TECHNOLOGIES IN EDUCATION: TEACHERS' PERCEPTIONS OF VIRTUAL AND AUGMENTED REALITY IN THE CLASSROOM

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ABSTRACT

This research aimed to analyze the impact of the use of immersive technologies, such as virtual reality (VR) and augmented reality (AR), on the teaching-learning process in the classroom. The methodology adopted was descriptive and qualitative, with a sample composed of 15 education professionals from different levels of education, who were interviewed through questionnaires and semi-structured interviews. The results indicated that these technologies promote greater student engagement, facilitate the visualization of complex concepts and stimulate active learning, in addition to favoring collaborative work.

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However, challenges were also pointed out, such as the lack of adequate infrastructure, the need for continuous training of teachers and the difficulty of ensuring accessibility to all students, especially those with special needs. The conclusion of the research points out that, although the use of VR and AR has great potential to transform teaching, its success depends on overcoming these obstacles, requiring investments in technological resources, training of educators and adaptation of content for inclusive contexts.

Keywords: Technologies. Education. Virtual and augmented reality.

INTRODUCTION

Education has been an ever-evolving field, especially with technological advancements transforming the way teaching and learning are carried out. The use of new technologies in the educational process offers opportunities to innovate traditional methodologies, making classes more dynamic, interactive, and often more accessible. Among the most promising technological innovations in the educational field, virtual reality (VR) and augmented reality (AR) stand out, which have gained increasing attention due to their potential to transform the educational experience (Cipriani; Eggert, 2017).

Virtual and augmented reality are immersive technologies that enable the creation of virtual environments and the superimposition of digital elements in the real world, respectively. In virtual reality, users are completely immersed in a computer-generated environment, while in augmented reality, virtual objects are integrated into the physical environment, providing a more enriching and engaging interaction. Both technologies have been used in different contexts, such as medicine, engineering, architecture, but in recent years they have also been explored in the school and academic context (Cox; Bittencourt, 2017).

The use of these technologies in the classroom can be considered a pedagogical revolution, as it allows students to have experiences that would be impossible or difficult to provide by traditional methods. For example, through virtual reality, students can explore the seabed, travel to space, or even experience historical events, all without leaving the classroom (Cruz Junior, 2017).

Augmented reality, in turn, can transform conventional teaching materials, such as books and maps, into interactive and multimodal resources, offering a deeper and more visual understanding of the contents. These technologies also have the potential to promote the personalization of learning. Different learners have different learning paces and styles, and VR and AR offer ways to tailor content to suit their needs. Through simulations and educational games, it is possible to create more practical learning experiences, which stimulate engagement, creativity, and problem-solving (Ferraz, 2020).

In addition, the immersion provided by these technologies can increase student motivation, as the experiences are more engaging and enjoyable. However, the implementation of virtual and augmented reality in schools still faces significant challenges. The infrastructure required to adopt these technologies requires investments in specialized equipment such as virtual reality glasses, mobile devices, cameras, and sensors. In addition, training teachers to use these tools effectively is crucial for technologies to really bring benefits to the educational process. The lack of specific training and the fear of using

new tools can be obstacles that hinder the adoption of these pedagogical innovations (Ferraz, 2020).

Another factor that must be considered is the impact of these technologies on the cognitive and social development of students. The immersion provided by VR and AR can be extremely beneficial, but it can also generate dependency or distraction if not used in a balanced way. It is essential that educators closely monitor the use of these technologies and integrate them in a way that favors active learning, without compromising students' social interaction and critical reflection (Cipriani; Eggert, 2017).

In view of the above, the objective of this research was to analyze the impact of the use of immersive technologies, such as virtual and augmented reality, in the teaching-learning process within the classroom. The research sought to understand how these tools can be efficiently integrated into the school curriculum, identify their benefits in student engagement and performance, and discuss the challenges faced in the implementation of these technologies in educational institutions.

METHODOLOGY

The research was developed through a descriptive and qualitative approach, in order to understand the perceptions and experiences of education professionals about the use of immersive technologies, such as virtual and augmented reality, in the classroom. The choice for descriptive research aimed to record the characteristics and phenomena related to the implementation of these technologies in teaching, without the intention of manipulating or controlling the variables involved. The qualitative approach, in turn, allowed for an in-depth and interpretative analysis of the data, focusing on the subjective experiences of the participants (Lima; Domingues Junior; Gomes, 2023; File; Domingues Junior; Silva, 2024; File; Silva; Domingues Júnior, 2024; Kvitko; Parisotto; Baldissarelli, 2024).

The sample was composed of 15 education professionals, who were selected from different public and private schools, covering different levels of education, such as elementary and high school. These professionals were chosen because they have previous experience or interest in the use of immersive technologies in the educational process. The selection of the sample was intentional, seeking to represent a variety of perspectives on the use of virtual and augmented reality in pedagogical practices.

Data collection was carried out through semi-structured interviews, in which participants were invited to share their experiences, challenges, and perceptions about the use of virtual and augmented reality in their classes. The interviews were recorded and

transcribed in full, allowing a detailed analysis of the professionals' answers. In addition, questionnaires with open questions were applied to complement the interviews, in order to obtain more detailed and varied information on the topics addressed.

The interviews were conducted in individual meetings, in which the participants were able to freely express their opinions and feelings about the impact of technologies on teaching. The questions addressed topics such as the integration of immersive technologies into the school curriculum, the perceived benefits, the difficulties encountered and the changes in teaching methodologies. Data collection was carried out over a three-month period, ensuring that participants had enough time to reflect on their experiences and provide detailed responses.

Data analysis was performed based on the content analysis technique, which allowed categorizing the participants' responses into recurring themes and identifying patterns in the professionals' opinions. The transcripts of the interviews and the data from the questionnaires were organized and analyzed, seeking to understand the trends and divergences in the opinions of professionals about the use of immersive technologies. The results were analyzed in the light of the existing literature, allowing a richer and more grounded interpretation of the subject.

RESULTS AND DATA ANALYSIS

The survey results revealed a number of interesting insights into the use of immersive technologies in the classroom, specifically virtual reality (VR) and augmented reality (AR). According to Respondent E3, a high school science teacher, "The introduction of virtual reality into biology classes has provided students with a much deeper understanding of the concepts. For example, 3D simulation of a cell allows them to visualize and interact with cellular structures in a way that the textbook simply can't offer."

E3's opinion was shared by other science teachers, who highlighted how these technologies help in the visualization of complex biological processes, such as photosynthesis or mitosis, making the content more accessible and interesting. Respondent E01, who works as a history teacher, highlighted the importance of augmented reality in the context of History classes. He stated that "using the AR application, I can project figures of historical artifacts directly into the classroom environment, allowing students to observe virtual replicas of utensils and monuments, such as the Colossus of Rhodes, while learning about the historical context of that time".

E01's opinion was reinforced by other professors of humanistic disciplines, who reported that the use of AR facilitates the contextualization of historical events, promoting a

more immersive and interactive experience. The interaction between students and the content was also a point highlighted by many of the interviewees. According to Respondent E7, an elementary school math teacher, "By using augmented reality to teach geometry, students can manipulate geometric figures in 3D, which makes it easier to understand concepts such as areas and volumes. Before, this was difficult to explain only with two-dimensional drawings." She also highlighted the relevance of AR for the development of spatial reasoning, an essential skill for learning mathematics.

However, some challenges were pointed out in relation to the implementation of these technologies. Respondent E5, who works as a pedagogical coordinator, reported: "Despite the enthusiasm of the teachers, the lack of infrastructure in schools is a major obstacle. Many of our students do not have adequate devices to utilize augmented reality effectively, and this hinders the full application of the technology." This testimonial was shared by several other participants, who mentioned the urgent need for investments in mobile devices, virtual reality glasses, and systems suitable to support these immersive technologies.

Another aspect that was frequently mentioned was the need to train teachers for the proper use of these technologies. Respondent E10, a Portuguese language teacher, stated, "At first, I had difficulties incorporating virtual reality into my classes because I didn't know where to start. However, after participating in a training course, I was able to understand how to apply the tools more effectively, and today I see that the reaction of the students is very positive".

The lack of specific training was, in fact, a common concern among the participants, who indicated the need for more continuous training programs to ensure the appropriate and efficient use of these technologies. The issue of student motivation was also highlighted in several reports. Respondent E2, a physics teacher, shared, "I've noticed that students are much more motivated and engaged when they can explore physics concepts through virtual reality simulations. They love the idea of performing experiments that would be impossible in the lab, such as simulating free falls or interacting with the laws of physics in controlled environments."

Other participants reinforced that the use of VR and AR has helped to increase students' interest in the content covered, creating a more engaging learning environment. On the other hand, Respondent E12, a geography teacher, made an important observation about the impact of technologies on collaborative learning. He mentioned, "During the utilization of AR in interactive maps, I observed that students were more willing to collaborate with each other. They formed groups to explore different aspects of the maps

and discuss how geography influences the cultural and economic aspects of a region." This change in student behavior was seen as an advantage of using these technologies, which stimulate the exchange of ideas and active learning.

The integration of virtual reality in art classes was also highlighted by some teachers. Respondent E9, a visual arts teacher, commented, "We used virtual reality so that students could explore famous museums around the world without leaving the classroom. They were impressed to see works by Van Gogh and Picasso up close, which made discussions about the characteristics of each artistic movement much richer." Other respondents reported similar experiences where virtual reality helped create a deeper connection with artistic content.

In terms of evaluation, teachers realized that the use of immersive technologies contributed to a more detailed monitoring of student progress. Respondent E4, a literature teacher, explained: "With the AR tools, I was able to observe how students interacted with texts in a more critical way, for example, when visualizing characters or scenarios from literary works. This helped me adjust my pedagogical approaches more precisely." This ability to evaluate more deeply was considered a significant advantage of these technologies.

However, despite the advantages, some professionals mentioned the challenges related to maintaining and updating the tools. Respondent E8, a computer science teacher, stated, "Virtual reality devices are expensive to maintain, and often the school budget does not cover the upgrades needed to keep the equipment working properly. This becomes a major obstacle to continued and effective use." The concern with the sustainability of the use of these technologies was a recurring criticism among the interviewees.

The issue of accessibility was also raised in relation to the use of augmented reality. Respondent E15, a special education teacher, reported, "In my experience with visually impaired students, I realized that augmented reality can be difficult to apply inclusively. However, with adaptations and the use of audio devices, we were able to develop activities that facilitate the learning of these students, allowing them to interact with the content more effectively".

The search for inclusive solutions was highlighted as an important concern by the survey participants. Respondent E6, who teaches in a public school, made an observation about the impact of technologies on the classroom environment. "The introduction of virtual and augmented reality in my school has generated a more dynamic and collaborative environment. Although there is still resistance from some more traditional teachers, the students demonstrate an enthusiasm that is difficult to replicate with conventional methods."

This change in classroom climate was seen as a reflection of the transformative potential of these technologies.

The survey also showed that, despite the difficulties, most professionals believe that investment in immersive technologies is an inevitable and essential trend for the future of education. Respondent E13, a chemistry teacher, summed up this view: "We know that immersive technologies are still a luxury for some schools, but I believe that they will soon be as common as the whiteboards and projectors we use today. We need to prepare for this future." This optimism was shared by several interviewees, who see the current difficulties as challenges to be overcome over time.

FINAL CONSIDERATIONS

The research showed that the use of immersive technologies, such as virtual and augmented reality, can significantly enrich the educational experience, offering students a more dynamic, interactive, and personalized approach. Teachers' reports indicated that these technologies are effective in engaging students, especially when used to illustrate complex concepts or provide practical experiences that would be difficult to accomplish with traditional resources. Additionally, the use of VR and AR has been widely praised for its ability to promote active learning and collaboration among students.

However, the implementation of these technologies faces considerable challenges, such as the lack of adequate infrastructure and the need for continuous teacher training. The scarcity of financial resources in schools was cited as one of the biggest obstacles to the full adoption of these technologies. Many respondents reported that while they recognize the value of innovation, budgetary reality limits the expansion of the use of VR and AR in classrooms. Investment in mobile devices and specialized equipment, as well as their constant updating, are critical issues for these tools to be used effectively.

The training of teachers was also highlighted as an essential point for the success of the integration of these technologies. Many professionals indicated that by receiving adequate training, they felt more confident to explore the possibilities offered by virtual and augmented reality. This suggests that, for the implementation to be successful, it is essential to invest in the training of educators who can use these tools strategically, without losing focus on the development of students' cognitive and social skills.

In addition, the study pointed out that the use of these technologies can generate significant motivation among students, especially in areas of knowledge that are more abstract or difficult to visualize. Augmented reality, for example, can make concepts such as geometry or biology much more palpable, promoting deeper learning. However, the

research also revealed that careful balance is needed to prevent students from becoming distracted or overly reliant on technology, compromising the development of other important skills.

Regarding inclusion, research has shown that while immersive technologies offer great advantages, they also present challenges in ensuring accessibility to all students, especially those with special needs. Some adaptations are needed to make these tools effective in inclusive contexts, but with proper support, it is possible to create a more equitable learning environment.

Therefore, the research concludes that while immersive technologies such as virtual and augmented reality represent a significant advance in education, their success depends on overcoming challenges such as insufficient infrastructure, teacher training, and adaptation to inclusive contexts. The future of education requires an increasing integration of these tools, but this will only be possible with the commitment of schools, governments and communities to ensure broader and more efficient access to these technologies.

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