PANORAMIC REVIEW

Metaverse and education: a panoramic review

Metaverso y educación: una revisión panorámica

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ABSTRACT

One of the most obvious ways in which the metaverse can influence higher education is by providing a more immersive and enriching learning experience for students; allowing students to experience and practice in a more functional and meaningful way. A panoramic review was conducted with the aim of describing the main applications and potentialities of the metaverse in education, in which 44 scientific articles were included. Augmented reality can become a powerful tool to enhance teaching and learning, as it allows students to interact more actively with the content and fosters more immersive and meaningful learning. Metaverse avatars are a technology that allows users to create and control a digital representation of themselves in a virtual environment. The metaverse can have applications in education, including communication and collaboration, learning enrichment, enhanced project-based learning, and accessibility. It can be concluded that the metaverse can provide a more immersive and enriching learning experience for students. Through virtual reality, learning environments can be created that simulate real situations and scenarios, allowing students to experience and practice in a more hands-on and meaningful way. The metaverse can facilitate distance learning and collaboration between students and teachers in different parts of the world, expanding learning opportunities and fostering cultural diversity.

Keywords: Metaverse; Education; Avatar; Augmented Reality.

RESUMEN

Una de las formas más evidentes en las que el metaverso puede influir en la educación superior es proporcionando una experiencia de aprendizaje más inmersiva y enriquecedora para los estudiantes; lo que permite a los estudiantes experimentar y practicar de manera más funcional y significativa. Se realizó una revisión panorámica con el objetivo de describir las principales aplicaciones y potencialidades del metaverso en la educación, en la que se incluyeron 44 artículos científicos. La realidad aumentada puede convertirse en una herramienta poderosa para mejorar la enseñanza y el aprendizaje, ya que permite a los estudiantes interactuar de manera más activa con el contenido y fomenta un aprendizaje más inmersivo y significativo. Los avatares del metaverso son una tecnología que permite a los usuarios crear y controlar una representación digital de sí mismos en un entorno virtual. El metaverso puede tener aplicaciones en la educación, incluyendo la comunicación y colaboración, el enriquecimiento del aprendizaje, la mejora del aprendizaje basado en proyectos y la accesibilidad. Se puede concluir que el metaverso puede proporcionar una experiencia de aprendizaje más inmersiva y enriquecedora para los estudiantes. A través de la realidad virtual, se pueden crear entornos de aprendizaje que simulen situaciones y escenarios reales, lo que permite a los estudiantes experimentar y practicar de manera más práctica y significativa. El metaverso puede facilitar el aprendizaje a distancia y la colaboración entre estudiantes y profesores de diferentes lugares del mundo, lo que amplía las oportunidades de aprendizaje y fomenta la diversidad cultural.

Palabras clave: Metaverso; Educación; Avatar; Realidad Aumentada.

INTRODUCTION

The metaverse is a concept increasingly present in today's society and it refers to a virtual reality in which different activities and experiences can be developed. This technology has the potential to transform higher education in several ways and it is important to explore how it can influence the future of education.[1]

One of the most evident ways in which the metaverse can influence higher education is by providing students with a more immersive and enriching learning experience. Through virtual reality, learning environments simulating real situations and scenarios can be created, which allows students to experiment and practice more innovatively. This can be especially useful in fields like health sciences, engineering and architecture, where it is important to be able to experiment and practice skills in a safe environment before applying them in the real world.[2]

Besides, the metaverse can facilitate distance learning and collaboration between students and professors from different places around the world. Through virtual reality, you can attend classes and participate in academic activities without being physically present.[3]

This can be especially useful to those students who, for different reasons, cannot attend classes in person. Furthermore, the use of virtual reality can also help those students who should travel to attend college to reduce their transportation and accommodation expenses.

The goal of this review is to describe the main applications and potentialities of the metaverse in education.

METHODS

A panoramic review of the literature was conducted, following the methodology PRISMA.[4] In order to develop this piece of research, the keywords "metaverse" and "education" were used in the search, without any time limit, including the articles in Spanish, English or Portuguese.

Finally, 44 scientific articles were chosen for their analysis and systematization.

RESULTS AND DISCUSSION

The metaverse can also be a valuable tool for research and development of projects in higher education. Through virtual reality, students can have access to data and resources that would otherwise be inaccessible or expensive to obtain. Besides, the metaverse can provide a safe, controlled environment to conduct experiments and tests that could be dangerous or impossible to carry out in the real world.[5]

Another way in which the metaverse can influence higher education is by using avatars, which allow students to attend classes and participate in academic activities without having to be physically present.[6]

Augmented reality and education

Augmented reality (AR) is a technology making it possible to superimpose virtual elements on physical reality, creating an experience of "improved reality".[7]

In the context of education, augmented reality can be used in different ways to improve teaching and learning. AR applications in the area of education can be systematized as follows:[8,9,10,11,12]

- To explain complex concepts: AR can be used to display and explain abstract concepts in a manner being more concrete and easier to understand. For instance, it can be used to show how the biological systems or the physical laws work in everyday life;
- To create immersive learning experiences: AR can create more immersive and attractive learning experiences for students, as it allows them to interact with the content more dynamically and playfully;
- To facilitate collaboration and teamwork: AR can be used to create collaborative activities and projects in which students can work together to solve problems and develop activities;
- To increase accessibility: AR can be used to make content more accessible to visually or auditorily disable students as it enables the creation of versions of content adapted to their needs;
- To improve evaluation and feedback: AR can be used to provide students with real-time feedback and evaluation during the learning process, which can help to identify and correct problems more effectively.

Based on these elements, we can systematize that AR can become a powerful tool to improve teaching and learning, since it allows students to interact more actively with the content and fosters more immersive, meaningful learning.

Avatars and education

Metaverse avatars are a technology enabling users to create and control a digital representation of themselves in a virtual environment. This technology can have applications in education in several ways:[13,14,15,16,17,18,19,20,21,22]

- Communication and collaboration: metaverse avatars can be used to communicate and collaborate with other students and professors in real time, which can be especially useful in situations when students cannot attend classes physically or in the context of distance education;
- Enriched learning: metaverse avatars can be used to create immersive, enriching learning environments.

For instance, students can use avatars to explore historical sites, museums or laboratories in a virtual manner, which allows them to experience the content more interactively and meaningfully;

•   Improved learning based on projects: metaverse avatars can be used to conduct collaborative and research projects in a virtual environment, which allows students to work as a team and share ideas more efficiently;

•   Accessibility: metaverse avatars can be used to improve accessibility in education. For instance, disable students can use avatars to participate in classes and learning activities more comfortably and safely.

Applications of the metaverse in education

The metaverse can have a series of applications in education, including communication and collaboration, enriched learning, improved learning based on projects and accessibility.

The applications and tools generated in the metaverse can be applied in the educational field, strengthening already existing educational tools, we can mention:[23,24,25,26,27,28,29,30,31,32,33]

1.   Virtual classrooms: many educational institutions have begun to use videoconference platforms to give online lessons during the COVID-19 pandemic. Some of these platforms offer experiences in the metaverse, allowing students to attend classes from anywhere in the world and have a more immersive experience than a traditional videoconference;

2.   Simulations: the metaverse can be used to create simulations of real or imaginary situations or environments, which allows students to experiment and learn in a more practical and playful manner. For instance, simulations of laboratories, museums or historical sites can be created for students to explore them and learn about them more interactively;

3.   Virtual exhibitions: the metaverse can also be used to create virtual exhibitions allowing students to explore and learn about different topics in a more immersive and attractive manner. This can be especially useful to those students who, for any reason, cannot go to an exhibition in person;

4.   Virtual excursions: the metaverse can also be used to make virtual excursions to places that would otherwise be difficult o impossible to visit, such as the seabed or outer space. This allows students to have a more immersive experience and learn in a more attractive manner.

Use of the metaverse in some countries

Strategies for the implementation of the metaverse in education are described in several countries around the world, though its use and adoption varies widely from one place to another.

Some examples of leading countries that have used the metaverse in education include:

•   United States: in the United States, the metaverse has been used in education for some years, especially in colleges and higher institutes. For instance, some institutions have used metaverse platforms such as SecondLife to offer online courses and training programs and also to create more immersive and enriching online learning environments;[1,34,35,36]

•   Japan: Japan has been a pioneer in using the metaverse in education and has used platforms like SecondLife and OpenSim to create online learning environments and offer online training programs. Besides, the Japanese government has invested in research on and development of the metaverse technology for education and other applications;[37,38,39,40]

•   United Kingdom: in the United Kingdom, the metaverse has been used to create online learning environments and offer online training programs, mostly in the field of higher education in health.[41,42,43]

In the Latin American context, the metaverse has been used in education; however, the adoption of emerging technologies can vary widely from one place to another;[44] the academic offers of training programs with the implementation of metaverse tools have been recorded in Argentina,[45] Brazil,[46,47] Chile[48] and Mexico.[49]

Beyond the limitation of these findings in the region, the use of the metaverse in education is likely to continue expanding as this technology progresses and turns more accessible.

CONCLUSIONS

We can conclude that the metaverse can provide students with a more immersive and enriching learning experience. By way of virtual reality, learning environments simulating real situations and scenarios can be created, which allows students to experiment and practice in a more practical and meaningful manner. Moreover, the metaverse can facilitate distance learning and collaboration between students and professors from different places in the world, which increases the learning opportunities and fosters cultural diversity.

Another way in which the metaverse can influence education is by using avatars, which allow students to attend classes and participate in academic activities without having to be physically present. This can be especially useful to those students who, for different reasons, cannot attend classes in person. Furthermore, the use of avatars can also help those students who must travel to attend college to reduce their transportation and accommodation expenses.

Finally, the metaverse can also be a valuable tool for research and the development of projects in higher education. Through virtual reality, students can have access to data and resources that would otherwise be inaccessible or expensive to obtain. Besides, the metaverse can provide a safe, controlled environment to conduct experiments and tests that could be dangerous or impossible to carry out in the real world.

In conclusion, the metaverse has the potential to transform higher education in several ways and it can offer a more immersive learning experience, facilitate distance learning and the use of avatars and be a valuable tool for research and the development of projects.

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CONFLICT OF INTEREST
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