Metaverse as a Learning Environment

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The metaverse is unavoidable in an increasingly digitalized society and will potentially have a profound influence on what is understood as teaching and learning in its formal and informal dimensions, both in initial and continuing education.

metaverse   teaching   virtual classroom   virtual reality

1. Introduction

We are increasingly living in a super-smart society, characterized by the close connection between artificial intelligence, the internet of things, big data, and man [1][2][3][4][5]. This factor increases the influence of this technology and the way it is mobilized in the (re)definition of one's individual and collective identity [6][7][8]. It was in this context that the COVID-19 pandemic, and the consequent security measures related to physical distance, boosted the increasing implementation of the digital dimension [3][9][10][11] in many of the sectors of life. These include education through elements such as online classes, virtual conferences, and lectures, among others [12].

A subsequent phase is the growing interest and presence of the metaverse, which, in a way, deepens the digital dimension in social and economic life and, potentially, in education itself [13][14][15] in the (possible) development of the United Nation's Sustainable Development Goal 4—quality education. However, the metaverse as a learning environment is a topic that is (still) very little studied [16].

However, what is the metaverse all about? First, it is pertinent to emphasize that it cannot be confused with any exclusive software program or specific platform exclusive to any company or even of a state/public entity, state, or governmental nature [17][18][19]. It is not easy to present a single definition [20], but the one that follows seems enlightening to us:

"The metaverse is a post-reality universe; it is a perpetual multi-user environment that combines physical reality and digital virtuality. It is based on the convergence of technologies that enable multisensory interactions with virtual environments, digital objects, and people, such as virtual reality (VR) and augmented reality (AR). As a result, the metaverse is a web of social and networked immersive environments on persistent multi-user platforms. It allows for real-time embodied user communication and dynamic interactions with digital artifacts [21]" (p. 278).

The metaverse is intrinsically linked to Web 3.0 [18][22] and blurs/fuses the physical and virtual dimensions [23][24] in what Allam et al. [25] call *phygital*. In addition, the metaverse is shaped as a continuity that merges the physical and

the virtual worlds, largely through the existence of "avatars" as digital identities [16], a "digital representation of oneself in the digital world" [25] (p. 777), which raises profound and emerging challenges [26].

2. The Metaverse and Digital Society

The metaverse, as a fully immersive digital environment, is accessed through an avatar with a digital time-space, which is not necessarily the same as the physical world [26][27][28][29][30][31][32].

Jaber [33] sustains that this metaverse as complex system is composed of a set of components that include (1) humans (which are at the core of the metaverse); (2) the physical infrastructures (the real/physical world); (3) the interconnected virtual worlds (named the sub-metaverse); (4) the metaverse engine (whose functioning is fed through the use of blockchain, artificial intelligence, interactivity, and digital twin technologies; (5) the in-world information flow (the technologies permanently update the virtual world through the inputs from the real world); and (6) the flow of information across physical and virtual worlds).

In education, the concept of skeuomorphism—combining, in the virtual world, objects and environments that are similar to those in the physical world—can be used to enhance the educational experience, allowing for the design of a very personalized metaverse, thus creating the illusion that teachers and students are in the same real/physical space [16]. Therefore, given the potential advantages of the metaverse, its use in education is likely to be widespread in the near future [34].

3. The Metaverse and Education

The metaverse and education are intertwined to the extent that, in contemporary education, they are always digitally mediated; students share virtual spaces, methods, and content that enhance both their academic and personal development. However, there are many skeptical voices about the relevance of the metaverse in education, believing that it can be misleading in terms of improving the educational process [31].

However, the metaverse can contributes to enriching the educational process, including the teacher-student relationship, which, through the metaverse, has no barriers in terms of time and space. Moreover, the metaverse is fundamental to changing the classic educational model, which is traditionally static, to a dynamic model by mobilizing a wide range of situations, methods, tools, and forms of learning and assessment and placing the student at the center of the educational process, which potentially increases their motivation for learning technical and also soft transversal skills [24][31][33][35].

In this virtual scenario, educational actors are assigned digital identities and, through the use of information technologies, such as virtual reality, augmented reality, the internet of things, and blockchain, for example, interact in formal and informal teaching contexts in the virtual world. This allows for overcoming some of the barriers that traditional teaching and learning venues face, such as time and space, while actors have the possibility to learn both physically and virtually in an open and shared space, as well as increase participant motivation [16]. These

new tools offer a world of new possibilities to both teachers and students to enrich the teaching and learning process [36].

Five relevant propositions about the importance of using the metaverse in education [37], pp. 36-37:

"Proposition 1. The use of metaverse in education should mirror the real-world learning environment for learners and educators. The metaverse can extend the forms of learning by providing learning opportunities that would not be possible otherwise.

Proposition 2. The use of metaverse can better facilitate new forms of training and go beyond the capabilities of the physical classroom and e-learning platforms combined.

Proposition 3. Educators need to elevate their pedagogical methods and course syllabus to accommodate teaching in the metaverse.

Proposition 4. New metrics need to be developed for evaluating learning experiences in the metaverse.

Proposition 5. Education providers need to offer new technical equipment and train educators on how to serve their learners in the metaverse".

The use of the metaverse in educational processes offers both students and teachers the possibility to experiment with new and innovative approaches and forms of teaching and learning, as well as to interact with the academic community, including by emulating the real world through virtual reality [38]

4. Conclusion

It is crucial to carefully weigh the advantages and shortcomings of using the metaverse in the educational environment. First and foremost, it is paramount to understand the students' views and uses of the metaverse, their levels of immersion, and the effects on their learning. On the other hand, being a virtual world, the metaverse allows individuals to have experiences that they would not otherwise have in the real world, but this may lead to an uncritical acceptance of the content and products offered, which may or may not be suitable to students' needs and/or competencies.

The use of the metaverse in education is just beginning its first steps and, thus, its users will find many benefits but also many pitfalls arising from its use, especially at a time when research on this topic is still scarce and people lack adequate training to properly use the metaverse in education [24]. Therefore, and for now, educational institutions and students should be cautious and aware of the good and the not-so-good sides of the metaverse.

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