A EDUCAÇÃO ENQUANTO FENÔMENO SOCIAL:

Gestão e práticas pedagógicas

Américo Junior Nunes da Silva
(Organizador)

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A educação enquanto fenômeno social: gestão e práticas pedagógicas

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APRESENTAÇÃO

Diante do atual cenário educacional brasileiro, resultado de constantes ataques deferidos ao longo da história, faz-se pertinente colocar no centro da discussão as diferentes questões educacionais, valorizando formas particulares de fazer ciência e buscando superar problemas estruturais, como a desigualdade social por exemplo. Direcionar e ampliar o olhar em busca de soluções para os inúmeros problemas postos pela contemporaneidade é um desafio, aceito por muitos professores/as pesquisadores/as.

A área de Humanas e, sobretudo, a Educação, vem sofrendo destrato constante nos últimos anos, principalmente no que tange ao valorizar a sua produção científica. O cenário político de descuido e destrato com as questões educacionais, vivenciado recentemente e agravado com a pandemia, nos alerta para a necessidade de criação de espaços de resistência. Este livro, intitulado "**A Educação enquanto fenômeno social: Gestão e práticas pedagógicas**", da forma como se organiza, é um desses lugares: permite-se ouvir, de diferentes formas, os diferentes sujeitos que fazem parte dos movimentos educacionais.

É importante que as inúmeras problemáticas que circunscrevem a Educação, historicamente, sejam postas e discutidas. Precisamos nos permitir ser ouvidos e a criação de canais de comunicação, como este livro, aproxima a comunidade das diversas ações que são vivenciadas no interior da escola e da universidade. Portanto, os inúmeros capítulos que compõem este livro tornam-se um espaço oportuno de discussão e (re)pensar do campo educacional, considerando os diversos elementos e fatores que o intercruza.

Neste livro, portanto, reúnem-se trabalhos de pesquisa e experiências em diversos espaços, com o intuito de promover um amplo debate acerca das diversas problemáticas que permeiam o contexto educacional, tendo a Educação enquanto fenômeno social importante para o fortalecimento da democracia e superação das desigualdades sociais.

Os/As autores/as que constroem essa obra são estudantes, professores/as pesquisadores/as, especialistas, mestres/as ou doutores/as e que, muitos/as, partindo de sua práxis, buscam novos olhares a problemáticas cotidianas que os mobilizam. Esse movimento de socializar uma pesquisa ou experiência cria um movimento pendular que, pela mobilização dos/as autores/as e discussões por eles/as empreendidas, mobilizam-se também os/as leitores/as e os/as incentivam a reinventarem os seus fazeres pedagógicos e, consequentemente, a educação brasileira. Nessa direção, portanto, desejamos a todos e a todas uma provocativa leitura!

Américo Junior Nunes da Silva

SUMÁRIO

CAPÍTULO 7

USES AND APPLICATIONS OF VIRTUAL REALITY IN EDUCATION

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ABSTRACT: The effective preparation of students to face the working world is a very complex task, especially because of the practical part that is required for this, since it is necessary that the student must not only learn theoretical concepts, but also concepts whose learning is reinforced through practice, which for educational institutions is very costly in material terms or risky in human terms, since sometimes they do not have enough laboratories or they do not have the necessary equipment and supplies, This problem also occurs when students are expected to learn from real industrial situations, since the possible demands that a company would face if a student were to have an accident during an industrial visit, together with the high costs and logistics necessary to carry out this activity, make many of the efforts made by university personnel and industrial plant administrators to provide sufficient practical experience within their facilities unsuccessful. In order to solve this problem, for more than a decade, educational institutions have been using an innovative technology derived from ICT, Virtual Reality, whose applications in the school environment are the focus of this article. This technology allows to involve students in a multisensory way, immersing them in a virtual environment created by computer, where they can experiment, choose, make decisions and initiatives, fail and try again, as many times as necessary, until they develop the necessary skills and abilities that allow them to learn how to act and react in real work situations, as well as to react to accidents, fortuitous events or malfunctions.

KEYWORDS: Student training, Virtual Reality, Education.

1 | INTRODUCTION

Virtual Reality is a technology that has had a great acceptance in the educational field in the last decade worldwide, partly due to the technological convergence that has occurred in the field of ICT which has allowed not only a decrease in hardware and software costs, but also a greater power in the acquisition, processing and reproduction of information, which has made this technology a very useful tool in many and very diverse scenarios, among which stands out the teaching-learning, where there have been very encouraging results of its application, mainly in those situations where traditional teaching methods have failed to adequately convey the topics with the expected

success, such as, for example, the case of teaching complex scientific concepts or abstract character, or when these represent a risk to students as would be the case of a visit to an industrial plant, or when performing an experiment involving the handling of hazardous or toxic substances [1].

2 | DEVELOPMENT

This paper develops a descriptive analytical study, which was carried out through an exhaustive review of various indexed documentary sources and other sources of a recognized scientific level, also including several scientific articles related to the main topic, which served as a basis for developing this research and whose results are shown below.

2.1 Definition of Virtual Reality

There are multiple and very diverse definitions of the term Virtual Reality (VR), interpreting it in different cases as a combination of three perspectives: philosophical, psychological and technological [2]. From the philosophical perspective, VR is considered as the area of possible interaction that a subject has with the simulation; from the technological perspective, VR has to do with computer technologies and the interactions that occur with it and finally from the psychological perspective, VR is understood as the artificial modification of reality and how subjects behave within that modification. Some authors affirm that virtual reality is the harmonic interaction of these three perspectives (Figure 1), but for the case of this article, only the technological and psychological perspectives of VR are considered, and the philosophical perspective is left for other future studies.

Figure 1. The construct of Virtual Reality [3]

The definition taken as a basis in this work considers VR to be the *computer simulation of a real or imaginary system that allows a user to interact within the simulated system by displaying the effects in real time*. Islande (cited by Fällman et al. [4]), states that there are also terms such as synthetic environment, cyberspace, artificial reality, simulation technology, which have been adopted as synonyms of the term VR due to the large number

of uses that this technology has had, uses that are increasing day by day because currently the costs of implementing this technology have dropped, coupled with the simplicity of its method, the ease of use and the advantages of solving problems that previously required complicated and expensive specialized equipment to display synthetic simulations with simplicity. Table 1 shows an evolution of the concept of VR and its main characteristics, given by various authors:

Year	Author	Characteristics	Objetive
1989	Lanier (cited by Steuer, [5])	Three-dimensional realities implemented with stereoscopic vision, glasses and gloves.	Users can interact with the environment
1992	Coats (cited by Steuer, [5])	Electronic simulations of environments, experienced through a data suit, glasses and fiber optic gloves.	Enable the end user to interact in realistic three-dimensional situations.
1992	Greenbaum (cited by Steuer, [5])	Alternative world full of computer-generated images computer-generated images that respond to human movements.	Allow the user to visit them, through expensive equipment such as a suit, video glasses, stereo sound and fiber optic data gloves. stereo sound and fiber optic data gloves.
1997	Bell & Floger [6]	Computer simulations, three-dimensional graphics, immersion and interaction	Computer simulations, three-dimensional graphics, immersion and interaction
1999	Keppell et al. (citado por Fallman et al. [4])	Immersive computer-generated environments.	Stimulate the user's mind to use their knowledge in a similar way as they would in reality. similar to what they would do in reality.
2000	Warwick (cited by Sulbaran & Baker [7])	Computer-generated interactive three-dimensional environment.	Modeling the real world or an imaginary world to transmit sensory signals, relating them in some way to their meaning.
2005	Manseur [8]	Computational methods and tools.	Generate virtual objects and scenarios that simulate real systems and landscapes
2006	Burdea & Stanney (citados por Tijou et al. [9])	Computer-generated environment, 3D graphic world, including stereoscopy, acoustics, tactile sensations, and even smell and taste. even smell and taste.	Allow to create immersive sensations.
2008	Pan et al. (cited by Lee & Wong [10])	Highly interactive, computer-generated 3D program in a multimedia environment that provides the effect of immersion.	Allow participation within abstract spaces with real-world objects (e.g., chemical molecules or geometric models), or processes (e.g., population growth or biological development).
2009	Cruz-Neira (citada por Ou et al. [11])	Virtual environment created through specialized hardware and software, which in some cases is combined with the user.	Simulate the real world, being able to exchange thoughts and actions with other users and objects within the environment.

2012	Xia (cited by Wusha et al., [12])	Immersion, interaction and imagination, through high-tech peripherals and software. software.	Enjoy multiple, real-time perceptions of human-computer interaction, just as in the real world. world.
2013	Anissimov (cited by Zhu [13])	Computer-generated models provide visual, auditory, tactile sensations and in recent times stimulate other senses.	To provide users with immersive sensations that make them feel that they are really inside the virtual world.
2013	Rusell (cited by Zhu [13])	Integration of technologies such as computer graphics, visualization, parallel processing, and high parallel processing and high-tech simulation systems. simulation systems.	Achieve real, hands-on experience and natural human-computer interaction. It includes physical simulation and reality.
2013	Kenneth (cited by Zhu [13])	Integration of human-machine interaction technologies, with tactile, visual and auditory behaviors.	To obtain the maximum results from the techniques and methods related to the perception and perception and operation capacity of the human being.
2013	Zhao (cited by Zhu [13])	Immersion, interaction, ideas, actions and autonomy,	Allow users to appreciate sounds, movements, smells and tastes, just like in the real world.

Table 1. Characteristics and objectives of VR over time

(Own Elaboration)

2.2 Virtual Reality in education

The first practical use identified of a VR application in education occurred in 1993 and it was through a prototype of an applied physics laboratory. By 1998, the Institute for Defense Analyses of the United States (IDA) issued a full report on the applications that could be made of this technology in the field of education [14]. Since then, VR has reached such a level of development that it has been considered among the group of innovative technologies applicable to education, training and research [15], offering new opportunities and challenges for the education sector. One of these major challenges was overcome in recent years, when the possibility of multiplying its use and application arose due to the considerable reduction of the high costs associated with its implementation and the technological convergence that has occurred in the field of ICT.

From there, this technology has matured rapidly, offering today an unprecedented avenue for delivering new educational experiences to students of all ages and in all disciplines, since as Professor Bowen of the University of Houston [16] mentions in a comparison of traditional education with that which could be offered through VR, the best that the former could offer students in the classroom or lab, was only the traditional lectures of classical materials from past eras, complemented with little student participation in laboratory experiments and little observation of other regions, cultures and peoples through two-dimensional images provided through photographs or videos, noting also that for centuries, the main medium that had been used in education had been the spoken and

written word, with the limitations that this implied.

Since Bowen's statement in the 1990s, VR has gained much presence as an alternative approach to traditional learning experiences [17], mainly due to the ability of this technology to provide a highly interactive visual environment very similar to the one offered by the real world; allowing students to experience the feeling of being present within the environment with the possibility of interacting with the objects within it. Current research has demonstrated a series of encouraging learning results with the use of VR, showing an improvement mainly in subjects such as science, chemistry, physics and mathematics, among others. To overcome the obstacles presented by the concepts related to these topics, the use of virtual environments offers a very powerful feature: immersion, which takes place within the appropriate context, allowing an interactive experience that is complemented with a representation of the concept beyond the production of mathematical formulations typical in physics courses. For Gordin et al. (Cited by Fällman, Backman & Holmlund 1999), in the academic areas mentioned above, success for a student depends largely on his or her ability to envision and manipulate abstract information. Finding ways to help people to recognize patterns; to qualitatively understand physical processes, to move between different frames of reference and to more easily understand dynamic models that may contain intangible information, should be very important and useful for many educational situations.

As West (cited by Fällman, Backman & Holmlund 1999) points out, the ability to work with abstract and multidimensional information is a crucial skill in today's society, not only in the academic world, but also in a large part of productive environments. Traditional methods of visualization and the actual visualization of models and data, e.g., on the computer screen or in books, is done through two-dimensional diagrams even though they attempt to describe a reality that is by nature three-dimensional. VR allows students not only to visualize these models and data in a more appropriate three-dimensional context, allowing also to interact with them when necessary, observing them from several different points of view, including changing sizes, as well as the perspective from which users experience them [4]. From the above it is clear that a VR system is different from other computer applications, by the fact that it gives the user the feeling of being present in the virtual world and being able to act accordingly, this notion of presence is increased within a Virtual Environment (VE) where VR is used, which has two key components that other technologies do not have, immersion and interaction. In order to be considered as a complete system, an VE applied to education must not only ensure the presence of the user, but must also make something happen without this necessarily being the result of a user action [18]. Consequently, objects in the virtual environment have to evolve having autonomous behaviors. This notion of autonomy is essential for learning as it allows associating the multisensory information of the graphical data with the necessary behavior within the virtual environment.

In a VE, the learner can face variable situations and complex worlds. This variability is doubly useful for building new knowledge through abstraction, since learning can be

procedural, where the point is to acquire knowledge on the basis of existing knowledge, or declarative, where skills require an effort of understanding and mobilization of previous knowledge. In general, systematic and random variability of contexts has been presented as an essential condition for abstraction and thus for knowledge transfer (Mendelsohn, cited by Bossard, C., et al. 2008). Varied practice, through the succession of different situations (but in a similar way), produces interferences between situations that contribute to forgetfulness: only the points between two situations that have something in common are taken into account. Computer simulations (which allow numerous repetitions) and the use of virtual reality (which allows a wide range of situations, thanks to the autonomy of the agents), offer interesting prospects for achieving transfer. Virtual simulation also offers the possibility of multiple practice sessions, including practice where different factors are connected. In this regard, many training VE additionally provide performance feedback, which allows the participant's progress to be monitored and recorded electronically. Within the training program, historical situations are included either from real disasters or scenarios where crisis situations are simulated; representing a wide range of possible technical and human problems very similar to those that a trainee may encounter in the real world [18].

Due to the potential of this technology, there are currently an increasing number of applications, which focus exclusively on learning as opposed to training [19]. Learning should be viewed differently from training, although they can be difficult to separate and depend on each other. Learning consists of the acquisition of information that is provided by the virtual environment. Training, on the other hand, mainly involves the responses given by the user in the environment itself. For Gorzerino et al. (Cited by Staretu, 2012), training arises from the actions performed by the user in the environment, while learning results from contextual inputs. At present, in relation to the application of VR in education the numbers are low, it should not be forgotten that all current uses of VR technology in education are at least to some extent, exploratory in nature, and even though no explicit evaluations have been conducted, researchers and teachers are forming their own opinions about the value of this technology. Many educational researchers and practitioners believe that VR technology offers great benefits that can support education. For some others, VR's ability to facilitate constructivist learning activities is the key factor, while for others it focuses on the potential to provide alternative forms of learning that can support different learning styles of students, such as visual, auditory or kinesthetic learners.

Nevertheless, VR is becoming increasingly popular in today's educational media due to its wide variety of applications in today's society [10]. Becoming a very suitable and powerful medium that can be used in schools [20], especially in those situations where it is required that what is abstract and intangible becomes concrete and manipulable [21], as is the teaching of science. However, its application cannot be limited only to the above situations since it has been shown that this technology is also useful in humanities and arts studies, for example in those cases where it is necessary to model places that cannot be

easily visited, such as historical cities, museums or zoos, which could be very beneficial to complement theoretical studies in subjects such as culture and foreign languages, allowing students to engage in historical or fictional events enriched with information about those places [21,4].

Currently, two types of VR content are used in the field of education [22, 23]: the first one is the one that tries to imitate the real world, for example, by creating a virtual museum to strengthen the study of history, art and cultural heritage of a country, or through the development of materials that allow, for example, to show how bacteria enter the human body and cause some disease. The second type of content consists of computer simulations of 3D objects, which are then reproduced in an interactive VR environment (for example, the generation of a machine design from a 2D diagram). This makes VR also a very useful tool to achieve significant learning, due to its multimedia characteristics and the possibility of involving students in a synthetic environment that is very similar to reality, making them feel they are really inside the virtual scenario, facilitating learning. Because of the features it has and the ability to allow students to visualize complex or abstract concepts, observe events on an atomic or planetary scale, regardless of distance, time or safety factors that would otherwise make this impossible in reality. VR offers many advantages to education, including delivery of information through multiple channels, addressing different learning styles, and furthermore experiential learning [23]. The area of training and simulation is not an irrelevant area for higher level education, so it is feasible to explore this field with VR tools using it as an educational strategy to help students gain knowledge of complex systems and processes, abstract models, and other non-intuitive topics [4].

2.3 Some uses and applications of Virtual Reality in education

Virtual Reality created through hardware and software, allows to stimulate the senses of users, immersing them inside the simulated synthetic environment, allowing them to interact in some cases through haptic devices such as data gloves and head-mounted display devices. For several decades now, VR technology has been used in various fields of knowledge, including scientific visualization, the military, medicine, engineering, and to a lesser extent education. Being very useful in situations where it is required to visualize complicated models of parts or assemblies, find a deficiency in the initial design phase, change a design or color of a final product among many other applications (see figure 2). VR has also been successfully applied in the simulation of dangerous situations avoiding unnecessary risks for the user.

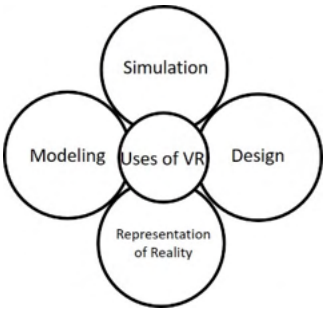

Figure 2. Main uses of VR.

In 1965, the idea of VR was first proposed by scientist Ivan Sutherland, through the development of the first immersive system in history, in which users were introduced to an environment of surround sound and three-dimensional displays. Between the 70's and the late 80's, the concept of VR was used to a great extent and mainly in the United States. But it is since the 1990's that virtual reality has entered a period of rapid growth, caused by the development of electronic devices that generate, process and display information at high speed and advances in the application of information technology and high-performance computing, as well as human-computer interaction technology and computer and communications equipment and networks. This increased at the same time the demand for VR applications for military, aerospace and complex design operations, stimulating even more its rapid development, since then this technology has been applied abundantly in different areas, helping the training of many professionals, from doctors to practice operations, pilots and aviators both commercial airlines and in the military context, through virtual simulators which are systems that aim to replicate or simulate, the experience of performing an activity as real and accurate as possible.

Virtual Reality is currently used successfully in various applications which can be classified into the following categories [24]:

a) Flight and driving simulators:

A real flight practice with the purpose of training a future pilot, can be extremely dangerous, since if at that moment he faces some extraordinary situation of danger, the student would not have the ability to react to such an eventuality, putting at risk his life and that of his companions, with the consequent loss of the aircraft; on the other hand the expenses involved in a real flight raise considerably the costs of the training leaving it out of reach of many students. Therefore, since its origins in aviation, several systems were used so that pilots could have the sensation of flying without actually being in the air.

This is why VR has been the technological ally of large aviation companies, not only in training, but also in aircraft design, modeling and testing. For example, commercial airlines such as Boeing and the U.S. military have been using flight simulators for over

twenty years [25]. These flight simulators are used for pilot training to develop new aircraft maneuvering skills under unusual operating conditions and also to acquaint already trained pilots with the flight characteristics of a new aircraft.

Driving simulators have been developed for a similar purpose as flight simulators: they allow driving lessons to be taken safely and under different terrain and weather conditions (rain, ice, traffic) or to test new vehicles even before they are released. In a VR-based virtual environment, it is possible to change any of the vehicle's characteristics (both aesthetic and functional) and then observe how the driver reacts to these changes. Simulation then allows designs to be tested before moving to the production stage. Driving simulators are now available not only for cars, but also for trucks, ships and trains.

b) Surgical simulators.

The use of VR systems in medicine has had many applications, mainly in the field of training future doctors and as part of their training in various specialty areas. With these systems it has been possible to greatly reduce costs, also allowing the study of a wide variety of pathologies, also offering the possibility of repeating procedures as many times as necessary. Stylopoulos mentioned that an ideal medical training system is one "*in which the trainee is able to reproduce the conditions of a real operation while immersed in a virtual world that is a faithful representation of the real world*".

Surgical simulators therefore have the ability to represent a situation so difficult for the trainee that, with a single mistake on his or her part, it can lead to the death of the patient, albeit only virtually. Following in the footsteps of flight simulators, surgery simulators provide virtual environments where a surgeon can use realistic haptic interfaces, allowing surgical procedures to be practiced on different patients. The use of surgery simulators has become widespread with the development of surgical robots, which have made it possible to perform surgeries through the haptic interface and displays that surgical robots are equipped with.

c) Design and Visualization:

Virtual reality can be used for students to design and test different machines and objects that could later be manufactured. Since VR labs used to be somewhat expensive, they were most often used to design objects that were also expensive (e.g., power plants, space rockets, ships or airplanes), this has changed in recent years with the arrival of more powerful and lower cost technologies. Such virtual environments are extremely complex as they must combine a good visual presentation with a detailed physical model that includes all the factors that could influence the testing of a piece of equipment.

The design of objects using virtual reality is not only limited to test concepts that could later be transferred to the real world, but also to those that can be realized in the reverse direction, i.e. objects that exist in the real world can also be transferred to a virtual environment, e.g. when simulating a famous museum through a virtual environment, the student can walk through the virtual museum, play with the elements contained in it and learn historical facts at the same time, without having to visit it physically. The virtual environment

can even include virtual characters that lived in the past, allowing the student to interact with them and learn additional information.

d) Telepresence and teleoperation

Telepresence is a use of virtual reality, which allows the student or user to be virtually placed in some other remote location. In it one has the ability to interact directly (often through a computer medium) with that location, no matter where he or she is. Teleoperation on the other hand differs from telepresence in that the operator does not interact with the distant location directly, but uses some device located at the distant location. Teleoperation on the other hand is mainly used to operate robots remotely. The best known examples are robots used to explore dangerous environments such as the Moon, Mars or simply dangerous places on Earth. The robot is equipped with a camera attached to its structure and is controlled by an operator located in a safe place that can even be millions of kilometers away. Currently there is a technology that is used to control unmanned military aircraft called drones. These robots and aircraft usually have a certain level of autonomy, allowing them to react to simple problems while the operator performs the more difficult tasks.

e) Augmented Reality

Augmented reality (AR) is the term used to define the vision that a user has through a technological device in a direct or indirect way, of a physical environment of the real world, whose elements are combined with virtual elements for the creation of a mixed reality in real time. AR consists of a set of devices that add virtual information to the already existing physical information, i.e., they add a virtual synthetic part to the real part and therein lies its main difference with virtual reality, since it does not replace physical reality, but superimposes the computer data generated on the real world.

In recent years, its use has been widely extended to fields such as tourism and advertising. Augmented reality has been successfully implemented in cell phones which can detect the user's position and provide information, such as the image of a street (real stimulus) with all the stores or landmarks marked (computer-generated visual stimulus).

For Professor Pablo Muñoz of the University of Santiago de Compostela [26], the advantages of integrating AR in education are the following:

a. Textbooks would improve their level of interactivity, allowing the visualization of objects in 3D, integrating exercises where the student could explore these objects from all possible perspectives. For example, think of basic principles of anatomy, engineering artifacts or works of art that could be viewed from different angles.

b. Augmented reality would also provide information on specific physical locations or even allow teachers, students and families to create itineraries, scenarios and experiences based on geolocation. This is the case of applications such as Eduloc or initiatives such as Espira.

c. It is a technology that can be very interesting for children to explore their immediate reality from another perspective.

d. It is also possible to integrate AR through more active and constructivist work methodologies such as WebQuests, improving student motivation and contributing to discovery learning.

e. From the point of view of e-learning, it can be integrated into on-line courses for the acquisition of practical learning and even be incorporated through virtual games based on gesture recognition and geolocation.

f. Another advantage of the use of augmented reality is its integration with different curricular areas such as mathematics, science, physical education, languages, environmental knowledge, etc. A clear example of this can be found in *learnAR*.

Finally, it can be said that virtual reality has also been successfully used to cure fear of heights, spiders, driving a vehicle, open spaces or public speaking. In addition, virtual environments with many positive stimuli can be used to treat other psychological disorders such as impotence or low self-esteem caused by excess weight [24].

3 | CONCLUSIONS

As can be seen throughout this article, the possibilities of using and applying VR technology in education are very broad and varied, ranging from the most basic levels of education to postgraduate levels. In turn, the contents can now be developed thanks to technological convergence and the lower costs involved in its design, generation and execution, which allows to generate increasingly innovative and attractive materials for students, which stimulate different human senses to be reproduced in virtual environments based on VR, such content can cover a very broad spectrum of topics, including the teaching of mathematics, physics and chemistry, history and art, and of course the health sciences such as medicine, psychology, biology and many others.

REFERENCES

[1] NADAN, Teeroumanee, et al. “Is Virtual Reality a Memorable Experience in an Educational Context?”. *International Journal of Emerging Technologies in Learning* (iJET), [S.l.], v. 6, n. 1, p. pp. 53-57, 2011. Disponible en web: http://online-journals.org/i-jet/article/view/1433/1666

[2] BRUDNIY, Aron. & DEMILHANOVA, Angelina. “The Virtual Reality in a Context of the “Mirror Stage””. International Journal of Advances in Psychology, 2012, 1: 6-9 Published Online July 2012.

[3] SINHA, R., et al. “Earthquake Disaster Simulation in Immersive 3D Environment”. En actas de *15th World Conference on Earthquake Engineering* (15WCEE), 2012, Lisbon, Portugal from September 24-28.

[4] FÄLLMAN, Daniel; BACKMAN, Anders & HOLMLUND, Kenneth. “VR in Education: An Introduction to Multisensory Constructivist Learning Environments”. *Universitets pedagogisk konferens, Umeå universitet*. 1999

[5] STEUER, Jonathan. “Defining Virtual Reality: Dimensions Determining Telepresence”. *Social Responses to Communication Technologies.* Department of Communication, 1993, Stanford University.

[6] BELL, John T. & FOGLER, H. Scott, “Ten Steps to Developing Virtual Reality Applications for Engineering Education”. En actas de *American Society for Engineering Education Annual Conference,* 1997

[7] SULBARAN, Tulio & BAKER, Nelson C., Enhancing engineering education through distributed virtual reality. En actas de *Frontiers in Education* Conference Proceedings, 2000, pp. S1D/13-S1D/18, 30th Annual Frontiers in Education - Vol 2.

[8] MANSEUR, Rachid. “Virtual Reality in Science and Engineering Education”. En actas de *IEEE/ASEE Frontiers in Education Conference,* FIE 2005, ISBN: 0-7803-9077-6, Indiana, October 19-22.

[9] TIJOU, Angele; RICHARD, Emmanuelle & RICHARD, Paul. “Using Olfactive Virtual Environments for Learning Organic Molecules”. En actas de *Technologies for E-Learning and Digital Entertainment*, *First International Conference, Edutainment 2006, Hangzhou, China, April 16-19.*

[10] AI-LIM, Elinda & WAI, Kok. “A review of using virtual reality for learning”. *Transactions on edutainment I*, Abdennour El Rhabili (Ed.). Lecture Notes In Computer Science, 2008, Vol. 5080. Springer-Verlag, Berlin, Heidelberg 231-241.

[11] OU, Jian; DONG, Yi-ning & YANG Biao. “Virtual Reality Technology in Engineering Hydrology Education”. *Computer Network and Multimedia Technology,* 2009. CNMT 2009. International Symposium on , vol., no., pp.1,4, 18-20 Jan.

[12] WUSHA, Huang, et al. “Virtual Training System for Hydraulic Pump Cart based on Virtual Reality”. *TELKOMNIKA*, 2013, Vol. 11, No. 8, pp. 4282-4290.

[13] ZHU, Yongyong. “QuickTime Virtual Reality Technology Applies to Practical Teaching Recording System”. *In TELKOMNIKA*, 2013, Vol.11, No.11, pp. 6315-6320.

[14] YOUNGBLUT, Christine. “Educational Uses of Virtual Reality Technology”, *Institute for Defense Analyses*. 1998. Virginia USA.

[15] ABULRUB, Abdul-Hadi G.; ATTRIDGE, Alex N. & WILLIAMS, Mark A. “Virtual reality in engineering education: The future of creative learning”. En actas de *Global Engineering Education Conference (EDUCON), 2011, IEEE, pp751,757.*

[16] LOFTIN, R. Bowen; ENGELBERG, Mark. & BENEDETTI, Robin. “Applying virtual reality in education: A prototypical virtual physics laboratory”. *Proceedings, IEEE 1993 Symposium on Research Frontiers in Virtual Reality,* 1993, pp.67,74.

[17] AI-LIM, Elinda; WAI, Kok, & FUNG, Chun. (2010). “Learning with virtual reality: its effects on students with different learning styles”. *In Transactions on edutainment IV,* Zhigeng Pan, et al. (Eds.). Lecture Notes In Computer Science, 2010, Vol. 6250. Springer-Verlag, Berlin, Heidelberg 79-90.

[18] BOSSARD, Cyril, et al. “Transfer of learning in virtual environments: a new challenge?”, *Virtual Reality. European Center for Virtual Reality,* 2008, 12:151–161

[19] STARETU, Ionel. “Aspects Regarding the Connections Between Classical Engineering and Virtual Engineering”. *TEHNOMUS* - New Technologies and Products in Machine Manufacturing Technologies, 2012, Universitatea Ştefan cel mare Suceava, Rumania.

[20] MIKROPOULOS, Tassos. et al. “Students’ attitudes towards educational virtual environments”. *Education and Information Technologies,* 1998, Volume 3 Issue 2, pp 137-148

[21] ABIDI, Mustafa; EL-TAMIMI, Abdulaziz, & AL-AHMARI, Abdulrahman. “Virtual Reality: Next Generation Tool For Distance Education”. *International Journal of Advanced Science and Engineering Technology,* 2012, ISSN 2225-9678 Vol.2, No.2 pp 95-100.

[22] ANTONIETTI, Alessandro., et al. “The Representation of Virtual Reality in Education”. *Education and Information Technologies*, Kluwer Academic Publishers, 2000, 5:4, pp 317-327

[23] BELL, John. T. & FOGLER, Scott. “The Investigation and Application of Virtual Reality as an Educational Tool”. En actas de *American Society for Engineering Education*, 1995, Annual Conference, Anaheim, CA

[24] MIHELJ, Matjaž; NOVAK, Domen & BEGUŠ, Samo. Virtual Reality Technology and Applications. *Intelligent Systems, Control and Automation: Science and Engineering*. 2014, Volume 68, Springer Science+Business Media Dordrecht.

[25] WONG, Vicent. Flight Simulation an application of Virtual Reality. *Surprice Journal*. 1996, Imperial College London.

[26] MUÑOZ, Pablo C. “La Realidad Aumentada y su Aplicabilidad en el Ámbito Educativo”. Diario el País, 2013, Disponible en internet: http://blogs.elpais.com/traspasando-la-linea/2013/07/la-realidad-aumentada- y-su-aplicabilidad-en-el-ambito-educativo.html

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