulations provide tailored and repeatable experiences, immersive simulations are particularly effective for practicing complex interpersonal skills, role-play develops empathy and perspective-taking, while clinical simulations are invaluable for developing practical teaching skills. This comprehensive framework of simulation types provides educators with a versatile toolkit for preparing student-teachers for the multifaceted challenges of real-world classrooms.

In the age of artificial intelligence and increasing technological reliance, embracing active methodologies like simulations in teacher education has become more crucial than ever. Active learning strategies such as problem-based learning, interactive simulations, and

personalised learning pathways have shown to increase student engagement, foster critical thinking, and deepen the understanding of concepts (Jiménez-Rodríguez et al., 2021; Selwyn, 2024; Zawacki-Richter et al., 2024). This is particularly important in teacher education, where developing these skills is essential for future educators (Levin & Flavian, 2022).

Simulations offer a unique opportunity to address the challenges posed by AI and technology overuse. Several studies by Álvarez (2023), Angelini (2016); Angelini and Muñiz (2021), Angelini et al. (2024); De Coninck et al. (2019); Levin et al., (2023); have demonstrated that real-case simulations provide students with authentic scenarios that closely mimic professional encounters. These soft skills are crucial for teachers and are areas where human intelligence still outperforms AI.

## 2. Literature Review

### *2.1 Simulation Methodology*

In simulation-based training, classical simulation aligns with Kolb & Kolb (2015) 'learning cycle' which consists of three main phases (García-Carbonell et al., 2012, 2014). The first phase is briefing (Phase I), which consists of preparation of the simulation. The trainer (also referred to as the facilitator) must provide all the necessary information and rules for the action phase (Phase II). The briefing sessions take place prior to simulation action. Participants discuss issues related to the simulation scenario. Research has great value in this phase. Participants should investigate and document the different issues or situations that will be dealt with in the scenario. They will thus be better prepared in terms of content and language for discussions during the simulation. Specific profiles can be strategically assigned to participants after they have analysed the scenario situations from the different perspectives of the profiles. In this phase, the general objectives of the simulation are presented. The facilitator forms the teams and then assigns the profiles to the individual team members.

Action (Phase II) is where the simulation takes place. All participants have objectives and responsibilities that are clearly specified in their profiles. The team leader can start the activity by thanking the members for their presence and addressing the problems that need to be solved. Debates, discussions, negotiations and decision making are expected. Debriefing (Phase III) takes place after the action phase. All participants (intra- or inter-group) reflect on the experience, their role and their learning process. It is the phase of reflection, sharing and evaluation at individual and group levels, in which participants analyse the different tasks and results of the previous phases. For a better understanding of the simulation, the Annex presents the simulation model.

### *2.2 Simulation as an Alternative Assessment Strategy*

The current study proposes the integration of simulation and virtual exchange as innovative pedagogical strategies for the professional development of pre-service teachers. This approach addresses the critical issue of authenticity in assessment by creating verisimilar scenarios that more accurately reflect the complexities of real-world teaching environments, thus transcending the limitations of conventional written examinations and assignments. The paradigm shift towards simulation-based methodologies is substantiated by several compelling factors: authenticity and contextual relevance, comprehensive evaluation of multifaceted competencies, mitigation of academic integrity concerns, enhancement of experiential learning outcomes, and adaptability and scalability of assessment protocols.

It has been extensively proved that simulations provide a more authentic assessment environment compared to traditional written exams and assignments (Álvarez, 2023; Angelini & Muñiz, 2021; Angelini et al., 2024; Murata & Siker, 2023; Pop, 2023; Siker, 2023). By creating 'real' scenarios that closely mimic professional encounters, simulations allow for the evaluation of teachers' competencies in contexts that closely resemble actual classroom situations. This authenticity is particularly valuable in assessing social-emotional learning competencies, which are difficult to evaluate through conventional written assessments, especially with the rapid proliferation of AI.

Furthermore, simulations offer a more robust alternative that is less susceptible to AI-generated content, as they require real-time, spontaneous responses in dynamic scenarios (Swiecki et al, 2022). This helps ensure that the assessment truly reflects the teacher's own abilities and decision-making skills. However, it must be highlighted that simulations not only serve as assessment tools but also as powerful learning experiences (Angelini, 2021; Fischetti et al., 2022; Ledger et al., 2022). They provide opportunities for experiential learning, immediate feedback, reflection on practice, and peer learning. This dual function of assessment and learning makes simulations a particularly efficient and effective pedagogical approach.

Additionally, the use of simulations aligns closely with the actual skills and competencies required in teaching practice. By assessing teachers in scenarios that mirror real classroom challenges, simulations provide a more accurate picture of a teacher's readiness for professional practice. This alignment ensures that the assessment process is not only evaluative but also preparatory for real-world teaching situations. With advancements in technology, simulations can be adapted to various contexts and scaled to accommodate large numbers of participants. Virtual and mixed-reality simulations, in particular, offer the potential for widespread implementation and standardized assessment across different educational institutions. While the shift towards simulation-based assessment presents challenges, including the need for new assessment frameworks and potential technological barriers, the benefits in terms of authenticity, comprehensive skill evaluation, and alignment with professional practice make it a justified and promising direction for teacher education assessment strategies.

## 3. Methodology

### *3.1 Context*

The methodological context of this study centered on a simulation titled "The School of Valtance," designed to provide an authentic, immersive experience for pre-service teachers. The simulation was conducted using Microsoft Teams, a digital platform that facilitated remote participation and observation.

To ensure the integrity of the simulated environment, observers were strategically positioned in breakout rooms within the Microsoft Teams platform. These observers maintained a non-intrusive presence by disabling both their audio and video feeds, effectively minimizing potential disruptions to the natural flow of conversation among participants. This approach aligns with established qualitative research practices that emphasize the importance of minimizing observer influence on participant behavior (Sandín, 2003; Twining et al., 2017; and Vallés, 1997, 2002).

The primary function of these observers was to conduct systematic, non-participant observation of the interactions and discussions among student-participants. Their task involved meticulous note-taking, focusing on salient aspects of students' learning processes, including but not limited to verbal expressions of thought processes, demonstrations of

content knowledge, application of pedagogical strategies, collaborative problem-solving approaches, and manifestations of critical thinking skills.

This observational data collection method allowed for the capture of rich, contextual information about the participants' engagement with the simulation, their cognitive processes, and their developing professional competencies. The use of multiple observers also facilitated data triangulation, enhancing the reliability and validity of the findings (Twining et al., 2017).

The "School of Valtance" simulation thus served as a controlled environment for assessing the efficacy of simulation-based learning in teacher education, while the observational methodology employed provided a means to gather detailed, qualitative data on the participants' experiences and learning outcomes.

*3.2 Participants*

This study involved 22 academics from the collaborating universities with extended experience in teacher education. These scholars served as observers during a simulation-based learning experience. These observers were assigned to 5 mixed teams of student-participants, totalling 144 future teachers enrolled in an Official Master Programme. The participants represented diverse backgrounds, hailing from countries such as the United States, Tunisia, Algeria, Poland, Romania, and Spain.

*3.3 Procedures*

The present study employs a qualitative post-treatment methodology, adhering to the rigorous guidelines established by Sandín (2003), Twining et al. (2017), and Vallés (1997, 2002). This approach was chosen for its capacity to provide rich, contextual insights into the complex dynamics of simulation-based learning in teacher education. Data collection was conducted through comprehensive and structured guidelines administered to observer academics, who provided detailed testimonies of their observations. These narratives were subsequently subjected to a systematic coding process using Dedoose 9.0.19, a sophisticated qualitative data analysis software. This coding procedure, following the principles of grounded theory, facilitated the organization and reduction of data to the point of theoretical saturation. Through this iterative process, emergent categories were developed based on the properties and dimensions identified within the data, allowing for a nuanced understanding of the phenomena under investigation. This methodological approach ensures a robust and theoretically grounded analysis of the simulation-based learning experience, providing valuable insights into its efficacy as an innovative pedagogical strategy in the context of pre-service teacher education.

E.g. Academics’ structured observations:

1. Participants' degree of attentiveness during the simulation.

2. Evidence of participants' preparation for the simulation.

3. Relevance of dialogue observed during the simulation.

4. Difficulties observed during the simulation and their nature.

5. Presence of dissonant profiles, their impact on communication, and their role in challenging other participants constructively.

6. Overall perception of the learning effectiveness and usefulness of simulation-based learning.

The qualitative analysis identified two broad categories related to the integration of AI in the simulation:

1. AI as a Facilitator of Collaborative Learning

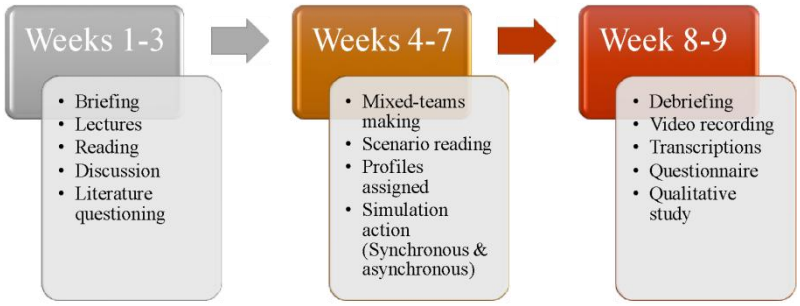
2. Challenges and Ethical Considerations Surrounding AI

*3.4 Temporalisation*

The temporalisation encompasses between 8-9 weeks in which a thorough briefing or preparation of the simulation scenario and pre-mentoring guidelines are given. Students-participants attend participative lectures that delve into the related topics that would appear in the educational scenario without knowing neither the scenario itself not their profiles roles. In this way we guarantee impartiality and a deeper understanding of the issues from different perspectives. Figure 1 shows the preparation of the simulation +V.E proposal.

***Figure 1***:

*Temporalisation*




*3.5 Research Ethics*

Regarding Ethics of the investigation, this research respects the ethical standards applicable to this type of project: the material and human resources necessary to carry out the research project do not interfere with the performance of other types of studies and all participants have been anonymised. The purpose of the collection and processing of the data is solely for the purpose of identifying the natural persons whose information is subject to study or analysis in the research work. The researchers or research teams process the data with the necessary security measures, in accordance with the law to guarantee the confidentiality and integrity of all this information.

In any case, on the basis of the necessary real and true identification of the person, the researcher or research team dissociates (anonymises or omits) the data, so that they cannot be identified.

## 4. Results

Results of the qualitative study identify two broad categories of analyses related to AI during the simulation: AI as a facilitator of collaborative learning, and challenges and ethical considerations surrounding AI.

*4.1. AI as a Facilitator of Collaborative Learning*

Observers noted that AI tools played a crucial role in enhancing collaborative discussions among participants from various cultural backgrounds. The ability to brainstorm and organize information effectively allowed for richer dialogue and more innovative problem-solving approaches.

> "AI serves as a tool for [participants] to brainstorm and organise information discussed during the sessions according to some participants. "[1]
>
> "The feasibility of input data, the effectiveness of feedback on recipients, and the AI to generate or synthesise feedback using existing data efficiency are also observed in line with ethical standards."[5]
>
> "Simulation-based learning, augmented by AI technologies, provides a dynamic platform for technical and non-technical skills development. Ultimately, by prioritising non-technical skills, embracing learner-centered education, and responsibly using AI technologies, participants could reach potentially good solutions for the problems posed in the scenario."[6]

Observations highlight the significant role of AI in enhancing simulation-based learning experiences, particularly in fostering collaborative learning and skill development. AI tools facilitated more effective information sharing and idea generation among the participants from diverse cultural backgrounds. We infer this led to richer, more nuanced discussions and promoted cross-cultural understanding.

In addition, by helping participants organise and structure the information discussed, AI tools allowed for more coherent and productive dialogues. This organisation enabled participants to quickly access and build upon previously discussed ideas, leading to more comprehensive problem-solving approaches.

Also, the possibility to quickly brainstorm and organise ideas with AI assistance may have encouraged participants to explore more creative and innovative solutions to the challenges presented in the simulation scenarios. AI-powered tools in the simulation enable participants to access educational resources and support anytime. This aspect of AI integration is particularly valuable in simulation-based learning for a more personalized learning. AI can adapt the simulation experience to each participant's skill level and learning style, ensuring that everyone is appropriately challenged and engaged. Also, AI can provide immediate, data-driven feedback on participants' performance, allowing for rapid skill improvement and knowledge acquisition.

Another relevant finding about the use of AI technologies is participants' engagement with content in a way that promotes social awareness and relationship skills.

> "Everyone strongly supports each other when someone can't explain something. Some helped themselves by supporting themselves with pre-prepared notes, some generated by AI as they said". [16]
>
> "I really enjoyed the students' discussion. I think this project helped the students to realise the importance of learning and how the knowledge may be applied to real situations. I observed how the students discussed different solutions to the problem and tried to find out the best one. And it was totally amazing. The students demonstrated their knowledge and high interest. Also, thanks to the project, they developed their communication, intercultural, and team working skills. AI played its part as some acknowledged having used ChatGPT to better speak their minds. I think the contacts the students established in the framework of the project will be kept afterwards". [18]

AI served as a tool for participants to brainstorm and organise information discussed during the sessions. The quote "Everyone strongly supports each other when someone can't explain something" demonstrates how this AI-enhanced collaboration fosters social awareness and relationship skills. By focusing on social awareness and relationship skills, which include competencies like social understanding, empathy, inclusion, communication skills, and collaboration, participants were able to create a supportive learning environment. This mutual

support is crucial for developing empathy and understanding among diverse groups of learners.

Also, AI can facilitate a more personalised approach that allows students to develop their social and emotional skills at their own pace while engaging in collaborative problem-solving.

*4.2. Challenges and Ethical Considerations Surrounding AI*

This second category of analysis identifies academics' concerns regarding the potential for AI-generated content to undermine academic integrity. They highlighted the need for strategies to ensure that assessments accurately reflect individual competencies rather than relying on AI assistance.

> "Conversations were fluent and participants demonstrated preparation. I observe a slight risk of violating academic integrity apart from dependency on technology as they rarely referenced researchers during the discussions. they seemed to solely rely on AI 'truths'. Are we reducing cognitive abilities such as critical and creative thinking by allowing students to use AI? [12]

The ethical aspects of AI integration in education are closely intertwined with its effects on students' cognitive abilities, particularly when there is over-reliance on AI systems. This may impair students' critical thinking skills, as they become accustomed to receiving ready-made answers rather than engaging in independent analysis and problem-solving. While some studies suggest that AI chatbots can enhance problem-solving abilities, especially when integrated into educational systems (Labadze et al., 2023; Parsakia, 2023), there is a risk that reliance on chatbots could limit users' exploration of alternative problem-solving strategies. This raises ethical questions about the long-term impact on students' cognitive development and their ability to think creatively and independently.

The observation that participants rarely referenced researchers during discussions is concerning. It suggests an over-reliance on AI-generated information without proper attribution or critical evaluation of sources. This behavior could indeed lead to academic integrity issues and a superficial understanding of the subject matter.

While AI models can produce coherent and seemingly authoritative text, they may also generate inaccurate or misleading information. This is particularly problematic in academic contexts where the reliability and accuracy of information are paramount. Students and educators alike must develop critical thinking skills to evaluate AI-generated content, distinguishing between factual information and potential errors or biases introduced by AI systems.

> "Most participants used AI -Grammarly for grammar correction and Chat GPT for language tasks. Some indicated they had limited access due to premium features". [14]

AI-powered tools can provide personalized learning experiences tailored to individual student needs, adapting content and pacing to optimize comprehension and retention. This technology can also extend learning beyond physical classroom boundaries, enabling students to access educational resources and support anytime, anywhere. While this personalisation offers significant benefits, it also raises ethical questions about equity in education and the potential for AI to exacerbate existing educational disparities.

## 5. Discussion and Conclusion

The integration of AI in simulation-based learning presents a multifaceted landscape of opportunities and challenges in educational assessment and skill development. This study's findings align with Dieckmann's (2020) assertion that simulations facilitate a more comprehensive evaluation of competencies, encompassing not only technical proficiencies but

also crucial non-technical skills such as social awareness, relationship management, ethical decision-making, and self-regulation. These competencies, while fundamental to effective teaching, often elude traditional assessment methods.

The robustness of simulation-based assessments in the face of AI-generated content is particularly noteworthy. By necessitating real-time, spontaneous responses within dynamic scenarios, simulations offer a more authentic evaluation of a participant's abilities and decision-making processes. This authenticity serves as a safeguard against the potential misuse of AI in academic settings, ensuring that assessments genuinely reflect individual competencies rather than AI-assisted performances.

However, the integration of AI in educational simulations is not without ethical considerations. As posited by Zawacki-Richter et al. (2024), responsible implementation of AI tools in education requires adherence to stringent ethical standards, particularly in areas of data management and feedback generation. This ethical consideration emphasises the importance of adopting a nuanced strategy that harnesses the advantages of AI while simultaneously addressing and minimizing associated risks. The concern regarding the potential erosion of critical and creative thinking skills due to AI overreliance is valid and echoes the findings of Selwyn (2024). As AI capabilities expand, traditional assessment methods may become increasingly vulnerable to AI-generated responses, potentially compromising their efficacy in evaluating genuine student learning. This necessitates a paradigm shift in assessment strategies towards methods that are less susceptible to AI assistance and more adept at measuring higher-order cognitive skills.

To address these challenges, this study proposes a multi-pronged approach:

1. Emphasizing critical thinking and source evaluation skills among students.

2. Reframing AI as a learning tool rather than a substitute for independent thought.

3. Implementing assessment methods that demand demonstration of understanding beyond mere information regurgitation.

4. Fostering creativity and original thought in academic pursuits.

These strategies align with the recommendations of Selwyn (2024), who advocates for a balanced integration of AI in education that enhances rather than supplants human cognitive processes.

In conclusion, as educational institutions navigate this evolving landscape, the synergy between human expertise and AI capabilities will be crucial in optimizing the teaching and learning process while safeguarding the fundamental tenets of education.

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