MENDIVE
REVISTA DE EDUCACIÓN

Original article

Emerging technological transformations in police teaching-learning processes based on virtual reality

Transformaciones tecnológicas emergentes en los procesos de enseñanza-aprendizaje policial a partir de la realidad virtual

Transformações tecnológicas emergentes nos processos de ensino-aprendizagem policial baseados em realidade virtual

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Received: February 22, 2024
Accepted: July 14, 2024

ABSTRACT

Global society is immersed in changes and transformations that affect institutional educational processes, due to emerging advances in science and technology. In this sense, the present research aimed to optimize the teaching-learning processes at the "Francisco de Paula Santander" General Police Cadet School (ECSAN), based on emerging technological transformations with the use of virtual reality simulators. A qualitative documentary analysis was carried out, based on the sources and the critical apparatus on the design of virtual reality scenarios as a successful experience in the ECSAN. An instrument was applied to collect information, as a survey, with 936 cadets from the school. In terms of results, as society transforms and students demand new methodologies and learning tools to acquire knowledge of the police profession, the need arises in the School to generate other learning and teaching scenarios that become an opportunity to connect informative content (theoretical, conceptual and doctrinal) with procedural content, based on a training model that encourages pedagogical interaction between knowledge, knowing how to do and being. In conclusion, it is important to maintain the use of ICT, as well as the permanent use of virtual learning scenarios, to generate a practical application of knowledge, allowing the resolution of problems according to the contexts and the various situations required by the police service.

Keywords: teaching-learning; police; virtual reality; simulators; innovation; technological transformation.

RESUMEN

La sociedad global se encuentra inmersa en cambios y transformaciones que inciden en los procesos educativos institucionales, debido a los emergentes adelantos en ciencia y tecnología. En este sentido, la presente investigación tuvo como objetivo optimizar los procesos de enseñanza-aprendizaje en la Escuela de Cadetes de la Policía General "Francisco de Paula Santander" (ECSAN), a partir de transformaciones tecnológicas emergentes con el uso de simuladores de realidad virtual. Se realizó un análisis cualitativo de tipo documental, a partir de las fuentes y el aparato crítico sobre

el diseño de escenarios de realidad virtual como experiencia exitosa en la ECSAN. Se aplicó un instrumento para la recolección de la información, a manera de encuesta, con 936 cadetes de la escuela. En cuanto a resultados, a medida que la sociedad se transforma y los estudiantes exigen nuevas metodologías y herramientas de aprendizaje para adquirir los conocimientos de la profesión policial, surge la necesidad en la Escuela de generar otros escenarios de aprendizaje y enseñanza que se conviertan en una oportunidad para conectar los contenidos informativos (teóricos, conceptuales y doctrinales) con los procedimentales, a partir de un modelo de formación que fomente la interacción pedagógica entre el saber, el saber hacer y el ser. A manera de conclusión, es importante mantener el uso de las TIC, así como el uso permanente de los escenarios virtuales de aprendizaje, para generar una aplicación práctica del conocimiento, permitiendo la resolución de problemas de acuerdo a los contextos y las diversas situaciones que exija el servicio de policía.

Palabras clave: enseñanza-aprendizaje; policía; realidad virtual; simuladores; innovación; transformación tecnológica.

RESUMO

A sociedade global está imersa em mudanças e transformações que afetam os processos educacionais institucionais, devido aos avanços emergentes na ciência e na tecnología. Nesse sentido, a presente pesquisa teve como objetivo otimizar os processos de ensino-aprendizagem na Escola Geral de Cadetes da Polícia "Francisco de Paula Santander" (ECSAN), a partir das transformações tecnológicas emergentes com a utilização de simuladores de realidade virtual. Foi realizada uma análise documental qualitativa, baseada nas fontes e no aparato crítico sobre a concepção de cenários de realidade virtual como experiência de sucesso na ECSAN. Foi aplicado um instrumento de coleta de informações, em forma de survey, com 936 cadetes da escola. Em termos de resultados, à medida que a sociedade se transforma e os alunos exigem novas metodologias e ferramentas de aprendizagem para adquirir conhecimentos sobre a profissão policial, surge na Escola a necessidade de gerar outros cenários de aprendizagem e ensino que se tornem uma oportunidade de conectar conteúdos informativos (teóricos, conceituais e doutrinário) com conteúdo processual, baseado em um modelo de formação que estimula a interação pedagógica entre o saber, o saber fazer e o ser. Concluindo, é importante manter a utilização das TIC, bem como a utilização permanente de cenários virtuais de aprendizagem, para gerar uma aplicação prática do conhecimento, permitindo a resolução de problemas de acordo com os contextos e as diversas situações exigidas pelo serviço policial.

Palavras-chave: ensino-aprendizagem; polícia; realidade virtual; simuladores; inovação; transformação tecnológica.

INTRODUCTION

The Institutional Educational Project that guides the educational scenario in the National Police reflects the meaning and training horizon that the institution develops in its students. In this sense, the National Police, in the face of the country's current challenges in security and citizen coexistence, begins a Process of Modernization and Institutional Transformation that demands the adaptation of police education. This process is aligned with contemporary strategies that promote the renewal of the police education system through the transformation of the curriculum, the strengthening of science, technology, police innovation, and the search for self-sustainability of the National Directorate of Schools (Terpstra & Schaap, 2021). The above shows the need to rethink the police educational model in response to the new realities facing the country, the progress in the incorporation of new technologies in education and the processes of

educational innovation, which are a trend in Higher Education in the world.

Today's society faces great challenges at all levels and is in constant transformation, which demands the training of suitable and comprehensive professionals capable of facing the present and future challenges of society that contribute to sustainable social development, as proposed by the Organization of the United Nations for Culture, Sciences and Education (UNESCO, 2020). In the knowledge society, educational efforts must be aimed at developing students' abilities to manage information and generate new knowledge, aimed at innovating processes and solving real problems, with the support of Information and Communications Technologies. (ICT) (Fajardo and Cervantes, 2020). This is how globalization and digital transformation promote new forms of interaction and collaborative work, which makes it easier for future professionals to be fully trained to solve real problems, generating the knowledge necessary to provide solutions to the world.

In the educational field, ICT have become tools that favor the didactics and pedagogies of educational scenarios, supporting the teaching-learning processes, based on virtual reality and the use of simulators. Simulation-based learning with immersive virtual reality is shown to be an effective methodology that significantly improves students' academic performance, compared to traditional methodologies (Mariscal *et al.*, 2020).

Within the framework of the institutional transformation process, police education constitutes a strategic line of special importance, to respond to the needs of security and coexistence within the framework of the different territories of the country. For this reason, the Institutional Educational Project-PEI outlines the guidelines that ensure relevant training, training and updating processes, contextualized and focused on the realities of the country, which make it possible to assume new educational approaches that, through agile methodologies, enable the development and strengthening of the skills required by police professionals to provide a more humane, effective police service and, above all, closer to the citizen.

This is how the implementation of simulated virtual scenarios in police education is proposed, which allows the school to be at the forefront of the evolution that is currently presented in educational innovation and the opening of new ways of teaching and learning, where technology It is a fundamental part of this transition process (Fajardo, 2019); acting as an important complement in the students' passage through police knowledge, closing the gaps between theory and practice. Likewise, the use of virtual platforms focused on virtual reality and metaverses are, in essence, the tools for modern education.

Therefore, in addition to applying technologies to education, we must, above all, implement police educational scenarios where students can learn to move and intervene in the new telematic space. The approach and development of virtual reality emphasizes that simulators have transversally permeated the daily lives of human beings, both in work issues and in the professional context. In this sense, the ECSAN does not escape the global and technological call of the knowledge society.

In terms of background, in the United Kingdom in 2017 AVRT (Adaptive Virtual Reality Training) emerged as a system to manage training scenarios for officers, with a focus on armed confrontation with 3D interactivity. They also use Oculus glasses Quest or HTC Vive, noise canceling headphones and training weapons, use of lasers or electroshock weapons. In 2021 Atrioventricular Reentry Tachycardia (AVRT) installed the largest police virtual reality training system in Essex and the Antilatency community. Thus, like this experience in the implementation of virtual reality, it can be mentioned that there is a universe of 11,676 articles on virtual reality with impact factor in Scientific Journal Rankings (SJR) and the Journal Citation Reports (JCR) and its location in the SJR quartiles. On the other hand, the Virtual Reality report market by

Component (Hardware and Software), Technology (Non- Immersive, Fully Immersive), Device Type (Head-Mounted Display, Gesture Control Device), Application and Geography-Global Forecast to 2022", reveals great exponential expectations in the growth of the virtual market, which in 2015 was USD 1.37 trillion and in 2022 it is USD 33.90, of which the defense sector has used.

In terms of innovation in the context of the national police, there is the implementation of ICT in educational settings, as is the case of the Police Aviation School (ESAVI), with the use of flight simulators and IVAO physical simulators, Bell 206 BIII helicopter, Cessna 172 aircraft, as well as the Air Tractor-AT 802 aircraft.

Taking into account the previous references, the problem that seeks to be solved is related to the teaching-learning processes that are provided in the ECSAN for police training; while there is no adequate, modern and cutting-edge technology and innovation infrastructure to optimize the quality educational work that students need, so that they can respond more efficiently to the demands of the current police service committed to the new emerging social paradigms.

According to the previous arguments, the question to be resolved is formulated: in what way can the teaching-learning processes be optimized at the ECSAN, based on the implementation of emerging technological transformations of virtual reality with simulators? Hence, it is a priority in this path of institutional change to rethink the educational approaches that have traditionally been applied to the training, training and updating process of the men and women of the National Police, as a key factor in the consolidation of a police force, that provides a more human, integral, disciplined, innovative and closer service to the citizen.

MATERIALS AND METHODS

The research approach is qualitative and the type of research is analytical and documentary, since it has the purpose of knowing and evaluating the impact of successful experiences on virtual reality on the teaching-learning processes of ECSAN students, from the use of simulators regarding police service procedures.

Likewise, the information collected was based on documentary research, going to the sources, the critical apparatus and the application of instruments for data collection, from interviews and surveys. The instruments were applied to the 936 ECSAN students, who participated in the project by giving their informed consent.

Regarding the procedure or phases of the research, these were executed in response to the research objectives related to virtual reality scenarios, as a successful experience in the ECSAN, in order to understand the key theoretical and methodological elements that underpin it and characterize it.

In line with ethical principles, this study with a qualitative approach and analytical and documentary methodology rigorously follows the ethical standards of the ECSAN research committee.

RESULTS

From the application of the research instrument, results are obtained that characterize the sample from the demographic and work categories. It was evident that the police officers are between 18 and 35 years old, of which the majority correspond to the male sex with 568 members and women with 368, as can be seen in table 1. Likewise, data corresponding to their marital status is established, years of service and rank (Table 1).

Table 1- Descriptive statistics of sociodemographic characteristics

	Rank	All	Women	Men
Age	18-20	68(11.97)	8(5.63)	9(6.33)
	21-23	68(11.97)	4(2.81)	13(9.15)
	24-26	148(26.05)	18(12.67)	19(13.37)
	27-29	148(26.05)	13(9.15)	24(16.89)
	30-32	304(53.51)	37(26.05)	39(27.46)
	33-35	200(35.20)	12(8.44)	38(26.75)
Degree	Cadet	712(66.4)	280(49.28)	432(76.04)
	Ensign	48(8.44)	28(4.92)	20(3.52)
	Student	176(30.98)	60(10.56)	116(20.41)

Note: categories corresponding to the ranges of age, marital status, years of service and police rank according to the selected sample

The representative sample is characterized by being mostly between 30 and 35 years old, which means that they are students with greater experience in chronological age and years of knowledge of the police institution, which is corroborated by the majority of the population, corresponding to cadets who have more than two years at ECSAN.

In terms of the respondents' perception of satisfaction with respect to the use of emerging technologies, a high level of `satisfaction' is calculated for each item per module, evidencing the following results (Figs. 1, 2 y 3).

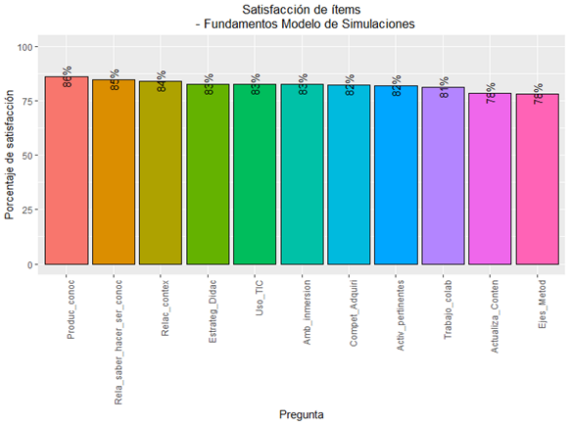

Fig. 1- Percentages of satisfaction of respondents regarding virtual environments
Note: satisfaction of items about virtual environments

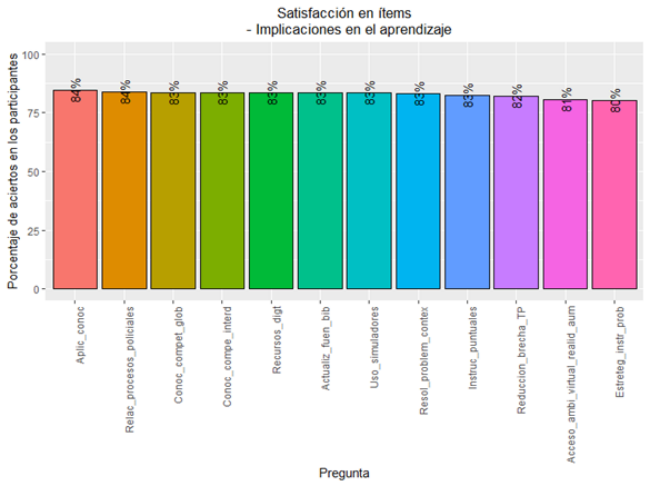

Fig. 2- Percentages of satisfaction of respondents regarding the implications of learning from virtual reality
Note: item satisfaction. Implications from virtual reality

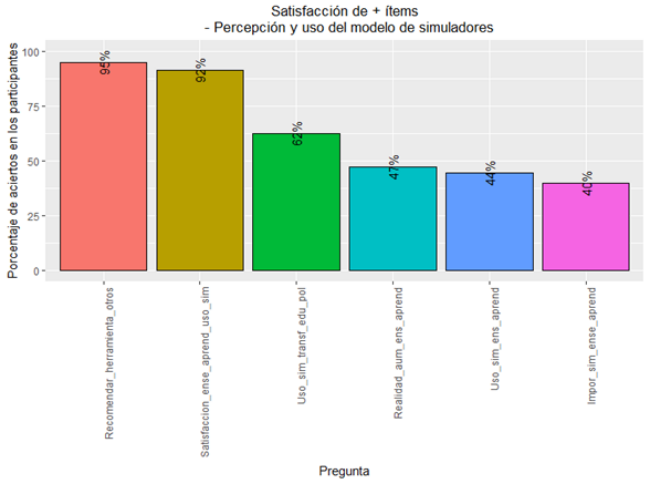

Fig. 3- Percentages of satisfaction of respondents regarding augmented reality and simulators
Note: item satisfaction. Perception and use of augmented reality and simulators

The results show that the greatest satisfaction of the respondents is perceived in relation to the implications of learning and satisfaction above 80%, when resorting to instructional strategies to solve problems from virtual environments.

This fact is consistent in evidencing a high participation in the application of real police scenarios or the reduction of the gap between theory and practice, relying on virtual learning environments.

From the analysis of consistency and reliability, the satisfaction with the greatest heterogeneity corresponds to the use of the simulator model, augmented reality and virtual scenarios in the classroom, given that satisfaction with its components is between 40% and 95%. This result implies that the greatest difficulty in using simulators to generate satisfaction among respondents corresponds to the importance, use and quantification of augmented reality and simulation situations in teaching-learning processes.

DISCUSSION

The results obtained in this research reveal that the use of virtual reality simulators in police training generates high levels of satisfaction among students, which is consistent with experiential and constructivist learning theories. According to Plesoianu & Costin (2012), experiential learning involves accumulating knowledge through practice, reflection and application, and plays a crucial role in developing skills and capabilities for professional and business success. Virtual reality facilitates this cycle by providing an immersive environment where students can practice and reflect on their actions in a safe and controlled context.

Virtual reality is present in all global scenarios (Curcio, *et al.,* 2016) and the use of simulators, as well as mixed reality, in such a way that one of the social segments where the need for its application is evident is in the educational sector and its high-impact implications on the teaching-learning processes of students. Similarly, Makransky and Petersen (2019) reported that virtual reality can increase student motivation and engagement, crucial factors for effective learning.

Taking these references into account, it is necessary to link well-developed theoretical frameworks to argue the nature and use of virtual realities, in order to support learning goals (Fernández, 2017), enabling the construction and empowerment of new knowledge, as well as skills and abilities to understand the reality of the world in which you find yourself. They thus become real opportunities to put into practice the knowledge acquired in the different professional disciplines that, in this specific case, correspond to police science in the context of police training at the ECSAN, with the support of the simulators in virtual reality scenarios. That is why the use of ICT has become a common practice, with global reach, from international and national contexts.

The implementation of virtual reality in the institution establishes the need to respond to the proposals of the globalized world with the use of appropriate technologies to apply to the educational context, in such a way that they contribute to the generation of critical thinking and the ability to solve problems. by the students, according to the contexts corresponding to their police work in real life, but strengthened from digital experiences (Morán, 2015).

Finally, in contrast to the results, Di Serio, Ibáñez and Kloos (2013) point out that, although augmented reality has great educational potential, its effectiveness depends largely on the quality of the implementation and the level of familiarity of the users with technology. The above suggests the need for a more robust implementation and more exhaustive training in the use of these technologies.

Furthermore, Merchant *et al.* (2014) conducted a systematic review and meta-analysis on the use of augmented and virtual reality technologies in education, and found that the effects on learning are, in some cases, limited and that variability in results can be attributed to contextual factors such as instructor preparation, content quality, and available technological infrastructure. In their study,

Merchant *et al.* argue that, without careful integration and appropriate pedagogy, emerging technologies may not provide significant benefits compared to traditional methods.

As findings, it is considered important to maintain the use of ICT, as well as the permanent use of simulators to generate practical applications of knowledge in specific social contexts. In this sense, emerging technological transformations are necessary in police teaching-learning processes based on virtual reality and the use of simulators.

It is important to develop teaching strategies in terms of updating content, the use of digital resources and the augmented reality environment to reduce the gap between theory and practice, in such a way that greater technological skills are acquired for problem solving of coexistence and citizen security.

It is necessary to make essential changes regarding the relevance of the activities and methodological axes in terms of the promotion of collaborative work and the relationships of the proposed cases with police processes and the resolution of problems in context.

Virtual reality supported by simulation is highly effective in generating innovative learning environments in correlation with real world environments, in such a way that, after having addressed learning from the virtual application, important advances are recognized when applying them in real life.

BIBLIOGRAPHIC REFERENCES

Curcio, I. D. D., Dipace, A., & Norlund, A. (2016). Virtual realities and education.

Di Serio, A., Ibáez, M. B., & Kloos, C. D. (2013). Impact of an Augmented Reality System on Students' Motivation for a Visual Art Course. Computers & Education, 68, 586-596. http://dx.doi.org/10.1016/j.compedu.2012.03.002

Fajardo, E. (2019). Las nuevas tecnologías: ¿amenaza u oportunidad en el escenario educativo? Revista de la Facultad de Ciencias de la Educación, 4(1), 181-197. https://www.semanticscholar.org/paper/Las-nuevas-tecnolog%C3%ADas%3A-%C2%BFamenaza-u-oportunidad-en-Pascagaza/4766f77afb7263c679e031c9a836bedea0967453

Fajardo, E. y Cervantes, L. C. (2020). Modernización de la educación virtual y su incidencia en el contexto de las tecnologías de la información y la comunicación. Academia y Virtualidad, 13(2), 103-116. https://doi.org/10.18359/ravi.4724

Fernández, M. (2017). Augmented Virtual Reality: How to Improve Education Systems. Higher Learning Research Communications 7(1):1 DOI:10.18870/hlrc.v7i1.373 https://www.researchgate.net/publication/318615917_Augmented-Virtual_Reality_How_to_improve_education_systems

Mariscal, G., Jiménez, E., Vivas-Urias, M. D., Redondo-Duarte, S., & Moreno-Pérez, S. (2020). Aprendizaje basado en simulación con realidad virtual. Education in the Knowledge Society (EKS), 21, 15-15. https://doi.org/10.14201/eks.23004

Makransky, G., & Petersen, G. B. (2019). Investigating the process of learning with desktop virtual reality: A structural equation modeling approach. Computers & Education, 134, 1530. https://doi.org/10.1016/j.compedu.2019.02.002

Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. Computers & Education, 70, 2940. https://doi.org/10.1016/j.compedu.2013.07.033

Morán, J. (2015). Mudando a educação com metodologias ativas. Convergências midiáticas, educação e cidadania: aproximações jovens. Coleção Mídias Contemporâneas, 2(1), 15-33.

Plesoianu. G, Costin C, A. (2012). Experiential Learning An Effective Approach for Gathering Knowledge and Capabilities in Professional Career. 14(2):310-322. http://www.rmci.ase.ro/no14vol2/12.pdf

Terpstra, J., & Schaap, D. (2021). Politics of Higher Police Education: An International Comparative Perspective. https://doi.org/10.1093/police/paab050.

Unesco (2020) Education form Sustainable Development A roadmap. https://doi.org/10.54675/YFRE1448

Conflict of interests:

The author declares that she has no conflicts of interest.

Authors' contribution:

The author participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.

Cite as

Cervantes Estrada, L. C. (2024). Emerging technological transformations in police teaching-learning processes based on virtual reality. *Mendive. Journal on Education*, *22*(3), e3783. https://mendive.upr.edu.cu/index.php/MendiveUPR/article/view/3783