Journal of Inclusive Methodology and Technology in Learning and Teaching
ISSN 2785-5104
Anno3 n.2 (2023)

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

TEACHING IN THE LAB THROUGH VIRTUAL REALITY

APPRENDERE IN LABORATORIO TRAMITE LA REALTÀ VIRTUALE

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Abstract

This contribution proposes a reflection on a virtual training experience carried out in a university through the use of 3D viewers. The project arose in response to the need posed by the pandemic period to reduce interaction and the use of tools. Hence, the idea of experimenting with laboratory didactics through virtual reality. The research group started to reflect on the experience, trying to systematize an interpretative view that overcomes certain classical antimonies (real/virtual; concrete world and imaginary world). What emerges is an interpretative matrix that is still in progress and is intended to serve as a key for identifying possible lines of didactic action, beyond forcing positions in the given categories. Without claiming to be a systematic review, the work aims to offer starting point for reflection a more integrated view of the use of virtual reality in education.

Questo contributo propone una riflessione su un'esperienza di formazione virtuale realizzata in un'università attraverso l'uso di visori 3D. Il progetto è nato in risposta alla necessità, posta dal periodo pandemico, di ridurre l'interazione e l'uso di strumenti. Da qui l'idea di sperimentare la didattica laboratoriale attraverso la realtà virtuale. Il gruppo di ricerca ha iniziato a riflettere sull'esperienza, cercando di sistematizzare una visione interpretativa che superasse alcune classiche antinomie (reale/virtuale; mondo concreto e mondo immaginario). Ne è emersa una matrice interpretativa ancora in fieri, che vuole essere una chiave di lettura per individuare possibili linee di azione didattica, al di là delle posizioni forzate nelle categorie date. Senza pretendere di essere una rassegna sistematica, il lavoro vuole offrire spunti di riflessione per una visione più integrata dell'uso della realtà virtuale in ambito educativo.

Keywords

virtual reality; laboratory; experience learning; covid19.
realtà virtuale; laboratorio; apprendimento esperienziale; covid19.

1. Introduction

During 2020, students in the Biotechnology and Biology degree program were like everyone else in Lockdown, but unlike many other students, numerous hours of required training in their curriculum had to take place in the laboratory through hands-on analysis and experimentation.

This learning space certainly could not simply be explained through a few online lectures. In addition, several secondary schools were supposed to have their students do an internship period in the university's biotechnology laboratories, and even then, working in laboratories was definitely forbidden.

Online teaching experiences pioneered by secondary schools had relegated students primarily to a passive role. The student was like a spectator of a movie, projected from the PC monitor. Lab teachers at the university with secondary school teachers began to hypothesize the possibility of conducting lab lessons through virtuality reality through a collaboration with a start-up company that was already producing VR-related software.

The question that guided the research and training activity was: can virtuality reality be an experience that is not simply a substitute or merely metaphorical for in-presence activity? Furthermore, can it become a learning context complementary to presence and with its own specificity in learning processes?

2. Theoretical framework of reference

Everyday school life activates meaningful learning when it becomes a "conscious practice, supported by one's own intentions and «continuous reflection based on the perception of internal and external constraints and resources» (Jonassen and Land, 2000). These reflections by Jonassen and Land highlighted, as early as two decades ago, that learning requires a high level of involvement on the part of the learner to interact with the issues to be addressed and the resources in the context. A constructive, rather than replicative, attitude is important in order to generate one's own knowledge through a circularity between experience and reflection. It is possible to make the student active through the support of the teacher who proposes sense-making and reality-related learning experiences that require interest and effort.

According to Dewey, educating through the encounter with experience means leading the learner to critical and reflective thinking, which for the author is a priority for the growth of the person. It means educating to explore reality, to recognize it as problematic, to investigate it in depth, using specific operating procedures that take on regulatory value. The involvement of the affective and emotional dimension of learning already emerges from Goleman's studies on emotional intelligence (2011) and Gardner's multiple intelligence (2013). According to authors, is possible to learn

emotional competence, understood not so much as the repression of emotions, but as the management of emotions in order to integrate them better into everyday decisions and behaviour. Increasing the awareness of one's emotions and knowing how to govern them, instead of repressing them, is, according to D. Goleman, the way to achieve a state of personal and social well-being. A further contribution, even more radical and based on neuro-scientific research is that of Immordino-Yang, in the line of research initiated by A. Damasio. The researcher states that the distinction between rational thought and the emotional dimension is a myth rather than a reality. The authors state that the role of emotions in directing behaviour and rational thinking has been underestimated for too long. Cognitive capacities are not disembodied rational systems, they are closely intertwined with emotional and socio-cultural functions.

Through this pedagogical framework that emphasises (a) the agency's students, (b) a research and discovery process connected with reality, and finally (c) the intertwining of the emotional and rational planes, we began to reflect on what characteristics the virtual reality should have to propose to the students.

3. Training Experience with Virtual Reality

The working group investigated and analysed various learning experiences through virtual reality. This research identified a few factors that are consistent with the premises previously stated in the framework.

The first didactic driver that the project team identified to support a didactic proposal centred on Virtual Reality is immersivity. This learning dynamic already emerged in the early 2000s, in the work of Carenzio (2006; 2008; 2011) on Media Education. The experience of immersion in the enjoyment of media represents a process of involvement, of encounter between emotional and cognitive dimensions that favours a deep rootedness of knowledge, a holistic experience of learning. Immersion, beyond a specific context, allows the student to carry out "a flow experience" (Csikszentmihalyi 2011), that experience that strengthens motivation, through the modification of the perception of time passing. The student is immersed in an experience in which the perception of time changes, as is often repeated in interviews "time flew by", signifying the pleasantness and depth of the experience.

A second didactic driver identified by the project team to support a didactic proposal centred on Virtual Reality is the value of the mistake. In the traditional scholastic experience, particularly in the Italian context, mistake is seen as deviation from an expected standard, which generates a judgement. The greater the errors, the worse the judgement. Castoldi (2016) and Grion, Serbati, Cecchinato (2022) well highlight the limitation of considering mistake only as a factor for certification or summative assessment. What we wish to highlight here is the importance of the

mistake as a key factor for learning, an opportunity to develop self-regulation competence, to understand the complexity of possible solutions, to open up to a co-constructive approach to knowledge. Virtual reality reinforces this opportunity, without the problems of waste and time, having the possibility to replicate the learning process countless times, learning from mistakes, performing a simulation that adheres to reality.

The last driver that the project team identified is the playful dimension. Learning through Virtual Reality makes possible an experience that is very close to the playful experience lived by young people through the use of technology.

The playful experience creates an interconnection between cognitive and emotional, involves a physical movement and on many occasions takes place in a social dimension. Learning in Virtual Reality can embrace these principles, increasing the motivation of students and supporting the maintenance of learning effort even in the most challenging phases.

In light of these considerations, the project team opted for a Virtual Reality experience through the use of visors capable of capturing hand movement. The students experience the educational laboratories in a totally immersive way through the use of visors. Once they put on the visor, they are immediately immersed in the virtual laboratory where they can choose the desired protocol to implement. Furthermore, the technology recognises the student's hands and represents them in the virtual world. There is therefore no need to use controllers. Professors can track student activities, evaluate different types of student performance data and visualise them via a web-based control panel. Furthermore, since VR can represent biological molecules and processes in 3D, students can better understand and learn biology using a process similar to a video game. The advantage of using VR becomes even more important in this pandemic period caused by COVID-19, which forces social distancing. Thanks to VR, students can learn to perform various laboratory techniques even without actually using the instrumentation. Other advantages of VR are that a) costs for expensive laboratory reagents and instruments can be reduced and b) mistakes can be made without waste. The purchase of reagents and instruments normally used for laboratory activities can be significantly reduced in this way, and the student can learn from mistakes without being afraid of creating damage in reality.

In the light of this experience, the Department of Medicine has also decided to launch an experiment to train students of the CdL in Medicine and Surgery through virtual reality. In particular, some specific visors and a 360° camera have been purchased to prepare augmented and virtual reality experiences also in medical training.

4. Reflection on experience

The training experience carried out in the laboratory context with the use of visors allowed us to reflect on some variables that can interpret a new relationship between traditional and online training.

Our reflection starts from Rivoltella's (2003) proposal in which the online learning experience does not position itself in an 'other world' but, going beyond the geographical paradigm, opts for a pragmatic paradigm in which it is the type of interactions that are characterised by a different pattern.

The analysis aimed to overcome the classic distinction between reality and virtuality as it occurs in the everyday experiences of the new generations. An initial attempt to categorise possible teaching and learning experiences between offline and online emerges from a previous experiment concerning the use of the blog as a reflective and narrative process on the internship experience (Bonometti, 2017).

Drafting current framework is based on two variables that intersect to define in an ideal-typical way four possible learning settings.

The first variable identifies at the extremes of a continuum, on the one hand, physicality, understood as bodily experience in a context of concreteness; on the other hand, virtuality, understood as an experiential environment in which one progressively distances oneself from a physical environment of reference.

The second variable places at the extremes of the continuum, on the one hand, reality understood as being present to oneself in relation to others and to a context; on the other hand, the dimension defined philosophically as 'phantasmagorical', i.e. the conception according to which (in both psychological and gneoseological terms) what is perceived is nothing but the phantasm, precisely, of reality. A moving, projected shadow that is deformed and has lost the appearance of reality, just as in Plato's myth of the cave.

The outlined quadrants can thus be outlined as follows (see Fig.1).

Reality

	Training experiences based in a traditional context. Cultural-historical dimension embedded in the context. Relationship embedded in a condition of physicality. Value of the artefact fixed in a concrete reality. The experience of the relationship in its physical nature 1	Training experiences based on augmented and virtual reality. Real experience of something that is not always possible to do in reality. Greater perception of reality than theoretical explanation Possibility to replicate, archive, review. Possibility of making mistakes 2	
Physicality	4 Experiences of dissociated experience. Dissociation of the physical dimension from that of concrete reality: a kind of illusory, even hallucinatory experience. Unawareness of perceptual filters, a bubble filtering meaning and sense-making regarding reality. Lack of awareness of the context/meta-context.	3 Stand-alone experiences distanced from concrete reality. A virtual environment without the 'weight' of concreteness experienced individually or in groups. Dematerialisation of reality Digitisation of the experience of reality and loss of the potential of control. Transformative approach of reality. Configuration of perceptions and patterns of meaning that define a new reality.	**Virtuality**

Illusory/Phantasma

Fig. 1: Matrix of learning experiences between real and virtual

Box 1 describes a traditional learning setting in which reality and physicality are intertwined. These are contexts in which the sense-making of reality is incorporated with the surroundings and the person physically experiences the context. This dynamic emerges from the classic training classroom, from a laboratory any physical context in which learning activity takes place

Box 2 represents a learning dynamic in which learners experience the learning of knowledge and skills in a real but not necessarily physical setting. The activities proposed are analogical to reality, the actions experienced are the same as those required in physical contexts. The level of reality is high even though the context is virtual. This dimension reinforces the possibility of learning from mistakes, of experimenting several times, of having a stronger sense-making than in a simple theoretical lesson in a traditional classroom.

Box 3 represents what is currently associated with the metaverse, a dimension "other" than the physicality of reality. Experiences that can be fostered in this dimension can have a consistency of their own, a high degree of distancing from physical reality, less possibility of controlling events, and a transformative approach to reality. More than a simulation, it is a configuration of another reality, with different criteria and relational and behavioral patterns In this dimension, it is also possible to glimpse distorted life experiences, which we can now call phantasmagorical or rather aligned to experiential models that are not yet configured and aligned to the known physical reality.

Box 4 logically represents a dissociated concrete life experience, in other words, the experience perceived by the person is dissociated from the concreteness of the context perceived by others. A level of illusion is possible due to perceptual and cognitive filters that do not allow a correct and real perception of the concreteness of reality. Having an experience with the perception of being in one context when you are actually in another. In other words, it can be described as acting according to perceptual filters linked to a social network within a physical context governed by different criteria and rules.

The matrix is a systematisation effort that attempts to identify criteria according to which the learning experiences intertwined with the online world can be declined.

6. Conclusion

Our social experiences are increasingly generated in a web of communications, relationships, emotions that find their consistency in the border space between the virtual and the physical world. What we have tried to articulate is how the dimension of reality is as much a feature of the physical world as of the virtual one, and the

educational experience must be able to choose teaching strategies on the basis of the efficacy of the proposal and consistency with the context.

Current questions and worries about the metaverse open up a very broad, articulated and interdisciplinary field of reflection. If, on the one hand, in the Covid and post-Covid era, multiple problems relating to an excessive use of social technologies have become apparent, on the other hand, it is necessary to understand the evolutionary and constructive aspects of these new lines of innovation. In this transitional phase, the educational world needs to understand and experiment with technological innovations, it needs to be in permanent dialogue with ICT and the evolution of platforms, to introduce learning experiences into teaching that overcome traditional stereotypes in favour of a multidimensional approach.

Otherwise, the world of school and university runs the risk of becoming a self-referential space, distant from reality, in which young people live for a few hours an experience anchored in the past and then return to their living world immersed in technology.

It is therefore necessary for the education system to be able to promote multi-level and cross-media learning experiences. This requires in-depth training and support for new and current teachers both to learn new technical skills and to develop a new cultural profile of the teacher. A teacher able to find an integration between the world of disciplinary knowledge and the current trends of change and innovation.

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