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REVIEW

The metaverse in virtual education: towards a teacher training proposal based on immersive environments

El metaverso en la educación virtual: hacia una propuesta de formación docente basada en entornos inmersivos

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ABSTRACT

The expansion of virtual education after the pandemic highlighted the need to incorporate immersive technologies into teaching and learning processes. In this context, the metaverse was considered an innovative alternative with the potential to enrich teaching practice in digital environments. Based on a theoretical review, the role of the metaverse as an immersive learning environment and its applicability to teacher training were examined. References such as Vygotsky's sociocultural theory and Siemens' connectivism were analyzed, highlighting the value of technological mediation and learning networks. Likewise, gaps in digital competencies and limitations in the pedagogical use of the metaverse in Latin American educational contexts were identified. In response, the need to design a training proposal for teachers at Colegio Nuevo Ecuador, aimed at the pedagogical appropriation of the metaverse, was raised. It was concluded that the integration of the metaverse into virtual education requires a specific training intervention that strengthens teachers' digital competencies. This action would improve the quality of teaching in virtual environments and promote more innovative, interactive, and relevant pedagogical processes.

Keywords: Metaverse; Immersive Learning; Virtual Education; Digital Teaching Skills; Educational Innovation.

RESUMEN

La expansión de la educación virtual tras la pandemia evidenció la necesidad de incorporar tecnologías inmersivas en los procesos de enseñanza-aprendizaje. En este contexto, el metaverso se consideró una alternativa innovadora, con potencial para enriquecer la práctica docente en entornos digitales. A partir de una revisión teórica, se examinó el papel del metaverso como entorno inmersivo de aprendizaje y su aplicabilidad en la formación docente. Se analizaron referentes como la teoría sociocultural de Vygotsky y el conectivismo de Siemens, destacando el valor de la mediación tecnológica y las redes de aprendizaje. Asimismo, se identificaron brechas en competencias digitales y limitaciones en el uso pedagógico del metaverso en contextos educativos latinoamericanos. En respuesta, se planteó la necesidad de diseñar una propuesta de formación dirigida al profesorado del Colegio Nuevo Ecuador, orientada a la apropiación pedagógica del metaverso. Se concluyó que la integración del metaverso en la educación virtual requiere una intervención formativa específica que fortalezca las competencias digitales docentes. Esta acción permitiría mejorar la calidad de la enseñanza en entornos virtuales e impulsar procesos pedagógicos más innovadores, interactivos y pertinentes.

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Palabras clave: Metaverso; Aprendizaje Inmersivo; Educación Virtual; Competencias Digitales Docentes; Innovación Educativa.

INTRODUCTION

In the context of the accelerated transformation of education driven by the COVID-19 pandemic, institutions have been forced to rethink their teaching models, prioritizing virtual modalities and emerging technologies.[1,2,3] One of the innovations with the most significant potential in this new scenario is the metaverse, understood as an immersive virtual environment that allows interaction through avatars and the simulation of learning spaces without physical limitations.[4,5,6,7,8]

Despite its growing international popularity, the use of the metaverse in education is still in its infancy in Latin America, particularly at the secondary level. Its implementation requires, among other factors, teachers with solid digital skills and specific training in the design and management of immersive pedagogical experiences.[9,10,11,12]

In this context, the intention arises to develop a study aimed at diagnosing the digital competencies of the teaching staff at the Colegio Nuevo Ecuador, located in Quito, to design a training proposal that allows the incorporation of the metaverse as an educational tool in its virtual baccalaureate modality.[13,14,15] This initiative is part of the line of academic innovation and seeks to anticipate emerging technological demands, laying the foundations for a sustained and contextualized pedagogical transformation.

This research aims to design a teacher training proposal based on using the metaverse as an immersive learning environment. The proposal seeks to strengthen the teachers' digital skills at Colegio Nuevo Ecuador in the context of its virtual education modality. This proposal will facilitate the pedagogical incorporation of immersive environments, promoting more meaningful, dynamic, and contextualized teaching-learning experiences.

DEVELOPMENT

As an interactive virtual space, the metaverse has captured the attention of multiple disciplines, including education, due to its ability to simulate real-life scenarios and encourage student collaboration in immersive environments. Although the concept is not new, its educational application has intensified due to the expansion of virtual education in the wake of the COVID-19 pandemic.[16,17,18,19,20] This health crisis forced education systems to adopt remote modalities, highlighting both the sector's possibilities and technological limitations.

In this context, the metaverse is an evolution of traditional virtual environments, allowing for more dynamic and meaningful learning experiences. According to Checa,[21] virtual worlds or metaverses are fictitious constructions in which participants interact through avatars they have created, seeking to reproduce real-world experiences in spaces without space-time limitations. This ability to recreate authentic situations makes the metaverse an educational tool with great didactic potential, especially in disciplines that require visualization, simulation, or practical experimentation.

However, adopting the metaverse in education requires overcoming significant challenges, including strengthening teachers' digital skills. As Esteve and Gisbert[22] point out, these skills comprise a set of abilities, knowledge, and attitudes related to information and communication technologies and imply multiple and complex literacies. In many cases, teachers' lack of preparation prevents these innovative tools from being effectively integrated into the pedagogical process.

Additionally, Ruiz Campo et al.[23] point out that, although university teachers recognize the value of the metaverse as a viable option for diversifying remote teaching, its practical implementation requires additional technical training and a favorable disposition towards methodological change. This point is crucial, as access to technology is not enough: teachers must understand the metaverse's pedagogical potential and have strategies to design relevant and meaningful educational experiences in these environments.

From a theoretical perspective, integrating the metaverse into education can be approached from the sociocultural theory of Vygotsky, who argues that all learning is a socially mediated process. In this sense, technologies —including the metaverse— can be understood as cultural tools that facilitate the construction of knowledge.[24,25,26,27,28] Complementarily, the connectivism proposed by Siemens[29] offers a framework for understanding learning as a distributed phenomenon based on the connection between people, content, and digital resources. Under this vision, the metaverse not only acts as a space but also as a network of interaction and knowledge.

Some recent studies have already explored using the metaverse in educational contexts. For example, Martín-Ramallal et al.[30], at the OFFF-2020 event in Spain, found that virtual worlds can complement —although not wholly replace— face-to-face knowledge transfer. Similarly, Ordoñez et al.[31] identified that these platforms stimulate collaborative learning, autonomy, and the development of multiple skills. However, they warn that

there are still gaps in technological availability and teacher training.

In the Ecuadorian context, research such as that of Aroca[32] has shown that using the metaverse as an assessment tool can increase student confidence and performance, which reinforces the need to explore its applicability beyond the face-to-face classroom. However, as Trejo[33] and other authors point out, many teachers are not yet prepared for this technological leap, reinforcing the urgency of teacher training programs aligned with these new environments.[34]

In short, the development of training proposals aimed at the pedagogical use of the metaverse is not only relevant but necessary. These types of initiatives would allow teachers to update their digital skills and redesign their teaching strategies to fully take advantage of immersive environments. This lays the foundations for a more innovative, inclusive virtual education adapted to the demands of the 21st century.

From the above, it is clear that the metaverse in education should not be limited to a technological vision but should be accompanied by a solid training process that allows teachers to take advantage of its pedagogical possibilities. The theories that support this integration — such as connectivism and sociocultural mediation — agree on the importance of forming meaningful learning networks and using tools that enrich the educational experience.

In this sense, the lack of digital skills identified in various Latin American contexts, specifically in the case of the Colegio Nuevo Ecuador, highlights the urgency of a planned intervention to prepare teaching staff to face the challenges of teaching in immersive virtual environments. The articulation between theory, practice, and institutional context suggests that a training proposal focused on the pedagogical use of the metaverse could represent an improvement in the quality of teaching and a strategic step toward educational innovation.

This reflection constitutes the basis for designing a teacher training program to provide teachers with conceptual, technical, and methodological tools that will enable them to implement immersive learning scenarios appropriate to the requirements of virtual high school and aligned with the demands of contemporary digital society.

CONCLUSIONS

The metaverse represents a disruptive opportunity to transform virtual education by enabling immersive learning experiences that encourage participation, critical thinking, and the meaningful construction of knowledge. However, its effective incorporation into school contexts depends directly on the teacher's preparation, both in technical and pedagogical terms. The theoretical review shows that, although there has been progress in technological development, there are still significant training gaps, especially in Latin American educational environments, where access, training, and willingness to change are real challenges.

Therefore, it is necessary to design and implement teacher training proposals that respond to these new educational demands, integrating the use of the metaverse as a didactic tool. These initiatives will strengthen teachers' digital skills and enrich their pedagogical practices in virtual settings. In turn, they will contribute to the consolidation of more inclusive, innovative, and sustainable educational models that respond to the needs of new generations of students and are aligned with the dynamics of today's digital society.

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