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La Realidad Virtual como herramienta de innovación educativa

Virtual Reality as a tool for educational innovation

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ABSTRACT

The review research aimed to analyze virtual reality as an educational innovation tool. Methodologically, it was developed under a descriptive-documentary typology with non-experimental bibliographic design, applying the content analysis technique for the selection and interpretation of the information collected from journals located in databases such as Scopus, WOS, Scielo, and Latindex 2.0. School knowledge can be deepened to the extent that it relies on technological resources, enabling a pedagogical exercise in line with current trends. Virtual reality has been has triggered positive effects on the academic performance of students in the educational settings where it has been put into practice, a situation that leads to thinking about the need of its implementation in the Ecuadorian educational system, for which it requires investment and adaptation of academic spaces to configure meaningful learning from virtual reality.

Descriptors: Computer uses in education; educational policy; educational software; educational technology. (Words taken from the UNESCO Thesaurus).

INTRODUCTION

There are several definitions about the meaning of Virtual Reality, which will be called VR from here on in this paper. One of them describes it as the human-machine interface (human-machine), which gives the person the opportunity to delve into a 3-dimensional(3D) graphic simulation generated by a computer that allows you to navigate interacting in real time with it (Pérez-Martínez, 2011). VR is a simulation developed in a 3D computer, whose content may be seen and manipulated by an avatar or a user. As a characteristic, it provides a multisensory and interactive response which allows an immediate sensation of reality (León- War, 2012).

VR offers multisensory information such as sound, vision, touch, with the intention of making the users feel that he is in the selected place. Until recently, both the software and hardware necessary for VR were very expensive, but at this time, it is easier to get them because the prices of computers or devices have been reduced, allowing many people and educational institutions to have the possibility of exploring the world of VR

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from their personal devices.

According to the sources consulted respect to VR, they agree on the meaning of being immersed in the 3D world, the feeling that people experience when the object leaves the screen and the sensation of approaching the person. These experiences generate in students a knowledge that allows them to understand abstract elements and complex phenomena that would otherwise be understood in a lower percentage; besides, VR permits them to experiment situations with the real world. There are two types of virtual reality which depends on the hardware used:

- Desktop VR: It is used by a person or a small group of people. The virtual environment is projected through a computer and people interact using the mouse to navigate in 3D or wearing the data gloves.
- Immersion VR: The person needs a VR head-mounted display or glasses, motion sensors and data gloves; this allows the user to achieve a high percentage of immersion in reality. (Urquiza-Mendoza, Auria-Burgos, & Daza-Suarez, 2016).

Virtual worlds can be designed for a single person called, in this case, user or for many, simultaneous users. When this virtual world supports several users, it gives rise to what is called a virtual community. The users that are part of this virtual community have a high cognitive level in the artificial world; so, in this simulated context, these users can communicate with others at the level of collaborative work, teaching and learning. This community changes the role of the teacher and student, since they become instructor and learner users. In this way, the learning process in the VR environment could be more significant (Jimenez, Villalobos-Abarca & Luna-Ramírez, 2000).

The incorporation of VR into the classroom as an innovation in 21st century education represents an important qualitative leap in the learning process within the different areas of knowledge, especially, those where it is difficult to visualize the processes that have been studied. This technology facilitates the teachers the explanation of complex processes (Urquiza-Mendoza, Auria-Burgos, & Daza-Suarez, 2016).

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VR is becoming more and more popular in educational institutions due to its wide variety of applications, for example, in the virtual museum helps strengthen the study of history, the heritage of certain countries and art, as well as the development and enrichment of students' knowledge in historical or fictional facts; they can also study the germs that enter the human body and cause diseases. This technology used in 21st Century Education allows the abstract and intangible components become concrete and manipulable. VR guarantees advantages in Education, including the delivery of information through channels, valuing the different learning styles and, especially, the experiential and meaningful ones. (Flores-Cruz, Camarena-Gallardo & Avalos-Villarreal, 2014).

Innovation, advances, research and new technologies have generated changes and learning needs. Society has planned demands in education that requires teaching models to adapt to time and space. ICTs offer a variety of possibilities for specific education depending on the needs of the students who want to train and depending on the content to be taught; therefore, they are means that allow the implementation of new pedagogical models for teaching and learning (Olivar & Daza, 2007).

Thus, by virtue of the novelty that virtual reality represents for education, especially, due to the technological investment that must be made, this research is based on a documentary review of research published in peer-reviewed journals in order to know the contributions and trends of VR to the educational field. In this respect, this study has been worked based on a descriptive-documentary typology, from the perspective of (Hernández, Fernández & Baptista (2014), applying content analysis as a technique for analyzing the information, which has made it possible to set the objective of analyzing virtual reality as a tool for educational innovation.

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Virtual Reality as a tool for educational innovation

The field of virtual reality becomes diverse in its usefulness, being a pioneer for the field of video games and advertising, and then it has been implemented in the medical industry, progressively, it has also been assumed for educational purposes. Ruiz-Davis & Polo-Serrano (2012) affirm the following:

Augmented Reality is presented as an improvement of the practical experience for the user in many aspects in addition to advertising, being able to achieve a change in people's life attitude, without additional effort and without breaking their daily routine, since the key lies in reaching the client wherever they spend their time (p. 18).

Augmented reality starts as an entertainment proposal that has been gradually adapted to various uses depending on the companies' needs and interests. This is configured at the time technology designs new models of mobile devices in their various presentations, consoles games, tablets, which are attractive for young people, a situation that is assumed by education when ICT is firstly incorporated and later, the augmented reality that emerges as an attractive pedagogical strategy for students by virtue of promoting better learning.

On the other hand, (Prendes-Espinosa, 2015), comment that augmented reality in the education sector will not go unnoticed, this leads to the idea that education will be impregnated by it for the next decade, even more, when 2.0 classrooms exit nowadays, coupled with the technological evolution of a globalized world that cannot be indifferent to those who design curricular programs and who must bear in mind augmented reality as part of it. In addition, Del-Cerro-Velázquez & Morales-Méndez (2017), highlight that:

The implementation of a didactic application, based on ICT resources, for the 3rd year students of ESO in the Technology subject has been an enriching and motivating experience, which has allowed us to verify the students' positive and tremendously receptive attitude to this type of experiences (p. 12).

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Learning motivation is a task that parents, representatives and teachers must face for assertively arousing students' interests to achieve significant learning as indicated by (Vallejo-Valdivieso et al., 2019). The augmented reality, being a viable alternative, is perceived as attractive for students, since it can be implemented for educational purposes. For this reason, educational organizations should invest in techno-logical devices, as well as in programs that allow generating learning from augmented reality. Taking into account such assertions, universities are called to design and promote augmented reality for educational and didactic purposes. In this sense, (Cabero-Almenara, Barroso-Osuna & Llorente-Cejudo (2016), point out that:

AR is a technology that is being presented as truly useful and with different possibilities to facilitate learning by students in different curricular areas... It must be recognized that more technological analysis is being carried out respect to its application in the educational field than research.

Augmented reality may be implemented transversally in the curriculum, being possible to be implemented in various subjects or in learning projects; so, students may be able to design strategies that allow them to concatenate virtual reality with curricular topics, enabling their learning development in line with their needs and interests, which allows considering the proposal of De-la-Torre-Cantero, et al., (2013), who state that:

The two technologies used as alternatives to physical models, augmented reality and digital tablets have been valued positively by all users, with average values of 7.10 and 8.00 (out of 9). There is a statistically significant preference for digital tablets in terms of their global assessment (p. 13).

Thus, augmented reality in conjunction with technological devices constitute part of the new generations' daily life; therefore, it is unavoidable by the educational authorities not to involve ICT, augmented reality, as well as other technological and computer trends to the educational field, coupled with the transition to the student-centered learning paradigm. In this regard, (Maya, Aldana-Zavala & Isea-Argüelles, 2019) argue that such a measure conceives quality and inclusive education.

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From the perspective raised, augmented reality can be implemented in various scenarios, which can be used for educational purposes, enabling learning from non-conventional contexts, being possible the formal and non-formal educational generation. (Del-Cerro-Velázquez & Morales- Méndez, 2017), support the need to introduce augmented reality in education, through the use of smartphones, which allow the management of applications that may be used for educational purposes and may be interesting for students to carry out an approach of academic activities through mobile devices.

On the other hand, Villalustre-Martínez & Del-Moral-Pérez (2018) highlight “the need to introduce these technologies in the training of future teachers to enhance their didactic integration in classrooms beyond instrumental use in an inclusive and dynamic way” (p. 25). This is necessary because teachers who are not familiar with new technologies, could assume a positive attitude towards the pedagogical use of them, being indispensable the generation of a paradigmatic change in education where virtual reality is included as an innovative element of learning, as indicated by (Lattá-Arias, 2019), (Urueta-Vélez, 2019), (Gómez, 2017). In addition, Maquilón-Sánchez, Mirete-Ruiz & Avilés-Olmos (2017), emphasize that:

The multiple variants of this technology make it possible to adapt its application in classrooms to the level of prior knowledge and skills acquired by students, teachers, and the technological equipment of the center. The use of this technology is also linked to active learning methodologies and the current paradigm of competency learning (p. 201).

Virtual reality allows the generation of meaningful and social learning, from the use of the students' previous knowledge, as well as the generation of competences, being this in accordance with the new curricular trends where the cross-curricular and bioethical training of the student is promoted, through the life project as a strategy that generates motivating learning throughout life, and builds an inclusive and quality education progressively.

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The students who have implemented virtual reality as a learning strategy has accomplished a higher academic performance than those who have not approached augmented reality, which in the opinion of (Donnelly, et al., 2014), projects the importance of an educational experience by virtue of encouraging students to achieve better learning (Carvalho-Beluce, &, Luciane-de-Oliveira, 2015). Likewise, (Hsieh & Yeehsieh, 2004) point out that school knowledge can be deepened to the extent that it relies on technological resources, enabling a pedagogical exercise in line with current trends (Chernikova, et al., 2020).

In addition to the aforementioned, VR allows transcending university students, who, through video games and simulation, have achieved a greater engineering learning (Bodnar, et al., 2016) in order to project the application of the educational reality at the various levels of the educational system.

CONCLUSION

Virtual reality in educational settings where it has been implemented has triggered positive effects on the students' academic performance, a situation that leads to its implementation in the Ecuadorian educational system. To achieve this, investment is necessary to configure meaningful learning from virtual reality in Academic spaces. On the other hand, VR may contribute to promoting students' multiple intelligences, since the various logical - mathematical, spatial and artistic processes are used to design, program and apply virtual reality education for pedagogical purposes, which may also project the development of new skills and competencies, favoring a constructivist education with a technological approach.

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REFERENCES

- Bodnar, C.A., Anastasio, D., Enszer, J.A. &Burkey, D.D. (2016), Engineers at Play: Games as Teaching Tools for Undergraduate Engineering Students. *J. Eng. Educ.*, 105: 147-200. <https://doi.org/10.1002/jee.20106>
- Burgueño-Salas, S. (2020). Latin America: Internte users by country 2020.. Statista. Available from <https://n9.cl/7fp9>
- Carvalho-Beluce, A, &, Luciane-de-Oliveira, K. (2015). Students' Motivation for Learning in Virtual Learning Environments. *Paidéia (Ribeirão Preto)*. 25 (60), 105-113. <https://doi.org/10.1590/1982-43272560201513>
- Cabero-Almenara, J., Barroso-Osuna, J. & Llorente-Cejudo, M. (2016). Technology acceptance model & augmented reality: study in progress. *Lasallian Research Journal*, Vol. 13 No. 2, 18-26.<https://doi.org/10.22507/rli.v13n2a2>
- Cantón-Enríquez, D., Arellano-Pimentel, J., Hernández-López, M., & Nieva-García, O. (2017). Didactic use of immersive virtual reality with NUI focused on the inspection of wind turbines. *Opening (Guadalajara Jal.)*, 9(2), 8-23. <http://dx.doi.org/10.32870/Ap.v9n2.1049>
- Campos-Soto, M., Ramos-Nava-Parejo, M., & Moreno-Guerrero, A. (2020). Virtual reality and motivation in the educational context: Bibliometric study of the last twenty years of Scopus. *Alteridad Education Journal*, 15(1), 47-60. <https://doi.org/10.17163/alt.v15n1.2020.04>
- Chernikova, O., Heitzmann, N., Stadler, M., Holzberger, D., Seidel, T., & Fischer, F. (2020). Simulation-Based Learning in Higher Education: A Meta-Analysis. *Review of Educational Research*. <https://doi.org/10.3102/0034654320933544>

Josefa Katuska Toala-Palma; Jéssica Lourdes Arteaga-Mera; Juana Maricela Quintana-Loor; María Isabel Santana-Vergara

- Danish, J.A., Enyedy, N., Saleh, A. & Humburg, M. (2020). Learning in embodied activity framework: a sociocultural framework for embodied cognition. *Intern. J. Comput.-Support. Collab. Learn* **15**, 49–87 (2020). <https://doi.org/10.1007/s11412-020-09317-3>
- Del-Cerro-Velázquez, F. & Morales-Méndez, G. (2017). Augmented Reality as a tool for improving spatial intelligence in secondary education students. *RED. Journal of Distance Education*, Núm. 54. <http://dx.doi.org/10.6018/red/54/5>
- De-la-Torre-Cantero, J, & Martin-Dorta, N, & Saorín-Pérez, J, & Carbonell-Carrera, C, & Contero-González, M. (2013). Ubiquitous learning environment with augmented reality and tablets to stimulate understanding of three-dimensional space. *RED. Journal of Distance Education*, (37), 1-17. Available from <https://n9.cl/fzhre>
- Donnelly, D. F., Linn, M. C., & Ludvigsen, S. (2014). Impacts and Characteristics of Computer-Based Science Inquiry Learning Environments for Precollege Students. *Review of Educational Research*, 84(4), 572–608. <https://doi.org/10.3102/0034654314546954>
- Flores-Cruz, J., Camarena-Gallardo, P., & Avalos-Villarreal, E. (2014). Virtual reality as an innovative technology applicable to the teaching process of engineering students. *Opening*, 6 (2), 1-10. Available from <https://n9.cl/ruw40>
- Gómez, J. (2017). Experience in instrument design for virtuality. *Koinonía Interdisciplinary peer-reviewed*, 2(3), 65-79. Available from <https://n9.cl/061f>
- Hsieh, S.J. & Yeehsieh, P. (2004). Integrated Virtual Learning System for Programmable Logic Controller. *Journal of Engineering Education*, 93: 169-178. <https://doi.org/10.1002/j.2168-9830.2004.tb00801.x>
- Hernández, R. Fernández, C., & Baptista, P. (2014). Investigation methodology. México, Mc Graw Hill Hispanoamericana. Hill Internacional.
- Hod, Y, & Twersky, D. (2020). Distributed spatial Sensemaking on the augmented reality sandbox. *Intern.J. Comput.-Support. Collab. Learn* **15**, 115–141. <https://doi.org/10.1007/s11412-020-09315-5>

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Jimenez , A., Villalobos-Abarca, M., & Luna-Ramírez, E. (2000). When and How to use Virtual Reality in Teaching. *Ibero-American Educational Computing*, (16), 26-36. Available from <https://n9.cl/htsrk>

Kraft, M. A., Blazar, D., & Hogan, D. (2018). The Effect of Teacher Coaching on Instruction and Achievement: A Meta-Analysis of the Causal Evidence. *Review of Educational Research*, 88(4), 547–588. <https://doi.org/10.3102/0034654318759268>

Lattá-Arias, C. (2019). Use of ICT for productive projects in educational institutions of Banana Zone Municipality. Magdalena. Colombia. *Koinonía Interdisciplinary peer-reviewed Journal*, 4(7), 233-246. <http://dx.doi.org/10.35381/r.k.v4i7.202>

León-Guerra, R. (2012). Non-immersive virtual reality application for Agricultural Engineers. *Agricultural Technical Sciences*, 21(1), 69-71. Available from <https://n9.cl/1q3n0>

Maquilón-Sánchez, J.J., Mirete-Ruiz, A.B. & Avilés-Olmos, M. (2017). Augmented Reality (AR). Resources and proposals for educational innovation. *Interuniversity Electronic Journal of Teacher Training*, 20(2), 183---203. <https://doi.org/10.6018/reifop/20.2.290971>

Maya, E., Aldana-Zavala, J., & Isea-Argüelles, J. (2019). Management Leadership and Quality Education. *CIENCIAMATRIA*, 5(9), 114 - 129. <https://doi.org/10.35381/cm.v5i9.102>

Mendoza, J. (2020). Latin America: Online consumption trends since COVID-19 pandemic. Available from <https://n9.cl/i3ow>

Olivar, A., & Daza, A. (2007). The impact of Information and communication technologies (ICT) on education in the 21st century. *NEGOTIUM*, 3(7), 21-46. Available from <https://n9.cl/2psi>

Pérez-Matínez, F. (2011). Present and Future of Virtual Reality Technology. *Creativity and Society*, (18), 1-39. Available from <https://n9.cl/uzrd>

Prendes-Espinosa, C. (2015). Augmented reality and education: analysis of practical experiences. *Pixel-Bit. Media and Education Journal*, (46), 187-203. Available from <https://n9.cl/348l>

Josefa Katuska Toala-Palma; Jéssica Lourdes Arteaga-Mera; Juana Maricela Quintana-Loor; María Isabel Santana-Vergara

Ruiz-Davis, S., & Polo-Serrano, D. (2012). Augmented reality as a new concept for smartphone online advertisements. *Reason and Word*, (80). Available from <https://n9.cl/h1m1b>

Soto-Triana, J. S., & Gómez-Villamizar, C. (2018). Virtual Reality Progress and Interventions in Clinical Psychology. *Clinic. Psychological Thesis*, 13(1), 1-15. <https://doi.org/10.37511/tesis.v13n1a5>

Urueta-Vélez, L. (2019). Teaching strategies and the use of information and communication technologies in departmental educational institutions in the Zona Bananera Municipality - Colombia. *Koinonía Interdisciplinary peer-reviewed journal*, 4(7), 185-201. <http://dx.doi.org/10.35381/r.k.v4i7.200>

Urquiza-Mendoza, L., Auria-Burgos, B., & Daza-Suarez, S. (2016). Use of virtual reality for future education in schools of Ecuador. *Science and Investigation*, 1(4), 26-30. Available from <https://n9.cl/a7ii>

Vallejo-Valdivieso, P., Zambrano-Pincay, G., Vallejo-Pilligua, P., & Bravo-Cedeño, G. (2019). Mental structures in the construction of meaningful learning. *CIENCIAMATRIA*, 5(8), 228-241. <https://doi.org/10.35381/cm.v5i8.257>

Villalustre-Martínez, L. & Del-Moral-Pérez, E. (2018). Geolocation and augmented reality for ubiquitous learning in initial teacher training. *@tic revista d'innovació educativa*. 21(18), 19-27. <https://doi.org/10.7203/attic.21.12633>

Zambrano-Ferre, A. (2005). Ethical Aspects about the Use of Virtual Reality in Human Anatomy Teaching. *Fermentum*, 15(44), 426-438. Available from <https://n9.cl/hn2o>