VIRTUAL WORLDS AND EDUVERSE: A REFLECTION ON THE BODY, SPACE AND LEARNING IN THE METAVERSE

MONDI VIRTUALI ED EDUVERSO: UNA RIFLESSIONE SUL CORPO, LO SPAZIO E L'APPRENDIMENTO NEL METAVERSO

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ABSTRACT
The concept of the metaverse has been gaining immense attention and traction above all in the entertainment, social interaction and commerce sectors. However, its potential extends far beyond these areas, significantly affecting the field of education. In the virtual world of the metaverse, the reality boundaries of physical space and the limitations of the human body are transcended, offering unprecedented opportunities for structuring engaging, interactive and highly effective learning environments. This paradigm shift has the potential to revolutionize education, making it more engaging, accessible and tailored to individual needs. On the basis of these reflections, this paper explores the transformative potential of the metaverse in the field of teaching, didactics and special pedagogy, shedding light on its capacity to reshape traditional learning environments.

Il concetto di metaverso sta riscuotendo enorme attenzione e popolarità soprattutto nei settori dell'intrattenimento, dell'interazione sociale e del commercio. Tuttavia, il suo potenziale si estende ben oltre questi ambiti interessando in modo significativo il campo dell'istruzione. Nel mondo virtuale del metaverso, i confini della realtà dello spazio fisico e i limiti del corpo umano vengono trascesi, offrendo opportunità senza precedenti per la strutturazione di ambienti di apprendimento coinvolgenti, interattivi e altamente efficaci. Questo cambio di paradigma ha il potenziale per rivoluzionare l'istruzione, rendendola più coinvolgente, accessibile e adattata alle esigenze individuali. Sulla base di queste riflessioni, il presente articolo esplora il potenziale trasformativo del metaverso nel campo dell'insegnamento, della didattica e della pedagogia speciale, facendo luce sulla sua capacità di rimodellare gli ambienti di apprendimento tradizionali.

KEYWORDS
Metaverse; Virtual Worlds; Eduverse;
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Introduction

The post-pandemic period has seen the birth of a new educational paradigm in Italian schools thanks to the ever-increasing use of new technologies and digital.

In Italy, in particular, there was a strong appeal both towards the regions and towards the educational sector to face not only the national challenges, as outlined by the National Recovery and Resilience Plan (Italian acronym, PNRR) of the Italian Government, but also at an international level, as articulated in the European Agenda 2030 Plan defined by the United Nations in 2015.

A noteworthy development can be attributed to the School Plan 4.0 introduced in 2022 by the Ministry of Education and Merit for which the integration of the metaverse in educational contexts constitutes a nascent field of exploration called "eduverse". The eduverse, understood precisely as learning in the metaverse, establishes new channels for social communication, greater freedom in creating and sharing content, and the provision of engaging educational experiences through virtualization. All this, in turn, establishes an educational and scholastic continuum, connecting physical and virtual spaces for learning, thus creating "onlife" learning environments. This exceptionally advanced educational framework, which is a forward-looking initiative, explicitly recognizes the emergence of new onlife scenarios (Floridi, 2019), in which digital paradigms embrace various aspects of our lives, including education, designing spaces of learning that blend traditional teaching with innovative digital components (transition of traditional classrooms into innovative hybrid learning environments). Innovation translates into the structuring of learning environments in which the physical classroom is not replaced but enhanced and extended through the integration of digital technologies.

The eduverse represents a new field of exploration, where the use of the metaverse merges with the educational system, configuring itself as a large-scale, interoperable network of 3D virtual worlds that are redirected in real time and can be experienced synchronously and persistently by an effectively unlimited number of users with a sense of individual presence, and with continuity of data, such as identity, history, rights, objects and communications (Ball, 2022). In this sense, the eduverse conveys a concept of extended reality, where through a spectrum of technologies that merge physical and virtual worlds, individuals interact using synthetic avatars, thus transcending the limits of physical appearance and space (Park and Kim, 2022).

The emergence of hybrid technologies, with the use of headphones, glasses and gloves, allow for greater sensorial and emotional connection, promoting immersion and optimization of sensory stimuli. At the same time, the metaverse adds layers of complexity to our understanding of reality (Milman, 2018), providing an ever-evolving space in which the physical and digital realms coexist and interact (Moro et al., 2022). This transformative change has significant implications for how we perceive and interact with our surroundings and the digital worlds to which we are increasingly connected.

The eduverse concept offers substantial potential for creating innovative learning environments that are conducive to fostering creativity, facilitating collaborative sharing, and enhancing communication in an effortless transition between the real and virtual domains. In Italy, specifically, there are numerous examples of immersive education initiatives implemented at different educational levels which represent a commitment to immersive technologies and the eduverse to transform the educational landscape, providing students with innovative and engaging learning experiences (Filippone et al., 2023; Finestrone et al., 2023; Mosa et al., 2023; Occhioni, 2017, 2021).

1.**Metaverse as learning environment**

The environment where we live and within which we share experiences plays a crucial role in shaping cognitive processes, especially learning. Rather than viewing cognition as a merely mental or brain phenomenon, embodied cognition suggests that the physical environment and interactions within it are intimately connected and intertwined with cognitive functions. (Gomez Paloma, 2017; Chemero and Heyser, 2009; Lakoff et al., 1999; Varela et al., 1992). Research in the field of cognitive neuroscience has provided clear evidence to support this idea and has underlined the importance of considering the body and the environment as integral parts of the cognitive system. Indeed, current thinking about how learning occurs emphasizes the constructivist approach, which argues that students must actively “construct” knowledge by extracting it from experiences that have meaning and importance for them (Garrison, 2009). Constructivism, as advocated by Jean Piaget and Lev Vygotsky, suggests that students construct knowledge through practical experiences and interactions. For

example, in a virtual biology lab, students can manipulate virtual samples and observe the results, allowing them to better understand biological concepts (Wadsworth, 1996; Vygotsky and Cole, 2018).

Furthermore, experiential learning theory, developed by David Kolb (2014), assumes that learning is a cycle involving concrete experience, reflective observation, abstract conceptualization, and active experimentation in an immersive environment that provides an ideal framework for experiential learning. Teachers can create immersive simulations and environments suited to various learning styles, while students can engage in immersive experiences, reflect on them and apply new knowledge, fostering deeper understanding. For example, history lessons can transport students to historical events, making learning engaging and memorable.

Connectivism highlights the importance of online learning in the digital age (Kop and Hill, 2008). Immersive environments facilitate the creation of learning networks. Students can connect with peers, experts and resources globally, enhancing their learning through shared experiences, discussions and collaborative projects beyond the limits of reality. Educators can accommodate students with disabilities and offer real-time translation capabilities, voice-to-text or virtual assistants, educational resources, such as textbooks, lectures, and supplementary materials, which can be digitized and rendered, through the software. consequently, easily accessible within the metaverse. This new possibility of using materials and tools eliminates the physical constraints of traditional resources and environments, guaranteeing the learning process accessible to all and within reach for all. Universal Design for Learning (UDL), based on the work of David Rose and Anne Meyer (2006), promotes inclusive education by accommodating diverse learning styles and needs. Immersive environments can be designed with UDL principles in mind, offering multiple means of representation, engagement, and expression to accommodate all learners. The metaverse, in fact, can be designed on a personalized learning path by monitoring individual progress and adapting the contents; accordingly, students receive tailored instruction, addressing their specific needs and strengths. Cognitive load theory emphasizes the management of cognitive resources during learning. Immersive environments can be designed to minimize extraneous cognitive load, ensuring that students can focus their mental effort on understanding content rather than navigating complex interfaces or environments (Paas and Sweller, 2014).

Although less emphasized in modern pedagogy, behaviorism, as advocated by B.F. Skinner (1985), focuses on observable behaviors and conditioning. Immersive environments can incorporate behaviorist principles by providing immediate feedback and rewards for desired actions, motivating students to actively engage.

In terms of education, the presence of the metaverse is a completely new concept compared to existing educational technologies (Zhang et al. 2022); therefore, the addition of the third dimension and the ability for users to interact with their three-dimensional visual identity marks a substantial progress. This innovation has the potential to break down barriers related to space, time and cost, making it possible to explore educational environments that were logistically and safely inaccessible (Tlili et al., 2022).

The concept of a “digital mirror world” suggests that the virtual environment faithfully replicates elements of the real world. This replica includes the appearance of buildings, objects and interaction. However, these familiar elements can be reimagined and repurposed to serve new functions and experiences (Heidicker et al., 2017). Furthermore, virtual reality's central role in generating immersive digital environments is achieved by leveraging visual and auditory stimuli that simulate spaces that not only resemble aspects of the physical world but also venture into fantastical realms beyond the possibilities of conventional physical reality (Smutny et al., 2019). For example, a student might learn the Spanish glossary of animals as a second language by watching them at close range while listening to the calls of endangered species.

True immersion occurs when the environment convincingly tricks a person's cognitive and perceptual system into believing they are somewhere other than their physical surroundings. (Patrick, 2000). The feeling of being present, similar to an extension of one's physical self, is central to virtual reality, even as the physical body remains rooted in the real world. This concept is fundamental in the discussion of engagement and interactivity because they are fundamentally intertwined with the notions of presence, as a subjective perception of being psychologically situated in the learning environment, and agency referring to the sense of having the ability to act and control. events within that space (Finestrone et al., 2023).

To understand the educational process in its complexity it is necessary to understand the link between embodiment, reality and virtual environments. In the next section, we will explore the multifaceted role of avatars in the

metaverse, examining their functions, challenges, and the profound impact they have on students' digital identities and experiences.

2.**The body in the metaverse: the avatar**

The rapid evolution of digital technology has ushered in a new era in education, characterized by the emergence of virtual worlds, a shared collective virtual space where physical and digital reality converge. A virtual world is, in fact, a 3D environment simulated and supported by the computer, accessible by multiple users on different devices. Each user embodied presence as an avatar (i.e. a digital representation with human or non-human characteristics) to interact in real time within the virtual world and explore its characteristics using visual objects, participate in a wide range of activities or tasks simulated and communicate with other peers at the same time and placed in a 3D online environment displayed on a video output (Girvan, 2018).

The avatar becomes the main interface through which to manipulate the available information (Kilteni et al., 2012). It is integrated into the user's bodily representation and serves as an extension of the self in virtual environments.

Thanks to new immersive and intuitive technologies, actions become embodied experiences. Users can physically move through 360° environments, adopting a first-person perspective or projecting their identity into a character, like in a video game (Oprean and Balakrishnan, 2020; VanFossen and Gibson-Hylands, 2023). This integration of multisensory information brings users closer to the metaverse, a concept that blurs the lines between the physical and virtual realms (Riva and Wiederhold, 2022).

The avatar is the point of convergence between the physical and virtual worlds. It provides the perception of presence and gives the opportunity to interact allowing a sense of immersion, identity and agency. Embodiment is, in fact, at the heart of the metaverse experience, connecting countless users without logistical boundaries allowing them to navigate, interact and express themselves.

The avatar can be understood as a customizable alter ego that reproduces actions and movements in real time. The avatar has a very high social function as through

it each user can show themselves to the entire relevant online community. Thanks to the creation of a personalized avatar, each user can choose to build themselves as they actually see themselves, breaking down every constraint and obstacle imposed by reality. Real person and avatar, understood as virtual person, thus become digital twins (Rossi et al., 2023).

Avatar is not limited to physical realism: users can embody avatars ranging from hyper-realistic human representations to abstract or fantastical forms. Students can experiment with identities, genders, appearances, and even species, fostering creative exploration with a profound impact on mental health. Avatars are not passive representations but active entities, which allow users to navigate and engage in the virtual world. These interactions fundamentally redefine the boundaries of physical existence, personal identity, and subjective experience. They imply that within the digital realm individuals can explore new dimensions of self-expression, identity and interaction that go beyond the constraints of the physical world. In this context the avatar serves as a means for individuals to project an idealized version of themselves online, reducing the discrepancy between their real and virtual identities (Bessière et al., 2007). For example, the Proteus effect, named after the Greek deity, known for shape-shifting, highlights the idea that individuals can adapt their behavior to fit their virtual representations (Yee and Bailenson, 2007). Another of the recently conducted social studies uses virtual embodiment to study racial prejudices and perceptions. Virtual embodiment in a virtual body, therefore, is seen as a very powerful tool for observing the world through someone else's eyes (Bellido Rivas et al., 2021).

In the experiences reported above, the avatars could replicate the user's voice and certain body movements, improving non-verbal and paraverbal communication. However, they do not have the ability to reproduce facial expressions. This small problem is implemented in the Framevr.io platform through the use of the emoticon function and, occasionally, through the possibility of activating the webcam that accompanies the avatar in its movements facilitating non-verbal communication, gestures and body language, making virtual socializing more authentic (Filippone et al. 2023).

The recent study conducted by Slater et al. in 2021 demonstrated how the avatar offers a level of psychological comfort by alleviating the anxiety associated with one's physical presence. The idea of using an avatar, which acts as a shield against any judgments, is generally perceived as beneficial by most people. As a matter of fact, many people find comfort in the anonymity and protection provided by avatars. Furthermore, in line with the needs of adolescents, it was observed that

there is also a need to customize different avatars. This observation highlights the implications of using more realistic avatars compared to fantasy and caricatural ones (Aseeri, and Interrante, 2021). This information highlights the complex interplay between user comfort, identity representation, and perception with the potential for personalization (Mosa et al., 2023).

3.**Metaverse and teaching: a challenge for the future of learning**

Although in the post-pandemic period the scientific debate is focusing on reflections that aim to understand what the advantages may be, but above all the disadvantages of the metaverse as an innovative tool for the teaching-learning process and its practical implications on teaching and its implications social, there are many educational experiences that aim to integrate immersive virtual reality into ordinary teaching practices. Specifically, the Italian school is opening up to pilot teaching experiences, flexible and reproducible in different contexts so as to configure a new scenario of teaching the different disciplines within virtual worlds, in a digital and immersive reality that allows to strengthen the student engagement, promoting the delicate transition that leads soft skills to become digital soft skills, enhancing their uniqueness in a constantly evolving educational context.

The educational impact of the metaverse and virtual worlds materializes mainly in the STEM (Science, Technology, Engineering and Mathematics) disciplines, thus resulting in an innovative methodology for their development. In particular, in the Italian panorama, one of the first studies and related teaching experiences was that of Occhioni in 2017. The researcher describes in her work Teachland, a real 3D book that proposes a virtual world characterized by a group of islands centered on mathematics and science, where students can interface with the contents of the disciplines through different immersive learning sets.

As it is an open and flexible platform, different schools can share projects and find new approaches to scientific questions. Along these lines, in 2021 Occhioni is proposing an educational experience focused on topics related to environmental sustainability within the "Sustainability Hub", a virtual world developed for the

exploration of geographical resurgences in relation to climate change, indicators of sustainable development and circular economy.

In 2023 Mosa et al., have developed a learning model within virtual worlds based on Debate. Although the Debate is a methodology designed for presence, it takes on the characteristics of a reality task when it leaves the classroom context. And considering that it is not always easy for students to deal with realities external to their own, conducting the debate within an immersive, non-dispersive or disorienting environment proved to be a clear context of use in which to bring out the potential of individuals.

In parallel, the study conducted by Filippone et al. (2023) made it possible to evaluate how cooperative learning within virtual worlds for the study of the topics included in the science curriculum of lower secondary school, promoted positive interdependence between students, peers and tutoring and enhanced the role of the teacher as a guide for learning in a motivating context and co-builder of knowledge.

In the latter case, the teaching experiences were also conducted in English, using the CLIL (Content Language Integrated Learning) methodology. This leads to reflection on how the methodology and didactic innovation of learning in virtual worlds can also affect the humanistic disciplines, in particular the study of foreign languages. This last aspect is particularly interesting because to learn language skills, students need frequent practice, especially to enhance conversation and speaking Rossi et al., 2023). The real context certainly favors this type of exercise, the effectiveness of which can be amplified within the virtual world which therefore becomes a place highly predisposed to sharing and cooperation by students even from different countries.

The experiences described are linked by the fact that the learning context of virtual worlds offers direct integration of students with the contents and offers the possibility of experiencing a more engaging and effective "learning by doing", on the one hand making knowledge more accessible and on the other, encouraging social aggregation. In this way, the teaching experience becomes a precious opportunity for teachers who are able to identify innovative solutions in these learning environments to make students perceive truly effective learning.

Learning in virtual worlds is configured as fully active teaching, that conveys a plurality of methodologies, including hybrid learning, computational thinking, experiential learning, the teaching of multiliteracies and debate, gamification, and represents an important hub in educational planning work whose aim is to

transform the classroom into an ecosystem of interaction, sharing and cooperation with a view to improving teaching action and learning outcomes (Buccini, 2023).

The point of contact between the educational experiences presented lies in the fact that virtual worlds can be personalized and adapted to everyone's individual needs, thus promoting a great opportunity for people with disabilities. In fact, the reflection that arises regarding the prospects of personalized learning in virtual worlds in reference to different learning styles appears to be important, as the single individual becomes able to interact with the virtual context by enjoying contents that would otherwise not be accessible in the real context.

Learning in virtual worlds therefore becomes a valid tool to support teaching and special pedagogy, configuring itself as a meeting place for diversity and valorisation of uniqueness, with a view to social inclusion.

Conclusions

Understanding the needs of one's own reality is the daily challenge that schools are called upon to undertake in a fragmented social context characterized by continuous changes that tend to disperse educational attention on different fronts.

The learning-teaching process, therefore, today must necessarily be centered on the student, who needs to find a coherent and credible position within a space that is redesigned daily in order to encourage meaningful learning.

Designing flexible learning environments that are adaptable to different contexts facilitates this new educational process, making the new education scenarios inclusive and encouraging the acquisition of transversal skills useful for orienting oneself in an increasingly international panorama.

Virtual learning environments, and more specifically virtual worlds, effectively combine these demanding demands that today's society imposes, encouraging the personalization of learning, the valorization of uniqueness while respecting differences, from an inclusive perspective.

Based on the reflection made in this article, virtual worlds can be configured as outdoor learning environments, in which each individual can experience himself in

his uniqueness, identifying himself in a space different from the real one with a body increasingly in line with the most depth of one's person.

From this perspective, virtual worlds represent an important innovation in the field of teaching, not only in STEM disciplines, but in all learning contexts, offering added value to the inclusive methodologies of teaching and special pedagogy.

Real world and virtual world constitute two sides of learning. In the first case, learning is based on a classic system characterized by face-to-face relationships, by the use of paper or digital books, by writing on sheets of paper or on static devices and by a teaching method which, although pervaded by new methodologies, is characterized by physical presence in a specific place. In the second case, that of virtual worlds, learning is based on a new system that is placed in a dimension (the metaverse) that expresses itself outside the walls of reality, in a social sharing that breaks down time and space, which promotes communication in ever new, renewable, customizable, and usable spaces without physical presence.

Although the studies present in the scientific literature, and the experiences reported in them, also highlight numerous negative aspects linked to the use of the metaverse in teaching, leading to it and its unbalanced use, possible phenomena of lack of adherence to reality and alienation from the real context, with negative repercussions on the social aspect (Manfredi and Gabbiadini), learning in virtual worlds constitutes one of the greatest challenges that innovation in teaching is called upon to face today.

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