Visions of three-dimensional or virtual workspaces, metaverses, and education. Virtual reality and learning.

Presentation of the special issue and conclusions

Visiones de espacios de trabajo tridimensionales o virtuales[1], metaversos, y educación. Realidad virtual y aprendizaje.

Presentación del número especial y conclusiones

Pierre Lévy
Université d'Ottawa.Otawa. Canadá
plevy@uOttawa.ca

Miguel Zapata-Ros
Universidad de Murcia. Murcia, España
mzapata@um.es

Abstract

The idea of this special issue was to give space to contributions that essentially included empirical research or development of technologies, such as inclusive virtual reality, and to analyze their influence on learning or its improvement. We were thinking of the metaverse, with the technology that it presents or with hypothetical new platforms that are emerging. The perspective was to improve and expand pedagogical possibilities in specific aspects, where it was more difficult to improve. This is the case with those offered by traditional symbolic systems, whose advantages are obvious and refined by tradition and culture: those related to learning and acquisition of reading and writing, learning and acquisition of abilities to produce computer codes (computational thinking) and, finally, those related to learning and acquisition of mathematical symbolic writing.
We briefly analyzed the problems and vicissitudes to deal with the novelty of the approach and possible doubts about the validity of the call for papers. It can be said that, although the monograph has brought together ten works of sufficient quality, most of the objectives set forth have not been achieved. Of the papers published here, four are exclusively about the metaverse. A very interesting one gives us an idea, after some conditions that guarantee its reliability, about the state of what is being done with metaverse in classroom practice in the design and implementation phases. Finally, there has been an aspect in which the objective has not been achieved at all, and this could cause us to reflect on some proposals made in terms of metaverse speculation. There was no contribution among the accepted papers or the many rejected manuscripts on the metaverse as a new code capable of supporting the communication and representation of thought or similar similar to how key codes, the basis of communication and learning, do so: alphabetic writing, writing through numerical codes and program codes, computational thinking.

Key words: metaverse, virtual reality, inclusive reality, computational thinking, symbolic languages.

[1] Metaverse description used by Karlsson, J. (2008) taken from Neal Stephenson's novel 'Snow Crash' (1992)

Resumen

Cuando se convocó, la idea de este número era dar espacio a contribuciones que esencialmente incluyesen alguna investigación empírica, o el desarrollo de tecnologías, como la realidad virtual inclusiva, analizando su influencia en el aprendizaje, o en su mejora. Pensábamos en metaverso, con la tecnología que se nos presenta o con las hipotéticas nuevas plataformas que fuesen surgiendo. La perspectiva era la de mejorar y ampliar posibilidades pedagógicas en aspectos concretos, donde era más difícil obtener mejora, como son las que ofrecen los sistemas simbólicos tradicionales. Cuyas ventajas son obvias y depuradas por la tradición y la cultura: las relacionadas con el aprendizaje y adquisición de la lectura y de la escritura, el aprendizaje y adquisición de habilidades para producir códigos informáticos (pensamiento computacional) y, por último, las relacionadas con el aprendizaje y la adquisición de la escritura simbólica matemática.

Analizamos sucintamente los problemas y vicisitudes para superar la novedad del planteamiento y posibles dudas sobre la validez de la convocatoria.

Se puede decir que, si bien el monográfico ha conseguido reunir diez trabajos de calidad suficiente, la mayor parte de los objetivos planteados no han sido conseguidos.

De los trabajos publicados, cuatro son exclusivamente sobre metaverso. Uno muy interesante que nos da idea, tras unas condiciones que garantizan su fiabilidad, acerca del estado de lo que se hace con metaverso en la práctica de aula en las fases de diseño e implementación.

Por último, ha habido un aspecto donde el objetivo no ha sido en absoluto conseguido, y eso podría hacernos reflexionar sobre algunas propuestas que en el plano de las especulaciones sobre metaverso se han hecho. No ha habido ninguna aportación, ni entre las contribuciones aceptadas ni entre las numerosas que se han rechazado, de metaverso como un nuevo código capar de soportar la comunicación y la representación del pensamiento y de las ideas similar a como lo hacen los códigos claves, base de la comunicación y del aprendizaje: La escritura alfabética, la escritura a través de códigos numéricos y la de códigos de programas, el pensamiento computacional.

Palabras clave: metaverso, realidad virtual, realidad inclusiva, pensamiento computacional, lenguajes simbólicos

When we presented the call for this special issue of RED a few months ago, we took into account, among other issues, the reasons that we present below:

The first is the compelling irruption of the metaverse, or what has been more precisely and rigorously defined as visions of three-dimensional or virtual workspaces, an example of which may be the *metaverse*, originally defined by (Stephenson, 1992, through Karlsson, 2008). This irruption also implies a strongly emphasized conceptualization of resource as an option for a new means of inclusive and interactional communication, which replaces or competes with symbolic codes whose learning and acquisition constitute and have constituted some of the key competencies for learning. This is the first challenge and the first theme that led us to propose this special issue.

Originally, it was proposed as a space for theoretical debate supported by empirical practices and research in which the limitations of the codes that they would hypothetically replace would be contrasted and discussed along with progress favored by the new space. Thus, our goal was to compare the codes that in successive revolutions have configured the means and key skills of communication and inculturation, with their consecutive literacies, and a hypothetical system of representation and communication with its predictable literacy, which is what arises with new communication and interaction support.

Therefore, this special issue intends to give space to contributions that essentially include some empirical research or the development and testing of a specific technology, namely inclusive virtual reality, and its influence or improvement on learning through this technology or hypothetical new platforms that are currently emerging. So far, we have mentioned specific aspects that are more difficult to improve, such as those that traditional symbolic systems offer, especially those related to learning and acquiring reading and writing, learning and acquiring abilities to produce computer codes (computational thinking) and, lastly, learning and acquisition of mathematical symbolic writing.

Despite the short time that has elapsed since the presentation of the metaverse, we also considered the acceptance of theoretical essays and critiques revolving around the politics and culture of educational innovation on these issues. Since we thought that the number of contributions would be limited, and closely linked to the first and second topics mentioned above, we decided to offer additionally a space for debate and presentation of research on virtual reality as a learning factor and its integration into instructional design schemes.

According to recent studies (Lee et al, 2010), desktop virtual reality (VR), but not only that modality, enhances and influences learning. Beyond the initial enthusiasm, some relevant constructs and various metrics to examine how virtual reality enhances learning have been identified. In addition, some models and hypothetical proposals have been analyzed, and an adequate adjustment and modeling has been carried out in the cases in which it was possible and convenient for learning. In those cases, the results supported the indirect effect of VR features on learning outcomes, which were mediated by both the interaction experience and the learning experience. Thus, we wanted to take the chance to find out what new results exist now about Virtual Reality as a learning factor and its integration into instructional design schemes.

With this monograph, we also wanted to present learning experiences that measure individually factors that influence learning, such as attendance, motivation, some cognitive aspects, control and active learning, and reflective thinking. In previous cases, they took center stage by affecting the results in the VR-based learning environment.

Although these ideas could seem excessively ambitious, we also propose to analyze the moderating effect of student characteristics, such as spatial ability and learning traits. The results can also be used by instructional designers and virtual reality software developers to improve the effectiveness of learning and strengthen implementation based on virtual reality and eventually new visions of three-dimensional or virtual workspaces of the metaverses.

It has been said that learning is a social (Onrubia, 2005) and situated phenomenon (Reigeluth, 2012; Merrill, 2007, 2009). We can consider what the Internet is like now. We interact with more people virtually than physically. As conceived by its creators (Stephenson, 1992, through Karlsson, 2008), metaverse would be one more step to go further to bond, if not identify, the physical and virtual worlds, mixing them both in a new

universe. The uniqueness is now that the space, the set of connected social applications, the hardware and software that support them, and the set of interconnected maximalist experiences, in its latest version the one presented by Zuckerberg (Newton, June 2021), would be managed by the company that manages to impose its metaverse, which obviously will not be just one. The pedagogy and study of learning possible with metaverse is something that is starting now.

Lastly, we wanted to provide a space to talk about the symbolic systems of communication and symbolic representation, taking into account that one of the stakes, and challenges is that the metaverse replaces or complements the existing codes to support and transmit knowledge and it becomes the means of relation and communication, just as reading, writing, arithmetic and, more recently, computational thinking are now.

Symbolic codes and literacies, including those that support reading, writing, and arithmetic and computational thinking, have already been already discussed (Pérez-Paredes & Zapata-Ros, 2018; Moreira Teixeira and Zapata-Ros, 2021; Zapata-Ros, 2015). Now it would be worth debating which of these features are equally attributable to the role of mediation in the same way that these visions of three-dimensional or virtual work spaces can contribute or counterpose as an alternative.

Today we present the results.

In summary, it can be said that, although this special issue collected ten papers of adequate quality, most of the original objectives have not been achieved. It would be lengthy and the analysis would go beyond the objectives of a presentation. However, we will point out some notes.

We launched the call for contributions exactly one year ago. In the time since then, the call has been widely disseminated through the usual means to the international and Hispanic scientific community in education and technology, with direct and personalized calls to colleagues who we know work on these issues. Therefore, it cannot be said outright that dissemination has been limited or insufficient. It could be argued, however, that the journal lacks sufficient quality or entity. However, the publication of quality evaluations and indicators from agencies in May-June, with Q2 in SJR (p73), JCR-JCI and Q1 in CiteSacore, classification by index, do not clearly support this hypothesis.

Therefore, one might think that we do not have a sufficient amount of research, or even a theoretical elaboration based on it, beyond what is speculative or what is biased to support any of the assumptions made. Nevertheless, the results are still interesting. Therefore, in the end, ten works are being published, among which some indeed do address the metaverse.

There is a systematic review of the literature by López-Belmonte et al (2023), which is exhaustive and covers17 articles, of which only a few provide empirical evidence on the use of metaverse. The objectives of the studies are related to the implementation of the resource and the educational design, but not clearly to the learning results in any case:

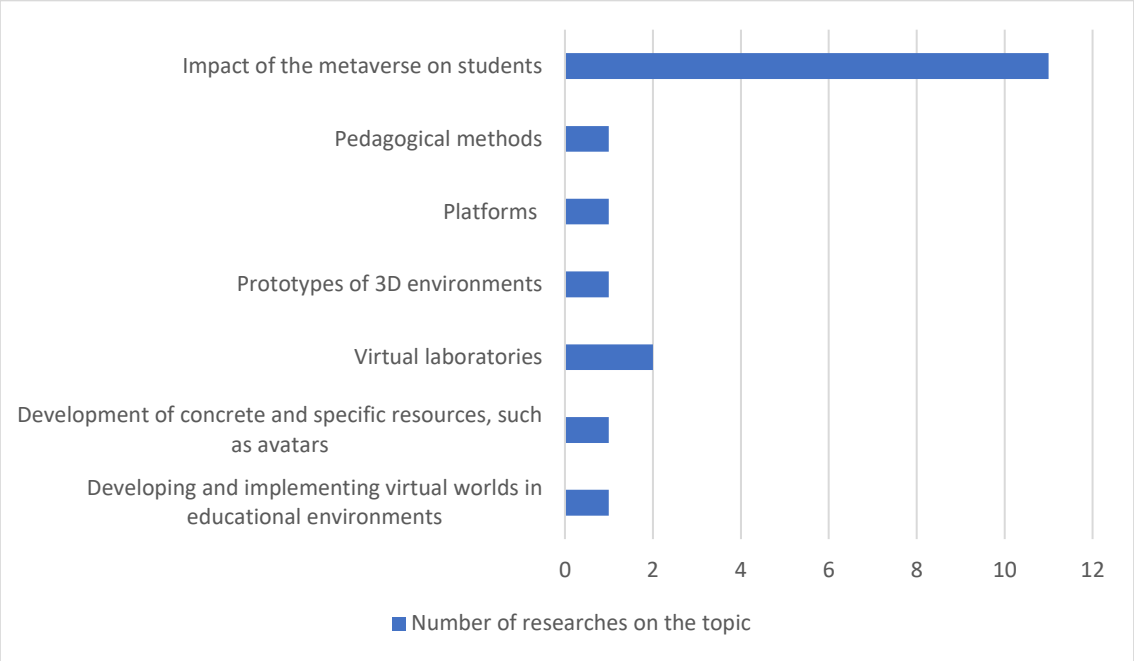
> *Regarding which have been the most relevant objectives in the documents on the educational metaverse (RQ2), the objectives presented in the various research studies on the metaverse in education are varied. On the one hand, they are about analyzing the problems and challenges that arise when designing, developing and*

implementing virtual worlds in educational environments (Díaz et al., 2020). On the other hand, they focus on the development of concrete and specific resources, such as avatars (Schlemmer et al., 2009), virtual laboratories (Clark, 2012; Schaf et al., 2012; Tarouco et al., 2013), platforms (García, 2011b), prototypes of 3D environments (Arcila, 2014) or pedagogical methods (Díaz et al., 2020). The rest of the research focuses on identifying the impact of the metaverse on students (figure 2).

In the best case:

To observe the effect (sic) of metaverse on the comprehension of a subject as well as identifying the difficulties that students and teachers may experience during the integration of metaverse into the educational process (Rodríguez-García et al., 2020)

The results are as follows (Belmonte et al, 2023):



In empirical research, there is a contribution at the limit of what could be the metaverse, though not declared as such, and immersive virtual reality, the object of the work by Lorenzo Lledó, Lorenzo-Lledó, Lledó Carreres and Pérez-Vázquez (2023) on *"creación de un entorno de realidad virtual inmersiva para la comunicación e interacción social en alumnado con trastorno del espectro autista"* ("the creation of an immersive virtual reality environment for communication and social interaction in students with autism spectrum disorder."

In the same sense, there is a contribution that is a case study of implementation of a resource and its analysis. This is an exploratory study on a metaverse created specifically to teach a subject, which analyzes particular aspects of how that metaverse affects collaborative work (López Solórzano and Ángel Rueda, 2023).

The work by Valdés Godínes and Angel Rueda (2023) is especially remarkable since it does not deal with the educational implementation of immersive virtual reality or the metaverse in education, but instead with the design of tools for teaching programming. The article falls within learning engineering applied to the teaching of programming. It is a very useful contribution in this field.

The six remaining articles do not deal with the metaverse or with immersive three-dimensional virtual reality environments.They address the option included in the call for proposals on virtual reality and computational thinking. These exceptional works could have originated a fourth RED monograph on computational thinking.

Finally, it is worth highlighting an aspect where our objective has not been achieved at all, and that could make us reflect on some proposals that have been made in terms of speculation about the metaverse. Despite what has been said above, there has been no contribution among the accepted contributions or among the many that have been rejected that has proposed the metaverse as a new form, a new code, capable of supporting communication and representation of thought and ideas similar to the key codes, the basis of communication and learning, alphabetic writing, writing through numerical codes, and program codes, that is, computational thinking.

Received: January 9, 2023
Accepted: January 9, 2023
Published: January 31, 2023

Lévy, P. & Zapata-Ros, M. (2023). Visions of three-dimensional or virtual workspaces, metaverses, and education. Virtual reality and learning *RED. Distance Education Journal, 23*(73). DOI http://dx.doi.org/10.6018/red.554591

Acknowledgement

To Jesús Garcia Laborda PhD, University Professor and member of the Department of Modern Philology at the University of Alcalá de Henares and to Mary Frances Litzler PhD, Honorary Lecturer of the Department of Modern Philology at the University of Alcalá de Henares, for the translation, adaptation and cohesion of the Spanish and English versions of the article

Funding

The present work has not been funded by any external institution.

References

López-Belmonte, J., Pozo-Sánchez, S., Moreno-Guerrero, A.J., & Lampropoulos, G. (2023). Metaverse in Education: a systematic review. *RED. Revista de Educación a Distancia, 23*(73). http://dx.doi.org/10.6018/red.511421

Karlsson, J. (2008). Taking Care of Xerox Business—Virtually. *Research-Technology Management, 51*(1), 15-18. https://www.tandfonline.com/doi/abs/10.1080/08956308.2008.11657479

Lee, E. A. L., Wong, K. W., & Fung, C. C. (2010). How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach. *Computers & Education*, *55*(4), 1424-1442.

López-Belmonte, J., Pozo-Sánchez, S., Moreno-Guerrero, A.J., & Lampropoulos, G.(2023). Metaverse in Education: a systematic review. RED. Revista de Educación a Distancia, 23(73). http://dx.doi.org/10.6018/red.511421

López Solórzano, J.G. y Ángel Rueda,C.J.(2023). Revisión sistemática de los entornos digitales inmersivos tridimensionales en la enseñanza de la programación. RED. Revista de Educación a Distancia, 23(73). http://dx.doi.org/10.6018/red.540731

Lorenzo, G.,Lorenzo-Lledó, A., Lledó, A., &Pérez-Vázquez, A.(2023). Creación de un entorno de realidad virtual inmersiva para la comunicación e interacción social: estudio piloto en alumnado con trastorno del espectro autista. RED. Revista de Educación a Distancia, 23(73).http://dx.doi.org/10.6018/red.539141

Merrill, M. D. (2007). First principles of instruction: A synthesis. In R. A. Reiser & J. V. Dempsey (Eds.), Trends and issues in instructional design and technology (2nd ed., pp. 62-71). Upper Saddle River, NJ: Merrill/Prentice-Hall.

Merrill, M. D. (2009). First principles of instruction. In C. M. Reigeluth & A. A. CarrChellman (Eds.), Instructional-design theories and models: Building a common knowledge base (Vol. III, pp. 41-56). New York: Routledge.

Moreira Teixeira, A. y Zapata-Ros, M. (2021). Introducción / presentación al número especial de RED "Transición de la educación convencional a la educación y al aprendizaje en línea, como consecuencia del COVID19". Revista Educación a Distancia (RED), 21(65). https://doi.org/10.6018/red.462271

Newton, C. (June 2021) MARK IN THE METAVERSE. *The Verge*. https://www.theverge.com/22588022/mark-zuckerberg-facebook-ceo-metaverse-interview

Onrubia, J. (2005). Aprender y enseñar en entornos virtuales: actividad conjunta, ayuda pedagógica y construcción del conocimiento. *Revista de Educación a distancia (RED)*.

Pérez-Paredes, P., & Zapata-Ros, M. (2018). El pensamiento computacional como alfabetización de la cultura digital. RED. Revista de Educación a Distancia. Núm. 58 DOI: http://dx.doi.org/10.6018/red/58/0 https://www.um.es/ead/red/58/Presentacion_pensamiento_computacional.pdf

Reigeluth, C. M. (2012). Instructional theory and technology for the new paradigm of education. *RED. Revista de Educación a distancia*.

Rodríguez-García, A.-M., Moreno-Guerrero, A.-J., & López-Belmonte, J. (2020). Nomophobia: An Individual's Growing Fear of Being without a Smartphone—A Systematic Literature Review. *International Journal of Environmental Research and Public Health, 17(2)*, 1-19. https://doi.org/10.3390/ijerph17020580

Stephenson, N. (1992). *Snow Crash*. Penguin.

Valdés Godínes, J. C., & Ángel Rueda, C. J. (2023). *El trabajo colaborativo en los EDIT, explorando el aprendizaje inmersivo en el metaverso*. RED. Revista de Educación a Distancia, 23(73). http://dx.doi.org/10.6018/red.539671

Zapata-Ros, M. (2015). Pensamiento computacional: Una nueva alfabetización digital. *Revista de Educación a Distancia (RED)*, (46). Recuperado a partir de https://revistas.um.es/red/article/view/240321