Virtual environments in university students: A systematic review study

Entornos virtuales en estudiantes universitarios: un estudio de revisión sistemática

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Abstract

The objective of this study was to analyze the implications of virtual environments for university students. To this end, the PRISMA method was used, ensuring a systematic and transparent selection process. Regarding the inclusion criteria, articles published in recognized databases, such as Scopus and Scielo, were considered, using the keywords "virtual environments" AND "students," both in Spanish and English. Furthermore, only open-access articles published between 2021 and 2025 were included, and Boolean operators such as AND and OR were applied during the search. As an exclusion criterion, articles published before 2020 were discarded. In total, 25 relevant articles were selected: 22 from Scopus and 3 from Scielo. The results show that virtual environments are a valuable tool for improving the educational experience in the university setting. These environments facilitate personalized learning, optimize feedback and assessment, and provide more interactive and engaging educational experiences. Likewise, the use of artificial intelligence as a support tool, through chatbots and virtual assistants, represents a promising alternative for providing feedback and managing educational workload. These innovative technologies have the potential to transform the university experience, fostering collaboration between students and promoting adaptive learning. Furthermore, they enhance skills such as cognitive flexibility and creativity, while

intelligent tutoring systems personalize teaching through algorithms and machine learning. However, it is important to consider the ethical and legal challenges associated with the use of virtual environments and artificial intelligence. Therefore, critical reflection on their implementation is required, avoiding evaluating them solely from a functional perspective.

Keywords: artificial intelligence, virtual environments, strategies.

Resumen

El objetivo de este estudio fue analizar las implicancias de los entornos virtuales en estudiantes universitarios. Para ello, se empleó el método PRISMA, lo que permitió garantizar un proceso de selección sistemático y transparente. En cuanto a los criterios de inclusión, se consideraron artículos publicados en bases de datos reconocidas, como Scopus y Scielo, utilizando las palabras clave "*virtual environments*" *AND* "*students*", tanto en español como en inglés. Además, solo se incluyeron artículos de acceso abierto, publicados entre los años 2021 y 2025, y se aplicaron operadores booleanos como *AND* y *OR* durante la búsqueda. Como criterio de exclusión, se descartaron los artículos publicados antes del año 2020. En total, se seleccionaron 25 artículos relevantes: 22 provenientes de Scopus y 3 de Scielo. Los resultados evidencian que los entornos virtuales constituyen una herramienta valiosa para mejorar la experiencia educativa en el ámbito universitario. Estos entornos facilitan la personalización del aprendizaje, optimizan la retroalimentación y la evaluación, y proporcionan experiencias educativas más interactivas y atractivas. Asimismo, el uso de la inteligencia artificial como herramienta de apoyo, a través de chatbots y asistentes virtuales, representa una alternativa prometedora para la retroalimentación y la gestión de la carga de trabajo educativa. Estas tecnologías innovadoras tienen el potencial de transformar la experiencia universitaria, favoreciendo la colaboración entre estudiantes y promoviendo el aprendizaje adaptativo. Además, potencian habilidades como la flexibilidad cognitiva y la creatividad, mientras que los sistemas de tutoría inteligente personalizan la enseñanza mediante algoritmos y aprendizaje automático. Sin embargo, es importante considerar los desafíos éticos y legales asociados al uso de entornos virtuales y la inteligencia artificial. Por ello, se requiere una reflexión crítica sobre su implementación, evitando evaluarlas únicamente desde una perspectiva funcional.

Palabras clave: inteligencia artificial, entornos virtuales, estrategias.

Introduction

The educational context during the pandemic was marked by an abrupt and unprecedented shift from in-person teaching to remote learning. This transition generated unique learning experiences that were particularly challenging for future educators, primarily due to a widespread perception of inadequate preparation during their initial training to effectively face remote teaching. Mentors, in turn, adopted a critical stance regarding the impact of professional practices in virtual environments on the development of teaching competencies. While the acquisition of new skills was acknowledged, the gradual return to in-person education highlighted the limitations that virtual learning left regarding the necessary capabilities for teaching in traditional contexts (Palma-Troncoso et al., 2024).

On a different note, traditional philosophical debates in areas such as epistemology, philosophy of mind, and philosophy of consciousness have recently incorporated virtual reality and the immersive experiences it offers. These discussions expand the analysis of virtual reality, encompassing ethical issues as well as phenomenological and ontological methodological approaches—essentially, the study of what is in relation to how it manifests and appears (Coeckelbergh, 2024).

In this regard, virtual environments, understood as digital spaces that facilitate technology-supported educational processes, present significant potential for fostering creative thinking in students. Creative thinking is defined as the ability to generate novel and functional ideas oriented toward problem-solving.

Regarding artificial intelligence (AI) in virtual environments, Adamopoulou & Moussiades (2020) define it as the capability of machines to simulate human cognitive processes such as learning, perception, and decision-making, with the aim of performing tasks autonomously and efficiently. This definition emphasizes the interaction between humans and technology in specific contexts, highlighting information production from a "black box" (Bearman & Ajjawi, 2023). Complementarily, Fritts & Cabrera (2021) describe AI as a set of algorithms and technologies that enable machines to perform tasks that typically require human intelligence, such as machine learning and natural language processing. Zhang et al. (2024) point out that students utilize these technologies for academic and emotional support, exemplified by tools like ChatGPT. In this framework, the culture of virtual

learning underscores the importance of collaboration and social interaction, emphasizing that technology should be a tool to enhance education without replacing human interaction in the learning process (Ferry et al., 2020).

Moreover, the relevance of digital environments lies in their capacity to strengthen digital competencies, moving beyond a merely instrumental or recreational approach to the use of devices and digital platforms, such as social media. In this context, there is a need to develop social, civic, critical, and expressive skills through active participation in digital spaces. This participation facilitates interaction and exchange with broader audiences, the creation of virtual communities, an understanding of new cultural forms of communication, digital inclusion and coexistence, collaborative problem-solving, the expansion of public space, and the emergence of new forms of expression. Therefore, digital citizenship demands a critical and reflective perspective on the digital realm, highlighting the fundamental role of schools and their connection to the cultural vision of youth (Morduchowicz, 2021).

In this context, the present work conducts a systematic review of the scientific literature on virtual environments and their relationship with the development of creative thinking, aiming to identify their main characteristics, advantages, and challenges in educational contexts. To this end, various databases were consulted, and the most pertinent and current articles were selected. It is expected that this review will provide a comprehensive and analytical perspective on the role of virtual environments in strengthening creative thinking (Sánchez & Calderón, 2025).

Methodology

In the present research, the PRISMA method was adopted to ensure a systematic and transparent selection process, reinforced by peer review. This approach involves meticulous documentation of each reviewed article, applying a systematic procedure that facilitates the clear and rigorous presentation of the obtained results. For the initial phase of document retrieval, an efficient search strategy was designed to accurately identify relevant literature.

Inclusion criteria considered articles published in recognized databases such as Scopus and Scielo, using the keywords “virtual environments” AND “students,” as well as articles in both Spanish and English. Additionally, only open-access articles were selected, applying Boolean operators such as AND and OR to optimize the search. The temporal focus was on articles published between 2021 and 2025, while documents published prior to 2020 were excluded.

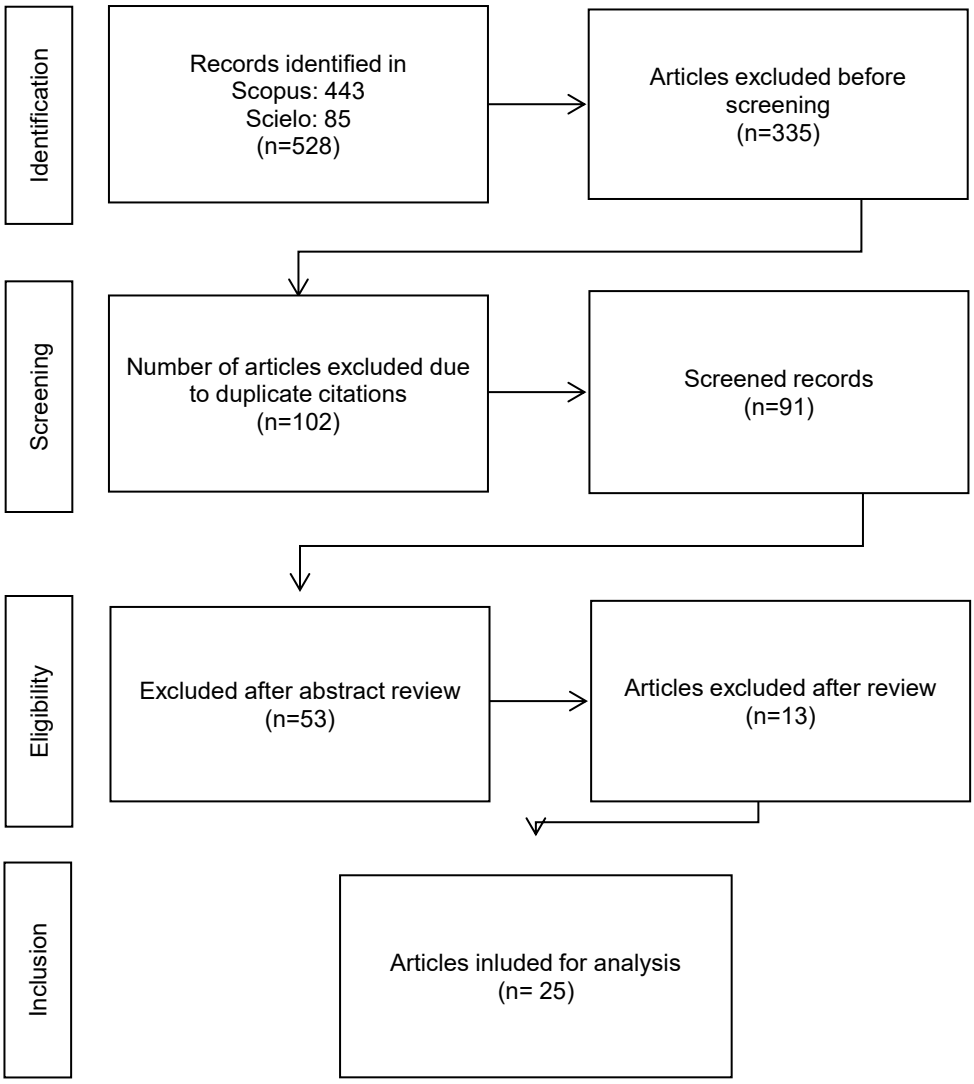
Ultimately, a total of 25 articles were selected, of which 22 originated from the Scopus database and 3 from Scielo (see Table 1). This process, aligned with PRISMA method recommendations, ensured the quality and relevance of the evidence collected for analysis.

Table 1

Search chains in database articles

Database	Search term	Results	Selected
Scopus	"virtual environments" AND "students"	443	22
Scielo	"virtual environments" AND "students"	85	3
	Total	**528**	**25**

Figure 1
PRISMA flow diagram for article selection



* Table formatted based on PRISMA guidelines with original data

Results and discussion

Table 2
Implications of virtual environments

N	Author	Implications of virtual environments
1	Peng et al. (2023)	Virtual learning environments have facilitated educational personalization, adapting to the individual needs of each student. They also contribute to identifying performance patterns and areas needing improvement.

2	Wang et al. (2024)	Virtual environments allow for timely intervention, benefiting both academic outcomes and the emotional well-being of students.
3	Lastrucci et al. (2024)	These virtual environments enable the development of specific motor skills without interfering with or overloading in-person clinical resources, thereby increasing the clinical confidence of training students.
4	Banihashem et al. (2024)	The use of artificial intelligence (AI) as a support tool offers a promising alternative to optimize feedback and manage educational load more efficiently.
5	Popescu et al. (2023)	AI, through chatbots, enhances communication efficiency and academic service delivery by automating routine tasks and providing personalized support that reduces administrative burdens for university students.
6	Kumar (2021)	AI-powered chatbots and virtual assistants present innovative educational tools with great potential to transform the university experience.
7	Annuš (2023)	It is essential for educational institutions and teachers to use these systems responsibly, providing adequate guidance and support for students to understand the limitations of AI and learn to interpret the generated responses correctly.
8	Rey & Vergara (2025)	Various Information and Communication Technologies (ICT), through virtual environments, have created digital spaces that allow users to interact, discover, and develop content dynamically.
9	Ilić et al. (2023)	AI in higher education enhances personalization by adapting content and activities to the specific needs of each student.
10	Jara-Abanto & Velasquez-Medina (2023)	Virtual environments are enhanced through adaptive learning, continuously adjusting to the student's progress.
11	Ng et al. (2023)	Technologies implemented in the classroom contribute to the development of essential digital competencies for the 21st century.
12	Dede & Lidwell (2023)	These tools have enabled students to strengthen key skills such as cognitive flexibility and creativity, preparing them to face future challenges.
13	Michel-Villarreal et al. (2023)	AI is an essential component in educational innovation, ensuring that graduates are equipped to work effectively with intelligent systems and adapt to changing labor demands.
14	Kamalov & Gurrib (2023)	Educational programs that adapt to the level and individual needs of each student promote more effective and personalized learning.
15	Adelana et al. (2024)	Intelligent tutoring systems in higher education personalize instruction through algorithms and machine learning techniques, positively impacting the educational experience by providing automated and constant support.

16	Rodríguez (2021)	Changes in the educational context have increased interest in developing intelligent tutoring systems that can efficiently support remote learning.
17	Chang et al. (2023)	Incorporating pedagogical principles such as goal setting, self-assessment, and personalization is fundamental in designing educational chatbots that respond to the individual needs of students based on self-regulated learning frameworks.
18	Moral-Sánchez et al. (2023)	Chatbots and conversational agents contribute to improving student satisfaction and enhancing students' digital competencies.
19	Amin et al. (2025)	Immersive technologies, such as virtual reality (VR), augmented reality (AR), and mixed reality (MR), create digital experiences that blend the real and virtual worlds, offering richer spatial interactions and deep sensory immersion.
20	Volgensang et al. (2024)	Immersive virtual reality is used in various clinical environments for multiple purposes, primarily to enhance learning processes.
21	Conceição & Chagas (2020)	Graduate program researchers understand and employ these digital tools, recognizing the value of AI and cyberculture as effective means of knowledge sharing; however, many do not feel adequately prepared or responsible for assuming this task.
22	Khlaif et al. (2023)	The quality of articles generated by ChatGPT and their influence in the context of research, data analysis, and literature review have been evaluated.
23	Bouhouita-Guermech et al. (2023)	AI presents ethical and legal challenges in scientific research, such as the need to ensure transparency and fairness in its use for decision-making, as well as the protection of human rights and participant privacy.
24	Shanley & Meacham (2024)	Common concerns revolve around technological viability and potential psychological impacts. Therefore, it is necessary to highlight that these technologies act as active mediators of experience, requiring critical reflection that goes beyond mere functionality.
25	Huang (2023)	The importance of properly managing the collection, use, storage, sharing, and disposal of data in AI systems is emphasized, ensuring compliance with rigorous information security standards.

Importance of virtual environments

Virtual learning environments have facilitated educational personalization, adapting to the individual needs of each student and contributing to the identification of performance patterns and areas for improvement. These technological advancements have been crucial in ensuring educational continuity in a context marked by drastic changes in traditional teaching and learning methods. In this regard, the integration of virtual environments in distance education has proven to be a valuable tool not only for optimizing the learning experience of students but also for supporting teachers in implementing effective virtual teaching strategies (Peng et al., 2023). Similarly, these environments enable timely interventions that improve both academic results and the emotional well-being of students (Wang et al., 2024).

On the other hand, virtual environments facilitate the development of specific motor skills without interfering with or overloading clinical resources, by safely using clinical equipment in simulated in-person settings, which enhances the clinical confidence of training students. However, despite the significant advantages of integrating virtual reality into training, there are important limitations that hinder its implementation, such as insufficient coverage in the current literature and the high costs associated with the necessary software and hardware (Lastrucci et al., 2024).

Regarding the use of artificial intelligence (AI) as a support tool, it represents a promising alternative for improving feedback and managing educational workload (Banihashem et al., 2024). In this context, AI, through chatbots, increases efficiency in communication and academic service delivery by automating routine tasks and providing personalized support that reduces administrative burdens for university students (Popescu et al., 2023). AI-powered chatbots and virtual assistants are emerging as innovative educational tools with great potential to transform the university experience. Their benefits include facilitating collaborative work, providing real-time feedback, and personalizing learning through humanized interactions. Although their impact on the affective-motivational aspects of learning may be limited, evidence shows that these assistants improve academic performance and foster collaboration among students, positively influencing methodologies such as project-based learning and design training. Additionally, these systems help alleviate the workload of educators by automating repetitive and low-cognitive tasks (Kumar, 2021).

Nonetheless, it is essential for educational institutions and teachers to use these systems responsibly, providing the necessary guidance and support so that students understand the limitations of AI and learn to interpret the generated responses appropriately (Annuš, 2023). In this context, various Information and Communication Technologies (ICT), through virtual environments, have created digital spaces that allow users to interact, discover, and develop content dynamically (Rey & Vergara, 2025).

In the university context, AI contributes to enhancing learning personalization by adapting content and activities to the specific characteristics of each student (Ilić et al., 2023). Furthermore, Jara-Abanto & Velásquez-Medina (2023) describe how virtual environments are empowered through adaptive learning. The technologies applied in the classroom foster the development of essential digital competencies (Ng et al., 2023), allowing students to strengthen key skills such as cognitive flexibility and creativity, which are indispensable for facing future challenges (Dede & Lidwell, 2023).

In summary, AI positions itself as an essential element in educational innovation, ensuring that graduates are prepared to work effectively with intelligent systems and adapt to changing labor market demands. AI faces the challenges inherent in the Knowledge Society and disruptive innovations, enabling a deep analysis of educational data that enhances processes such as tutoring and predicting student performance. Therefore, the global adoption of AI in education is a crucial strategic step that must be incorporated without delay into academic training and university policies (Michel-Villarreal et al., 2023).

Strategies in virtual environments

Intelligent tutoring systems in higher education stand out for their ability to personalize instruction through algorithms and machine learning, as highlighted by Kamalov & Gurrib (2023). The integration of these systems has shown a significant positive impact, improving the educational experience by providing automated support that adapts to the individual needs of students (Adelana et al., 2024). Recent changes in the educational context have increased interest in developing intelligent tutoring systems that can effectively support remote learning. These systems utilize advanced AI techniques to represent knowledge and facilitate personalized teaching, acting as experts that diagnose the student's situation and propose appropriate solutions or actions (Rodríguez, 2021).

Additionally, incorporating fundamental pedagogical principles such as goal setting, self-assessment, and personalization is essential in the design of educational chatbots. These conversational agents respond to individual student needs, relying on the framework of self-regulated learning (Chang et al., 2023). In this regard, chatbots and conversational agents not only enhance student satisfaction but also strengthen students' digital competencies (Moral-Sánchez et al., 2023).

On the other hand, immersive technologies such as virtual reality (VR), augmented reality (AR), and mixed reality (MR) create digital experiences that blend the real and virtual worlds, offering enriched spatial interaction and deep sensory immersion (Amin et al., 2025). In particular, immersive virtual reality is employed in various clinical environments for multiple purposes, primarily to enhance learning processes (Volgensang et al., 2024).

In the research domain, graduate students understand and utilize these digital tools, recognizing the value of AI and cyberculture as effective means of knowledge sharing. However, many researchers do not feel fully prepared or responsible for taking on this task. Their perceptions of science influence how they produce and disseminate knowledge, suggesting that a better understanding and use of these technologies could strengthen the relationship between science, researchers, and society (Conceição & Chagas, 2020).

Regarding the quality of articles generated by ChatGPT and its influence on research, Khlaif et al. (2023) analyzed its application in data analysis and literature review. They evaluated the ownership and integrity of research using AI-generated text, as well as the associated ethical concerns. They concluded that ChatGPT can

increase human productivity in research and be useful in academic writing, provided these aspects are addressed with caution and rigor.

Virtual environments and ethical challenges

Artificial intelligence (AI) presents significant ethical and legal challenges in scientific research, particularly the need to ensure transparency and fairness in its use during decision-making, as well as the protection of human rights and the privacy of participants. Additionally, it is essential to ensure accountability in decisions based on technical and scientific data, prevent unintentional biases in AI systems, and promote prospective ethical and legal regulations that accompany technological development.

These challenges are global in nature and are exacerbated by the lack of specific standards and guidelines that frame and support ethics in AI research worldwide. Current literature reveals a notable scarcity of significant advances in this area, underscoring the urgency of addressing essential issues such as transparency, accountability, and informed consent in the context of artificial intelligence (Bouhouita-Guermech et al., 2023).

Moreover, common concerns often focus on technological viability and the potential psychological impacts associated with the use of AI. It is crucial to highlight that these technologies act as active mediators of human experience, requiring deep critical reflection and should not be evaluated solely from a functional perspective (Shanley & Meacham, 2024).

Furthermore, there is a need to manage the collection, use, sharing, storage, and disposal of data in AI systems in accordance with strict information security standards. The protection of personal information involved in the lifecycle of these technologies must be guaranteed through robust legal frameworks and ethical norms. In this regard, obtaining informed consent for the use of personal data is fundamental, as is the accountability of all parties involved in the development and application of artificial intelligence, in order to safeguard human rights and dignity. These regulations and ethical practices are essential to preserving integrity and ethics in scientific research that utilizes AI (Huang, 2023).

Conclusions

Virtual environments have proven to be valuable tools for enriching the educational experience in higher education. In particular, artificial intelligence contributes to personalizing learning, optimizing feedback and assessment, and providing a more interactive and engaging educational experience. Its use as a support tool represents a promising alternative for improving feedback and managing educators' workload.

Among the most innovative strategies are AI-powered chatbots and virtual assistants, which have the potential to transform the university educational experience and foster collaboration among students. Additionally, virtual environments are enhanced through adaptive learning, promoting the development of key skills such as cognitive flexibility and creativity. Intelligent tutoring systems, based on algorithms and machine learning, enable personalized instruction in higher education, adapting to the individual needs of students.

However, it is essential to recognize that the use of virtual environments and artificial intelligence also presents significant ethical and legal challenges. Therefore, these technologies require deep critical reflection and should not be evaluated solely from a functional perspective, but rather considering their social, ethical, and pedagogical implications.

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