



Design of interactive virtual worlds to strengthen the participation of university students in digital educational environments

Diseño de mundos virtuales interactivos para fortalecer la participación de estudiantes universitarios en entornos educativos digitales

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ABSTRACT

The purpose of this study was to analyze the conceptions that university students have about the design of interactive virtual worlds as a teaching practice that promotes participation in digital teaching environments. The research was carried out within the qualitative, descriptive-exploratory and empirical approach. The participation was made up of a total of 112 university students from the degrees of Education, Engineering, Business Administration and Social Sciences based on a sampling by intentional criteria. The data were collected from a questionnaire of open questions, discussion groups and observation notes, from a pilot experience of a 3D virtual classroom analyzed from the thematic analysis. The results show how the aspects of immersion, the use of avatars, multimedia resources or collaborative activities encourage motivation, interaction and participation of students in virtual worlds, but also obstacles such as connectivity, dispositive limitations, the learning curve at the beginning of the experience and an excess of visual stimuli. Interactive virtual worlds can achieve university participation but only if there is an academic orientation in their purposes, teaching mediation, technical accessibility and collaborative activities with a pedagogical purpose.

Keywords: virtual worlds, higher education, student participation, immersive learning, digital educational environments.

RESUMEN

El propósito de este estudio fue analizar las concepciones que tienen el alumnado universitario acerca del diseño de mundos virtuales interactivos como una práctica de enseñanza que promueve la participación en entornos digitales de enseñanza. La investigación se llevó a cabo dentro del enfoque cualitativo, descriptivo-exploratorio y empírico. La participación estuvo constituida por un total de 112 estudiantes universitarios de las titulaciones de Educación, de Ingeniería, de Administración de empresas y de Ciencias sociales partiendo de un muestreo por criterios intencionales. Los datos fueron recogidos a partir de un cuestionario de preguntas abiertas, grupos de discusión y notas de observación, a partir de una experiencia piloto de aula virtual en 3D analizados a partir del análisis temático. Los resultados evidencian como los aspectos de la inmersión, el uso de avatares, los recursos multimedia o las actividades colaborativas incitan a la motivación, a la interacción y a la participación del alumnado en los mundos virtuales, pero también obstáculos como la conectividad, limitaciones dispositivas, la curva de aprendizaje al principio de la experiencia y en exceso de estímulos visuales. Los mundos virtuales interactivos pueden lograr la participación universitaria pero siempre y cuando hay una orientación académica en sus propósitos, una mediación docente, accesibilidad técnica y actividades colaborativas con propósito pedagógico.

Palabras clave: mundos virtuales, educación superior, participación estudiantil, aprendizaje inmersivo, entornos educativos digitales.

INTRODUCTION

Digital transformation has significantly modified teaching and learning dynamics in higher education, especially through the incorporation of platforms, digital resources, and environments mediated by emerging technologies. Al-Qaimari (2025) argues that university institutions face the challenge of integrating digital strategies that not only modernize their processes but also respond to new forms of academic interaction. In this same line, university digitalization is no longer understood as an instrumental process limited to the use of platforms, but has become a structural transformation that affects management, teaching, assessment, and the student experience (Díaz-García et al., 2022).

During recent years, higher education has experienced an accelerated transition toward hybrid and digital models, which has generated opportunities but also tensions related to student participation, motivation, and interaction. Laufer et al. (2021) warn that digital education can act as a bridge or as an exclusion factor, depending on the available institutional, pedagogical, and technological conditions. Therefore, strengthening digital competence in higher education constitutes a necessary condition for students and teachers to function effectively in technology-mediated educational environments (Zhao et al., 2021).

However, the use of traditional virtual platforms does not always guarantee active student participation. In many cases, digital environments reproduce passive practices centered on content reception, without promoting collaborative, immersive, or participatory experiences. Shah et al. (2021) point out that motivation in online learning is related to autonomy, interaction, and a sense of belonging within the training process. Similarly, Meroño et al. (2021) highlight that digital pedagogy acquires greater value when articulated with cooperative methodologies and activities that require active participation, not just connection to a platform.

In this context, interactive virtual worlds emerge as an alternative to redesign digital educational experiences. These environments allow students to interact through avatars, navigate three-dimensional scenarios, explore multimedia resources, and participate in collaborative activities within simulated spaces. Radianti et al. (2020) identify that immersive virtual reality in higher education offers relevant possibilities to improve interaction, visual representation of content, and experiential learning. Likewise, Kuhail et al. (2022) suggest that immersive experiences favor the active exploration of knowledge, provided they are linked to clear pedagogical objectives.

Recent literature also shows a growing interest in the use of virtual reality, the metaverse, and virtual worlds in university education. Caballero-Garriazo et al. (2023) show that virtual reality has been applied in different university contexts to strengthen teaching, simulation, and student participation processes. In turn, Conrad et al. (2024) indicate that the effectiveness of immersive learning depends on factors such as experience design, user interaction, cognitive load, and the didactic relevance of the resource. Therefore, the educational value of these environments does not lie solely in their technological novelty, but in the way they are designed and integrated into the training process.

The educational metaverse and virtual worlds have expanded the possibilities of social interaction in higher education by allowing closer, more collaborative, and visually immersive experiences. Lin et al. (2025) highlight that virtual worlds and the metaverse offer opportunities to analyze learning practices, academic performance, and social interaction in university contexts. Complementarily, Meléndez Araya et al. (2024) point out that metaverses applied to education require a critical perspective that considers their benefits, limitations, access conditions, and pedagogical meaning. This is relevant because the mere incorporation of virtual scenarios does not ensure an automatic improvement in student participation.

In the Latin American context, the use of virtual reality in university education is still in a consolidation phase, with important advances but also technical, pedagogical, and institutional challenges. Jimbo Román et al. (2024) highlight that virtual reality in higher education offers meaningful experiences for students, although its implementation demands planning, teacher guidance, and adaptation to the real conditions of each context. This perspective allows us to understand that the design of interactive virtual worlds must respond to both technological criteria and specific training needs.

Student participation constitutes a central dimension for assessing the relevance of these environments. Inman et al. (2020) explain that student engagement can be understood as a multidimensional phenomenon related to behavioral, affective, and cognitive aspects. From this perspective, participating does not mean only attending or connecting to an activity, but actively involving oneself, interacting with others, assuming responsibilities, and constructing meaning within the learning process.

Consequently, interactive virtual worlds can be relevant if they promote motivation, collaboration, communication, and active persistence in the educational experience.

Despite the growth of studies on virtual reality, the metaverse, and higher education, there is still a need to deepen the understanding of how university students perceive these environments and which design elements they consider most important to strengthen their participation. Most contributions have focused on describing the general benefits of the technology, but it is necessary to analyze the student experience from an empirical and qualitative perspective. This gap is especially important in university contexts where digitalization progresses unevenly and where participation depends not only on the technological resource, but also on teacher mediation, accessibility, activity design, and peer interaction.

Based on the above, the objective of this study was to analyze the perceptions of university students regarding the design of interactive virtual worlds as a strategy to strengthen participation in digital educational environments. The research was developed from a qualitative and empirical approach, considering a pilot experience with university students who interacted directly in a virtual world designed for academic purposes. Thereby, it sought to identify the elements of design, interaction, motivation, collaboration, and accessibility that influence student participation within these environments.

METHODS

The research was developed under a qualitative approach, with an exploratory-descriptive design. This approach allowed for the analysis of university students' perceptions regarding the design of interactive virtual worlds as a strategy to strengthen participation in digital educational environments. The study was empirical in nature, as the data were obtained from a pilot experience in which participants interacted directly with a virtual world designed for academic purposes.

The study was oriented from an interpretive perspective, as it sought to understand the meanings that students attributed to immersion, interaction, collaboration, and motivation within a three-dimensional virtual environment. This orientation was relevant because the primary interest was not to measure academic performance statistically, but to interpret how participants valued the learning experience and which elements of the virtual design favored or limited their participation.

The sample consisted of 112 university students selected through purposive criterion sampling. The participants were enrolled between the third and eighth semesters in programs related to Education, Engineering, Administration, and Social Sciences. Their ages ranged from 18 to 27 years. Regarding gender distribution, 64 women and 48 men participated. Inclusion criteria required that students had previously used digital learning platforms, participated in the pilot experience with the interactive virtual world, and voluntarily agreed to be part of the study. Students who did not complete the pilot activity or did not respond to the data collection instrument were excluded.

The pilot experience took place in a three-dimensional virtual classroom designed to promote academic interaction among students. During the activity, participants entered the environment using avatars, explored virtual spaces, reviewed multimedia resources, participated in a collaborative dynamic, and responded to a teacher-guided discussion. This experience allowed student responses to be based on a direct experience with the virtual world, rather than solely on general opinions about the use of educational technologies.

Data collection was carried out through an open-ended questionnaire administered to the 112 participants. The instrument consisted of questions aimed at exploring student perception of environment immersion, interaction through avatars, motivation to participate, collaborative work, the teaching role, accessibility, and technical or pedagogical barriers identified during the experience. This technique allowed for the collection of broad and diverse responses, in line with the qualitative approach of the study.

In addition, four focus groups were conducted with students selected from the initial sample. Each group consisted of participants from different academic areas, with the purpose of contrasting and expanding the findings obtained in the open-ended questionnaire. The focus groups allowed for a deeper exploration of students' opinions regarding the elements that facilitated participation, the limitations of the virtual environment, and the improvements needed to strengthen its application in higher education.

Observation notes were also used during the development of the pilot experience. These notes allowed for the recording of behaviors, access difficulties, forms of interaction, levels of participation, and relevant situations observed during the use of the virtual world.

The incorporation of this complementary technique strengthened the triangulation of information and allowed for the contrast of what was expressed by the students with what was observed during the activity.

The open-ended questionnaire underwent a validation process through the judgment of three experts in educational technology, higher education, and qualitative methodology. The specialists evaluated the clarity, relevance, coherence, and sufficiency of the questions in relation to the objective of the study. Subsequently, a pilot test was conducted with students of similar characteristics to the final sample, which allowed for adjusting the wording of some items and improving the sequence of the instrument.

The research procedure was developed in several phases. First, students were informed about the purpose of the study and their voluntary participation was requested. Then, the pilot experience was executed in the interactive virtual world. Subsequently, the open-ended questionnaire was administered to the 112 participants and the focus groups were organized. Finally, the obtained responses were transcribed, organized, and analyzed along with the observation notes recorded during the experience.

Data analysis was performed using thematic analysis. In a first phase, a general reading of the responses was carried out to become familiar with the data. Then, units of meaning related to immersion, social interaction, motivation, collaboration, pedagogical design, and implementation barriers were identified. Subsequently, these codes were grouped into categories and subcategories, which were reviewed to ensure internal consistency and a direct relationship with the research objective.

The final categories of analysis were: educational immersion, social interaction through avatars, student participation, academic collaboration, pedagogical design of the virtual world, and implementation barriers. These categories allowed for the interpretive organization of the results and the understanding of the aspects that strengthened or limited the participation of university students in the digital educational environment.

To guarantee the qualitative rigor of the study, criteria of credibility, transferability, dependability, and confirmability were applied. Credibility was strengthened through the triangulation of open-ended questionnaires, focus groups, and observation notes. Transferability was addressed through a detailed description of the context, the sample, and the pilot experience. Dependability was ensured through a systematic coding and categorization procedure. Finally, confirmability was promoted through the constant review of the data and the linking of interpretations with the participants' responses.

RESULTS

The thematic analysis of the open-ended questionnaires, focus groups, and observation notes allowed for the identification of four central axes associated with student participation in interactive virtual worlds: educational immersion, social interaction, collaborative participation, and pedagogical conditions of implementation.

Table 1. Central categories of the thematic analysis

Category	Analytical focus	Main finding
Educational immersion	Attention, presence, and exploration of the virtual environment	The three-dimensional classroom generated greater initial interest and fostered a more active experience than traditional platforms.
Social interaction	Communication through avatars and peer relationships	Avatars facilitated digital closeness and promoted greater willingness to participate.
Participation and collaboration	Motivation, initiative, group work, and persistence in the activity	Participation increased when tasks were collaborative, clear, and oriented toward a common product.
Pedagogical design and barriers	Instructions, resources, teacher support, connectivity, and accessibility.	The effectiveness of the virtual environment depended on the instructional design and the technical conditions for access.

Note. Own elaboration based on the thematic analysis of open-ended questionnaires, focus groups, and observation notes.

These axes synthesize the perceptions of the 112 students who participated in the pilot experience and allow for an understanding of which elements of the environment strengthened or limited their academic involvement.

Educational immersion

Educational immersion was one of the most valued aspects by the participants. The three-dimensional classroom aroused curiosity, attention, and a sense of more active presence than that experienced in traditional virtual platforms. Students highlighted that exploring spaces, observing resources, and moving within the environment made the activity feel less static and closer to an interactive learning experience.

However, immersion did not depend solely on visual design. Participants pointed out that the experience was more useful when the tour was accompanied by clear instructions and a defined academic purpose. In cases where students did not immediately understand how to navigate or what they were supposed to do, attention was focused on resolving technical aspects rather than on the academic activity.

Social interaction through avatars

The use of avatars strengthened interaction among students, as it allowed for a visual representation within the same digital space. Participants perceived greater closeness with their peers by observing their movements, locations, and interventions in the virtual classroom. This dynamic facilitated communication during group activities and generated a greater willingness to participate.

However, avatars also required pedagogical guidance. Some students initially focused on exploring or customizing their digital representation, which generated moments of distraction. Therefore, the avatar was more effective when linked to specific roles, tasks, or collaborative dynamics.

Academic participation and collaboration

Student participation increased when activities were organized as challenges, guided tours, or collaborative tasks. Students became more involved when they understood what they had to solve and how their intervention contributed to the group's outcome. This situation showed that the virtual world did not generate participation on its own, but rather when it was integrated into a clear academic dynamic.

Table 2. Elements of the virtual world that favored student participation

Identified element	Manifestation	Contribution to participation
Three-dimensional classroom	Students navigated the spaces, observed resources, and explored digital scenarios.	Increased curiosity and attention during the activity.
Use of avatars	Participants represented themselves digitally and interacted with peers.	Generated a sense of presence and enhanced communication closeness.
Multimedia resources	Visual materials, links, images, and interactive objects were utilized.	Helped maintain interest when aligned with the task.
Challenge-based activities	Students were required to solve a task within the virtual environment.	Promoted initiative, information seeking, and active participation.
Collaborative work	Groups organized ideas and constructed joint responses.	Facilitated dialogue, cooperation, and shared responsibility.
Teacher feedback	The teacher guided navigation, addressed questions, and led the discussion.	Reduced distraction and provided academic relevance to the experience.

Note. Own elaboration.

Collaboration was more visible in tasks that required dialogue, coordination, and the construction of a common response. Groups managed to organize ideas and make decisions within the virtual environment, which strengthened peer interaction. However, differences in the level of participation of some members were also identified, making it necessary to assign specific roles, times, and products within each activity.

Table 3. Conditions pedagogical necessary for the use of interactive virtual worlds

Pedagogical condition	Description	Implication for environment design
Clear academic objective	The activity must address a defined educational purpose.	Prevents the virtual environment from being used solely as a visual or recreational resource.
Precise instructions	Students need to know what to do, how to navigate, and what product to deliver.	Reduces initial confusion and improves participation flow.
Collaborative activities	Tasks should require dialogue, coordination, and joint construction.	Transforms the environment into a space for academic interaction.
Relevant resources	Objects, links, and materials must be related to the course content.	Strengthens the connection between technology and learning.
Teacher mediation	The teacher must guide, support, and provide feedback throughout the experience.	Maintains pedagogical focus and prevents distraction.
Experience assessment	The activity should conclude with reflection, a product, or evidence of learning.	Enables evaluation of participation and improvement of future implementations.

Note. Own elaboration.

Pedagogical design and implementation barriers

The pedagogical design was crucial in ensuring that the virtual world was perceived as an academic resource rather than merely a novel technological experience. Participants valued multimedia resources positively when they were directly related to the activity. In contrast, visual elements without a clear function were considered distracting or unnecessary.

Barriers affecting the fluidity of the experience were also identified. The most frequent were unstable connectivity, limitations of some devices, and the initial learning curve. These difficulties did not prevent the development of the activity, but they highlighted the need to plan a brief induction phase before using virtual worlds for academic purposes.

Synthesis of findings

The results indicated that interactive virtual worlds can enhance university student participation when they integrate immersion, social interaction, collaboration, and teacher mediation. The three-dimensional environment generated interest and facilitated peer communication, but its effectiveness depended on the clarity of the activities and the relevance of the resources used.

Table 4. Identified barriers and recommendations for improvement

Identified barrier	Effect on the experience	Improvement recommendation
Unstable connectivity	Disrupted the continuity of some participants.	Verify connection conditions before the activity and provide alternative access options.
Device limitations	Reduced navigation fluency for some students.	Design lightweight environments compatible with mid-range devices.
Initial learning curve	Some participants required time to adapt to the environment.	Include a brief induction phase before the academic activity.
Excessive visual stimuli	Distraction occurred when elements were unrelated to the task.	Prioritize functional resources and remove unnecessary decorative elements.
Fragmented use of avatars	Some students focused on moving or customizing the avatar.	Integrate avatars into specific roles, tasks, or collaborative activities.
Insufficient pedagogical guidance	The experience could devolve into exploration without academic purpose.	Ensure teacher support during the activity and in the final discussion.

Note. Own elaboration.

Consequently, the design of virtual worlds for higher education must be approached as a pedagogical process rather than solely a technological one. Student participation was enhanced when the environment enabled them to act, collaborate, and construct responses with academic significance. Conversely, technical barriers, lack of guidance, and excessive visual stimuli limited the experience for some participants.

DISCUSSION

The findings indicate that interactive virtual worlds can enhance student participation when integrated into a clear pedagogical framework. Immersion, exploration of the three-dimensional classroom, and the use of avatars increased willingness to participate, but their educational value depended on teacher guidance, the relevance of resources, and the clarity of tasks. This result aligns with Barja-Ore et al. (2023), who identified that virtual reality has gained visibility in education due to its capacity to expand forms of interaction and knowledge representation.

The participation observed in the pilot experience was not solely due to technological novelty, but rather to the relationship between activity, collaboration, and guidance. In this regard, the results are consistent with those proposed by Domínguez et al. (2021), who argue that interactive learning in large groups requires structured interventions to improve perceptions of the learning environment. Therefore, the virtual world should not be regarded as an automatic substitute for the classroom, but as a space that requires instructional planning to generate meaningful participation.

The use of avatars facilitated communication among students and fostered a sense of closeness within the digital environment. This finding is consistent with Domínguez and Vega (2020), who demonstrated that interactive environments can support the organization and synthesis of information when integrated with active learning strategies. In the present study, interaction through avatars was more meaningful when linked to challenges, collaborative tasks, or concrete academic products.

Similarly, the results show that student participation increased when the virtual environment promoted collaborative activities. This supports the assertion that the social dimension of learning remains central even in immersive digital spaces. Williams et al. (2024) highlight that active methodologies enhance learning strategies when they promote student involvement, reflection, and participation. Likewise, in this study, participants valued the virtual world more when it enabled them to engage in dialogue, coordinate actions, and construct responses with their peers.

Teacher mediation emerged as a decisive factor in preventing the virtual world from becoming a fragmented experience. Students required guidance to understand the purpose of the activity, navigate the environment, and connect digital resources to learning. This finding is consistent with Cabero-Almenara et al. (2021), who note that teacher digital competence is a relevant factor for the appropriate use of technologies in educational contexts. Thus, the success of a virtual world depends not only on the tool itself, but also on the teacher's ability to transform it into a didactic experience.

Multimedia resources were positively valued when they were related to the academic activity. In contrast, visual elements without a pedagogical function were perceived as distracting. This result is consistent with Garrido Astray et al. (2019), who highlight that digital resources contribute to learning when they strengthen specific competencies and are coherently integrated with educational objectives. Therefore, the design of virtual worlds should avoid the accumulation of stimuli and prioritize functional resources.

The identified technical barriers, such as unstable connectivity, device limitations, and the initial learning curve, indicate that the implementation of virtual worlds requires minimum institutional conditions. Pinargote Castro et al. (2024) emphasize that the accessibility of virtual and augmented reality in university education depends on strategies that consider benefits, challenges, and conditions of use. In this study, these barriers did not prevent participation, but they did affect the fluidity of participation for some students.

The findings are also consistent with Escandell Rico and Pérez Fernández (2024), who emphasize that simulation with virtual reality can enhance university education when oriented toward practical and situated experiences. Although the present study did not focus on clinical simulation, it demonstrated that the immersive experience was more highly valued when students were able to act, explore, and solve tasks within the environment. This supports the idea that participation improves when students move from being passive recipients to assuming an active role.

Similarly, Galecio Mora et al. (2025) note that virtual learning environments should be analyzed based on their capacity to organize resources, facilitate interaction, and address specific educational needs. In line with this, the results of this study indicate that the virtual world was perceived as useful when it integrated intuitive navigation, relevant resources, collaborative activities, and feedback. Without these elements, the environment risks being regarded merely as a superficial innovation.

Although the study focused on interactive virtual worlds, its results are also related to recent changes in assessment and teaching mediated by emerging technologies. Martínez-Comesaña et al. (2023) argue that the incorporation of advanced technologies in education requires a review of teaching and assessment methods to avoid instrumental or uncritical uses. In this context, interactive virtual worlds should be designed as comprehensive pedagogical experiences, where participation, collaboration, and reflection are prioritized over technological novelty.

Overall, the discussion confirms that interactive virtual worlds have the potential to strengthen university participation, provided they are integrated with clear pedagogical criteria. Immersion and avatars may generate initial interest, but sustained participation depends on meaningful activities, teacher mediation, technological accessibility, and resources aligned with academic objectives. Therefore, the contribution of this study lies in demonstrating that the design of these environments should focus on the student's educational experience rather than solely on the incorporation of immersive technology.

CONCLUSIONS

The interactive dimensions of virtual worlds led to increased participation by university students when the virtual worlds were designed as active, collaborative, and guided learning environments. The pilot experience showed that immersion, exploration of the three-dimensional classroom, and the use of avatars generated greater initial interest compared to conventional digital platforms.

Student participation did not depend solely on the technological novelty of the virtual world, but was also supported by the clarity of tasks, the timeliness of feedback, and teacher support. Thus, the virtual world was considered educationally sufficient when it enabled task completion, dialogue with students, and the creation of academic products with formative value.

The use of avatars facilitated social interaction and a sense of presence in the virtual environment, but their effectiveness depended on the existence of roles, periodic instructions, and concrete cooperation dynamics; otherwise, they risk becoming, at best, a mere distraction.

The main barriers identified in the research were: use of the technology with unstable Internet connectivity, limitations of some devices that appear current, the learning curve or initial learning by users, interfaces with a highly visual design (e.g., the aesthetic emphasis of virtual worlds), and the method of sharing knowledge from one group to another through an explicit communication tool such as chat. These usage conditions indicate that the use of virtual worlds in higher education requires technical planning for accessibility and an initial induction stage for students before using the virtual world.

The study concludes that the design of interactive virtual worlds should be understood as a pedagogical process, not merely a technical one. Their contribution to higher education lies in enabling more participatory digital experiences, provided they include defined learning objectives, teacher mediation, group work, and resources functional for teaching and learning.

REFERENCES

1. Al-Qaimari, G. (2025). Digital transformation in contemporary higher education institutions. En *Strategic Planning for Higher Education Institutions*. Palgrave Macmillan. https://doi.org/10.1007/978-3-032-04788-5_3
2. Barja-Ore, J., Liñán-Bermúdez, A., & Mayta-Tovalino, F. (2023). Visibilidad, impacto y colaboración en la producción científica sobre la realidad virtual en la educación médica (2017–2022). *Educación Médica*, 24(5), 100831. <https://doi.org/10.1016/j.edumed.2023.100831>
3. Caballero-Garriazo, J. A., Rojas-Huacanca, J. R., Sánchez-Castro, A., & Lázaro-Aguirre, A. F. (2023). Revisión sistemática sobre la aplicación de la realidad virtual en la educación universitaria. *Revista Electrónica Educare*, 27(3). <https://doi.org/10.15359/ree.27-3.17271>
4. Cabero-Almenara, J., Barroso-Osuna, J., & Palacios-Rodríguez, A. (2021). Estudio de la competencia digital docente en Ciencias de la Salud. Su relación con algunas variables. *Educación Médica*, 22(2), 94–98. <https://doi.org/10.1016/j.edumed.2020.11.014>
5. Conrad, M., Kablitz, D., & Schumann, S. (2024). Learning effectiveness of immersive virtual reality in education and training: A systematic review of findings. *Computers & Education: X Reality*, 4, 100053. <https://doi.org/10.1016/j.cexr.2024.100053>
6. Díaz-García, V., Montero-Navarro, A., Rodríguez-Sánchez, J. L., & Gallego-Losada, R. (2022). Digitalization and digital transformation in higher education: A bibliometric analysis. *Frontiers in Psychology*, 13, 1081595. <https://doi.org/10.3389/fpsyg.2022.1081595>
7. Domínguez, L. C., Carreño, O., & Sierra, D. (2021). Divide y vencerás: Efectos de dos intervenciones para el aprendizaje interactivo en grupos grandes de estudiantes sobre la percepción de la calidad del ambiente de aprendizaje. *Educación Médica*, 22(Supl. 5), 390–395. <https://doi.org/10.1016/j.edumed.2020.04.006>
8. Domínguez, L. C., & Vega, N. V. (2020). Efectos del mapa conceptual sobre la síntesis de información en un ambiente de aprendizaje interactivo: Un estudio preexperimental. *Educación Médica*, 21(3), 193–197. <https://doi.org/10.1016/j.edumed.2018.08.002>
9. Escandell Rico, F. M., & Pérez Fernández, L. (2024). Simulación de realidad virtual en la formación de los estudiantes de Enfermería: Una revisión sistemática. *Educación Médica*, 25(1), 100866. <https://doi.org/10.1016/j.edumed.2023.100866>
10. Galecio Mora, D. E., Carazas Durand, C. R., & Flores Cueva, M. Y. (2025). Entornos virtuales para el aprendizaje: Una revisión sistemática. *Revista InveCom*, 6(1). <https://doi.org/10.5281/zenodo.15447967>
11. Garrido Astray, M. C., Santiago Gómez, G., Márquez, M. G., Poggio Lagares, L., & Gómez Garrido, S. (2019). Impacto de los recursos digitales en el aprendizaje y desarrollo de la competencia Análisis y Síntesis. *Educación Médica*, 20(Supl. 2), 74–78. <https://doi.org/10.1016/j.edumed.2018.02.011>
12. Inman, R. A., Moreira, P. A. S., Cunha, D., & Castro, J. (2020). Evaluación de la dimensionalidad del Student School Engagement Survey: Apoyo para un modelo multidimensional bifactor. *Revista de Psicodidáctica*, 25(2), 109–118. <https://doi.org/10.1016/j.psicod.2020.02.001>
13. Jimbo Román, F. M., Bastidas González, K. A., & Zaragoza Alvarado, G. A. (2024). Uso de la realidad virtual en la educación universitaria: Vivencias, retos y posibilidades para la enseñanza en la educación superior. *Sapiens Studies Journal*, 1(1), 1–14. <https://doi.org/10.71068/61ca3a87>
14. Kuhail, M. A., ElSayary, A., Farooq, S., & Alghamdi, A. (2022). Exploring immersive learning experiences: A survey. *Informatics*, 9(4), 75. <https://doi.org/10.3390/informatics9040075>
15. Laufer, M., Leiser, A., Deacon, B., et al. (2021). Digital higher education: A divider or bridge builder? Leadership perspectives on edtech in a COVID-19 reality. *International Journal of Educational Technology in Higher Education*, 18, 51. <https://doi.org/10.1186/s41239-021-00287-6>
16. Lin, L. H., Pryor, M. R., & Beckmann, N. (2025). Social opportunities, learning practices, and performance in metaverse and virtual world: A comparative scoping review in higher education. *Computers & Education*, 239, 105391. <https://doi.org/10.1016/j.compedu.2025.105391>
17. Martínez-Comesaña, M., Rigueira-Díaz, X., Larrañaga-Janeiro, A., Martínez-Torres, J., Ocaranza-Prado, I., & Kreibel, D. (2023). Impact of artificial intelligence on assessment methods in primary and secondary education: Systematic literature review. *Revista de Psicodidáctica*, 28(2), 93–103. <https://doi.org/10.1016/j.psicod.2023.06.001>
18. Meléndez Araya, N. M., Jorquera Pallauta, J. L., & Meléndez Castillo, N. J. (2024). Metaversos en educación: Una mirada desde la literatura. *Ingeniare. Revista Chilena de Ingeniería*, 32. <https://doi.org/10.4067/S0718-33052024000100210>
19. Meroño, L., Calderón, A., & Arias-Estero, J. L. (2021). Pedagogía digital y aprendizaje cooperativo: Efecto sobre los conocimientos tecnológicos y pedagógicos del contenido y el rendimiento académico en formación inicial docente. *Revista de Psicodidáctica*, 26(1), 53–61. <https://doi.org/10.1016/j.psicod.2020.10.002>
20. Pinargote Castro, M. A., Solórzano Ortega, C. V., Lozano Torres, M. J., & Jiménez Mejía, F. J. (2024). Accesibilidad de la realidad virtual aumentada en la educación universitaria: Estrategias, desafíos y beneficios. *Revista Scientific*, 9(33), 252–275. <https://doi.org/10.29394/scientific.issn.2542-2987.2024.9.33.12.252-275>
21. Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778. <https://doi.org/10.1016/j.compedu.2019.103778>
22. Shah, S. S., Shah, A. A., Memon, F., Kemal, A. A., & Soomro, A. (2021). Online learning during the COVID-19 pandemic: Applying the self-determination theory in the 'new normal'. *Revista de Psicodidáctica*, 26(2), 169–178. <https://doi.org/10.1016/j.psicod.2020.12.004>

23. Williams, C., López-Entrambasaguas, O. M., Cayul, E., & Gaset-Poblete, J. (2024). Impacto de las metodologías activas en las estrategias de aprendizaje de estudiantes del área de la salud de primer año en la Universidad Finis Terrae. *Revista Médica Clínica Las Condes*, 35(5–6), 385–392. <https://doi.org/10.1016/j.rmcl.2024.02.004>
24. Zhao, Y., Pinto Llorente, A. M., & Sánchez Gómez, M. C. (2021). Digital competence in higher education research: A systematic literature review. *Computers & Education*, 168, 104212. <https://doi.org/10.1016/j.compedu.2021.104212>

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