Mar Camacho
Vanessa Esteve-González

3.1 MOVING BEYOND LEARNING: THE POTENTIAL OF IMMERSIVE ENVIRONMENTS IN EDUCATION

1. BACKGROUND

At a time when our educational system is constantly questioned for being disconnected from the real world, authentic experiences that can lead students to real academic achievement are becoming increasingly necessary. The affordances of virtual worlds as tools that connect students to the real world through technology are manyfold and go beyond authentic learning. Virtual worlds not only make it possible for students to practice, play and be creative but also enable many different learning styles, with opportunities for "just in time" learning. It is in this context that this technology needs to be leveraged in ways that enable students to become autonomous and aware of learning outcomes, fundamental if they are to be lifelong learners. Virtual worlds are changing the way information is accessed and experienced and the way information is communicated and learned. Although few experiences in higher education contexts have explored in any great depth the potential of virtual worlds in education, good practices –which will probably be the key to future innovation within educational institutions– need to be spread.

The aim of this article is to provide an overview of the potential of virtual worlds and metaverses in education, paying special attention to their pedagogical affordances. For this reason there is an extended review of concepts and terminology, which may sometimes be confusing, and a broad overview of the key points for effective practice.

2. AN INTRODUCTION TO THE USE OF IMMERSIVE ENVIRONMENTS

Three-dimensional environments are natural environments for students. Most of the games that they use in their leisure time use this technology and are known as massively multiplayer online role-playing games (MMORPG). They are a genre of role-playing video games in which a very large number of players interact with one another within a virtual game world. These should not be confused with MUVEs, which are online, multi-user virtual environments, sometimes called virtual worlds. MUVEs provide students with the opportunity to participate in interactive educational experiences at different stages of the physical classroom. These spaces

allow students to "be together at the same time and the same place," so that they can interact with each other. They tend to use 3D technology, both hardware and software, such as virtual reality, allowing users to have unique experiences, the virtual reality systems ranging from immersive systems in large spaces where the user physically goes Avatar immersive systems to desktop and persistent virtual worlds where users socialize and the user manipulates the avatar with devices input from the computer. With the development of learning technologies, students can communicate synchronously and asynchronously with other participants.

2.1. 3D virtual worlds and metaverses

Typically, virtual worlds are also known as metaverses, a concept taken from the Sci-fi novel "Snow Crash", written by Neil Stephenson in 1992. Although these terms are not exactly synonymous and there is still considerable debate in the literature, we shall agree with Castronova (2005) and assume that they can be used interchangeably.

Virtual worlds are the simulation of a space, a representation in three dimensions of geographic features and cities, and the digital simulation of real surroundings. Second Life (SL) is a 3D environment that allows users to interact through a representation known as an avatar. Their main characteristics are that they are simple to use, they provide a series of collaborative facilities and they have attractive 3D features. All in all, their new and highly immersive sensation have made virtual worlds interesting scenarios in which to test innovative educational environments or to apply new data mining techniques. Participants in a successful virtual world have a deep sense of presence in that world.

The metaverse is a more complex concept. In recent years, the term has grown beyond Stephenson's 1992 vision of an immersive 3D virtual world to include aspects of physical world objects, actors, interfaces, and networks that construct and interact with virtual environments.

Between 2007 and 2008, the Acceleration Studies Foundation (ASF) − a US-based nonprofit organization with an international advisory panel - and partners explored the virtual and 3D future of the World Wide Web in a first-of-its-kind cross-industry public foresight project: the Metaverse Roadmap (MVR).

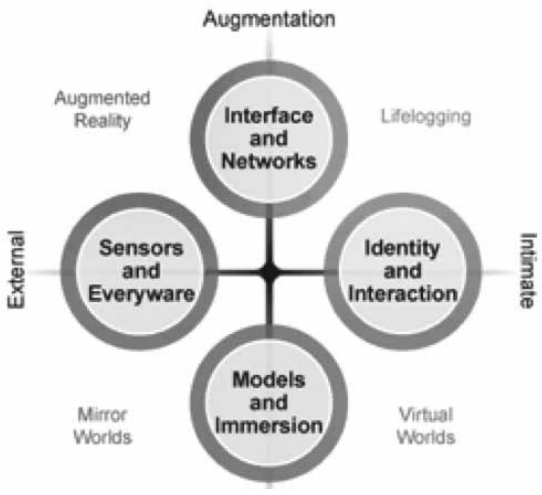

Figure 1. The Metaverse Roadmap (Smart, Cascio and Paffendorf, 2007)

The most important message given by this figure is the four scenarios, which emphasize different functions, types or sets of metaverse technologies:

- Lifelog. A digitally stored and electronically accessible record of various aspects of the experience history (GPS, time, and audio, visual, etc.) of physical objects (an object lifelog; Bruce Sterling "spimes"), or of human users (a user lifelog).
- Virtual worlds. A digital version of narratives set in "other realities" – these first existed in text form through text-based games and have evolved in many ways. Virtual world-based games are goal-oriented and take place within limitations of the rules of the game. Social-focused virtual worlds provide various levels of freedom in terms of avatar (the digital representation of a participant) customisation and the ability to build and/or create.
- Mirror world. A literal representation of the real world in digital form. It attempts to map (or mirror) real-world structures, like geography, or the stock market, in 2D or 3D form. GIS systems are often 2D mirror worlds. Google Earth is an example of a 3D mirror world.

As far as the typology of metaverses and virtual worlds is concerned, and from the standpoint of learning processes, the 3D training space is close to the constructs of what is called Web 2.0. In particular, Second Life (SL) can be analysed from the perspective of a "theatrical metaphor" that develops (Tu, Blocher & Roberts, 2008) from the four dimensions in this approach. The main contributions of SL can be analysed from the standpoint of the training process:

- Cognitive / scripts: We need to structure the training process so that SL can help students develop meaningful learning processes immediately and in a social way. Not only students have an identity and a role; teachers do, too.
- Social / actors: The avatars allow us to help students define their digital identity and assume a role within the world of SL. Teachers must also create their digital identity and assume the corresponding role in this world that represents the training environment (Dwyer, Hiltz & Passerini, 2007; Tu et al., 2008). In the same way, standards of operation and patterns of behaviour must be created in order to ensure the success of the teaching-learning process.
- Networking / stages: The same communication tools that SL offers help create a climate that is suitable for communication at a time that will implement the various roles that the actors (avatars) have taken during this training process and in this 3D environment (Boyd & Ellison, 2007, Jin, 2010).
- Integration / acting: The educational process is basically a communication process that takes place in a social environment. For this reason the 2.0 tools, including SL, have such potential in terms of promoting the learning process. "Social acts that bring out identities, awareness, relationships, connections and interactions among and between learners are necessary for interactive learning" (Thomanssen & Rive, 2010). Finally, the principles of social networks will be used to design and develop space for university education.

Professor Edward Castronova affirms (2001; 2005) that virtual worlds are 3-dimensional, digital environments in which a great number of people interact with one another by means of an avatar - a digital representation of self (Castronova, 2003). Therefore, the founding features of virtual worlds are:

- **Interactivity**: they exist on one computer but can be accessed remotely (i.e. by an Internet connection) and simultaneously by a large number of people, in such a way that the command inputs of one person affect the command results of others.
- **Physicality**: people access the program through an interface that simulates a first-person physical environment on their computer screen. The environment is generally ruled by the natural laws of Earth and is characterized by a scarcity of resources.
- **Persistence**: the program continues to run whether anyone is using it or not. It remembers the location of people and things, as well as the ownership of objects.

3. GOING BEYOND THE LEARNING EXPERIENCE: WHY VIRTUAL WORLDS MATTER?

The use of metaverses for learning can change not just what is learnt but, significantly, how we learn. It is for this reason that it is important to consider all the implications of integrating them into learning processes and to observe all the possible drawbacks and pitfalls of this integration.

Virtual worlds can be used to create very effective learning spaces. Since they are generalized rather than contextual, they can reach all disciplines. The social aspects of virtual worlds are extremely relevant to education. They lend themselves to role playing and scenario building, allowing learners to temporarily assume responsibilities without incurring real-world consequences. Businesses and universities have recognised the learning possibilities available in metaverses and 3D virtual worlds as spaces that offer both freedom and playfulness to create and collaborate while learning.

Metaverses and 3D worlds in education: traits and achievements

Virtual worlds

- provide a unique training and knowledge sharing environment,
- expand the understanding of both cultural and social experience,
- provide great opportunities for group interaction and allow meta reflection to support activities and achieve learning outcomes,
- enhance collaboration and communicative skills,
- allow learners to transfer learning from a learning context to a real life context more readily,
- encourage learners to gain experience working in flat organisational structures,
- develop students' ability to build networks and communities of practice,
- promote problem-solving and negotiating skills,
- help learners become goal-oriented, envisage outcomes and work towards them,
- generate the ability to produce knowledge,
- promote learning through simulations and role-playing,
- support creativity, exploration and the development of identity through open ways of learning,
- develop skills and experience in understanding other cultures and people,
- offer unique possibilities for expression.

4. FRAMEWORKS FOR SELECTING AND USING METAVERSES AND 3D WORLDS IN PRACTICE

The design, development and use of metaverses and immersive environments in education are closely interwoven. These interactive technologies, which are becoming more participatory, also affect the way in which learning activities are designed, developed and used in practice, and the whole process of learning. In order to ensure that activity theory and pedagogical approaches are suitably mapped it is important to analyse the frameworks and approaches that have been developed to suport the design and study of learning in metaverses and immersive worlds. Our starting point is the framework model for practitioners provided by Freitas and Oliver (2006) which picks up four generic principles: context, mode of representation, pedagogical approach and learner specification. This framework could become a starting point for practitioners who wish to start using metaverses and virtual worlds in their learning practices:

Context: the context of the metaverse is crucial to how effectively it is used. Contextual factors include where the metaverse is used, the technical support that is needed, the requirements, etc.

Pedagogical model: According to Mayes and Freitas (2004, 2006) learning processes are supported by associative (instructivist and often task-centred), cognitive (constructivist) and situated (learning in communities of practice) models of learning. The pedagogical model is particularly important since simulation or gaming are not learning experiences in themselves; rather they are integrated within a set of activities or processes according to the approach selected. In this regard, the role of debriefing is central to immersive worlds when used to pursue educational objectives through discussion, reflection, etc.

Learner specification: integrates aspects such as age, stage, learning needs, level of digital literacy, etc.

Representation: Young learners are acquiring high levels of immersion and interactivity in virtual worlds. The representation is the level of immersion and familiarity of interface with the learning group and the world which has multiple effects upon learning.

5. METAVERSES AND 3D VIRTUAL WORLDS IN THE CLASSROOM: SOME KEY POINTS FOR EFFECTIVE PRACTICE

Simulations and virtual worlds engage students in high-level cognitive thinking such as interpreting, analyzing, discovering, evaluating and above all problem solving. According to De Freitas (2006), a number of key points can be of help to educators, practitioners and other stakeholders when they implement their experiences using metaverses and 3D virtual worlds. They must

- ensure learning objectives are aligned with the metaverses, 3D virtual worlds and assessment so that learning can be most effective.

- ensure that the learning activities that take place within the metaverse are integrated with face-to-face learning.
- provide opportunities for reflection by means of dialogue and discussion.
- place aspects of learning within immersive environments so that learners can control them and engage with them.
- consider the level of immersion as part of the learning design so that learning is most effective.
- design role plays that allow students to empathise with and reflect upon situations from real life.
- develop realistic scenarios that allow transfer from rehearsal to real life contexts.
- align assessment with learning activities so that they are effective.
- ntroduce a feedback loop into learning activities so that learning remains effective.

6. CONCLUSION

Metaverses and 3D virtual worlds are increasingly being used in education and training to create authentic learning experiences that are immersive, authentic and media rich. In particular, they provide opportunities to structure remote learning in engaging ways and are fast becoming part of the learning landscape in general. While there is growing interest among practitioners and researchers in the training and knowledge sharing potential of these unique learning environments, current virtual world technologies offer a range of capabilities that need to be further developed. Higher education institutions need to see the potentialities of these technologies and integrate them in their day-to-day teaching and learning practices.

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AUTHORS

Mar Camacho. *Department of Pedagogy. Rovira i Virgili University. Tarragona, Spain. Email: mar.camacho@urv.cat*

Vanessa Esteve-González. *Department of Pedagogy. Rovira i Virgili University. Tarragona, Spain. Email: Vanessa.esteve@urv.cat*