International Journal of Learning, Teaching and Educational Research
Vol. 24, No. 4, pp. 354-369, April 2025
https://doi.org/10.26803/ijlter.24.4.17
Received Jan 21, 2025; Revised Apr 4, 2025; Accepted Apr 7, 2025

Levels of Virtual Reality Immersion and their Use in Education: A Systematic Literature Review

Karla Esther Espinoza Castro
Universidad Nacional de Educación (UNAE)
Azogues, Ecuador

Jheyson Steven Gaona Pineda
Universidad Católica de Cuenca (UCACUE)
Cuenca, Ecuador

Diego Eduardo Apolo Buenaño
Universidad Nacional de Educación (UNAE)
Azogues, Ecuador

José Luis Plaza Chalco
Universidad Nacional de Educación (UNAE)
Azogues, Ecuador

Abstract. Virtual reality transforms traditional educational paradigms by offering dynamic and personalized spaces focused on students' needs. Thus, it is crucial to understand the different levels of immersion for effective and practical implementation in educational contexts. This article aimed to identify and analyze three levels of virtual reality and its characteristics in the academic context, and examined its particularities and advantages. The researchers conducted a systematic literature review following the preferred reporting items for systematic reviews and meta-analyses protocol to attain this objective. Using the SCOPUS database, the researchers analyzed academic articles related to different levels of virtual reality immersion published from 2014 to 2024 in English and Spanish. These articles were selected using descriptors associated with the use of virtual reality in education, double-blind peer review, and empirical studies about virtual reality implementation in educational contexts. This resulted in identifying 58 articles; however, of this number, 23 fulfilled all the inclusion criteria. The results showed that three levels of immersion positively impact students' learning results. The non-immersive virtual reality offers a balance between accessibility and improved interaction, while semi and fully immersive virtual reality provide experiences that enhance students' motivation and knowledge retention, particularly in areas such as medicine and science. The three different virtual reality levels offer various learning options and advantages, from accessibility and low cost, to fully immersive experiences. Nevertheless, more research is needed regarding the accessibility of virtual reality and its role in pre-service education to optimize its use in education.

Keywords: Virtual reality; educational technology; teaching methods; pedagogical innovation; interactive learning.

1. Introduction

The current society is characterized by digital transformation and knowledge management, information and communication technologies, particularly virtual reality (VR). These aspects are changing traditional educational paradigms (Marougkas et al., 2023). Conversely, conventional educational methods work with limited resources and physical static methods. Thus, there is a need to introduce change and innovation.

Consistent with modern times, digital simulation tools allow teachers to create dynamic, personalized learning spaces, focusing on each student's needs (Merchant et al., 2014). In these spaces, students can interact safely in real-time, optimizing learning processes and significantly reducing the costs of materials, equipment, and instruments needed in real-life situations. According to Espinoza et al. (2024), VR facilitates the implementation of complex experimental practices that helps students immerse in virtual environments.

The level of immersion, a fundamental concept of VR, refers to the system's capacity to stimulate users' senses by facilitating their interactions with the feeling of a physical presence in the virtual environment. The literature has identified three primary levels: non-immersive, semi-immersive, and fully immersive. Each of these levels has specific characteristics and applications. Thus, understanding how these levels operate is essential for VR's practical implementation and application development in diverse fields such as education, medicine, engineering, and professional development (Rojas et al., 2022; Vergara et al., 2017).

The versatility of VR has transformed the way different academic disciplines are taught. For example, sciences, engineering, architecture, psychology, linguistics, and medicine are introducing VR in their teaching methods. For this reason, this technology has transcended its initial perception as an entertainment tool. Nowadays, VR has become a versatile pedagogical facilitator that can be used in formal and autonomous learning contexts due to its capacity to simulate controlled scenarios, making it an ideal tool for training situations, especially when they have to be carried out in dangerous or impracticable real contexts (Espinoza et al., 2024; De Fino et al., 2022; Rivera et al., 2019; Rubio et al., 2023).
Considering this technology's relevance and transformational potential, this study aimed to identify and systematically analyze the VR levels and their characteristics and uses in educational contexts. Additionally, through a systematic literature review based on empirical evidence, the researchers examined the characteristics of each immersion level and their advantages,

applicability, and efficacy in different contexts. The results explain how the different immersion levels enrich users' experience based on educational potential and practical relevance in schools.

2. Materials and Methods

This study employed the preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol. Urrútia and Bonfill (2010) recommended using PRISMA because it establishes guidelines to guarantee the transparency and replicability of results. The systematic revision had four main phases: identification, screening, inclusion, and exclusion, as explained in Figure 1.

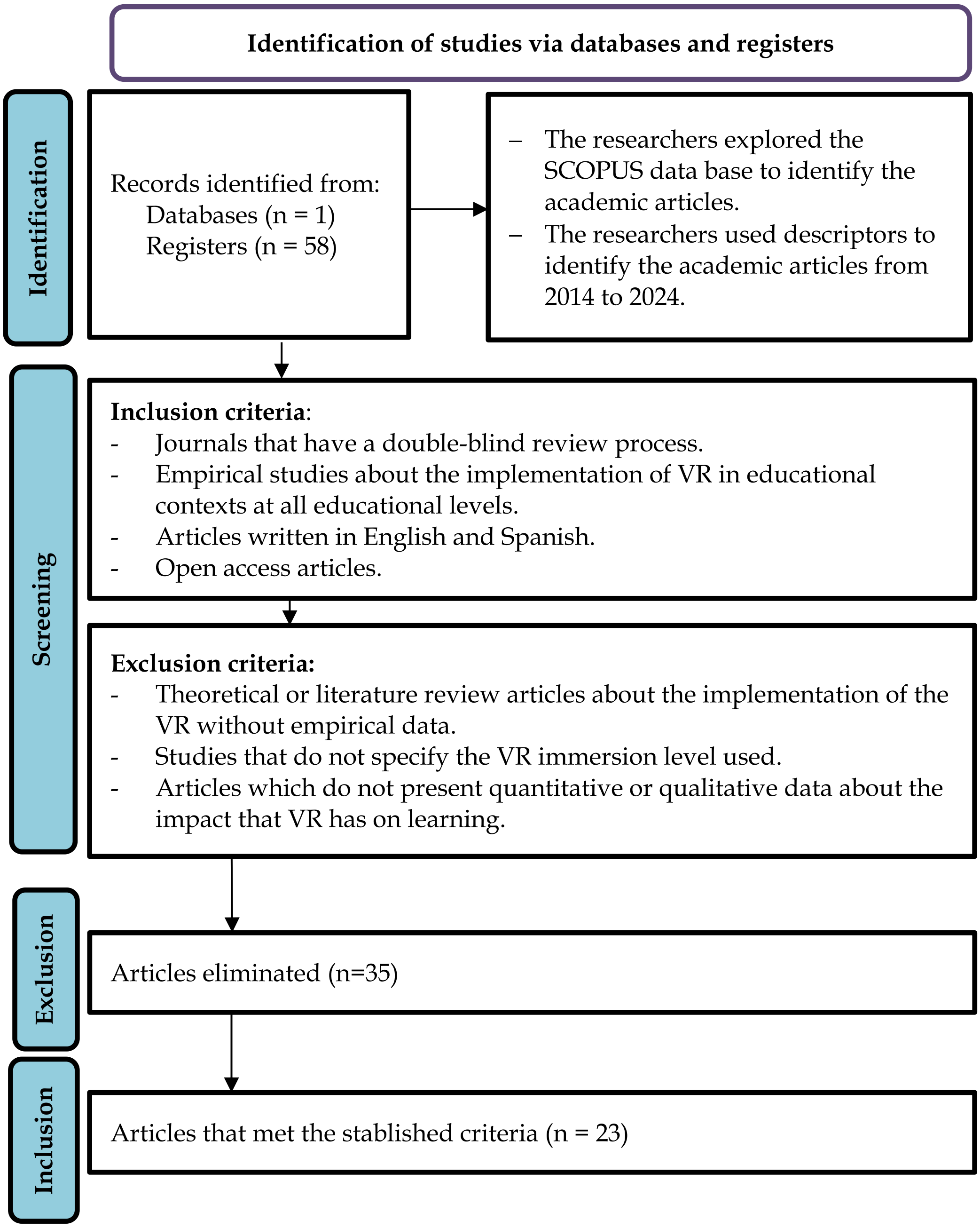

Figure 1: PRISMA protocol process

2.1 Identification

Using the SCOPUS database, the researchers systematically searched academic articles related to VR and its use in education. This database was selected because it is one of the primary sources of international scientific literature, which is blind peer reviewed. Furthermore, the researchers established a period of 10 years (from 2014 to 2024). The search strategy was structured using the following combination of Booleans descriptors and operators: TITLE-ABS-KEY ("virtual reality" OR "realidad virtual") AND ("education" OR "learning" OR "teaching" OR "educación" OR "aprendizaje" OR "enseñanza") AND PUBYEAR > 2013 AND PUBYEAR < 2025 AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (OA, "all")).

With regards to the inclusion and exclusion criteria, the researchers established the following: 1) articles published in academic journals that have a blind peer review process, 2) empirical studies about the implementation of VR in educational contexts at all educational levels, 3) English and Spanish publications that analyze the VR immersion levels and its impact on learning, 4) open-access articles published from 2014 to 2024. Journals that have a blind peer review process guarantee that the accepted studies have high quality. Selecting empirical studies provided experiential information that showed a practical use of VR. Regarding the language, the researchers carried out this study in Ecuador, where the official language is Spanish. Thus, articles in this language were chosen; the selection of English was because it is a global language. Finally, considering accessibility, open- access articles were selected.

The exclusion criteria were: 1) theoretical or literature review articles about the implementation of the VR without empirical data, 2) studies that do not specify the VR immersion level used, and 3) articles that do not show quantitative or qualitative data about the impact of VR on learning. The theoretical articles were excluded because they did not provide experiential data regarding the application of VR in education. Since these articles remain theoretical, it was difficult for the researchers to infer the actual use of the different levels of VR immersion in education. In the same manner, the researchers excluded articles without data since the conclusions and recommendations of the articles were not data-driven.

2.2 Screening

Following the methodology proposed by Apolo et al. (2018), in which he proposed an initial review of the titles and abstracts of the selected scientific articles to verify whether they met the selection criteria, the researchers read the titles and abstracts of the relevant studies to identify and analyze the characteristics of the different VR immersion levels and organized the articles to proceed with the next phase.

2.3 Inclusion

Following the inclusion criteria, the researchers selected 23 articles and made a thorough text analysis. For this analysis, the researchers considered the following aspects: 1) author, 2) publication year, 3) country of origin, 4) educational level of implementation, 5) VR level of immersion used, 6) objectives of the study, and 7) main results.

In a second level of analysis, the researchers grouped the results of the selected articles in three main categories, namely, 1) the effectiveness of the VR levels of immersion in educational contexts, 2) the characteristics and benefits of each VR level, and 3) application and challenges of the application of the VR levels.
The articles selected are presented in Table 1 and the subsequent results are presented in the results and discussion sections.

Table 1: Selected articles based on the inclusion criteria

Authors and Publication Date	Type of VR Used	Title	Highlights of the Article
Vergara et al., 2017	Immersive and non-immersive VR	On the Design of VR Learning Environments in Engineering	Application of non-immersive VR on engineering students. Shows individualized and collaborative learning suggestions facilitated by immersive VR.
Tepe et al., 2018	Non-immersive VR	VR Applications in Education	VR applications in education and the benefits that technology based on VR has on creating a real digital environment for students.
Mas et al., 2022	Fully immersive VR	Digitization and VR projects in archaeological heritage. the case of the archaeological site of Motilla.	Accessibility of VR to historical sites. Promotion of historical education with cost reduction.
López et al., 2019	Fully immersive VR	Digital competence of future teachers to carry out a process of teaching and learning through VR	VR helps increase students' digital, information, literacy, and communication competencies. VR allows teachers to create digital content that helps students develop their capacity to solve problems.
Alemán 2023	Non-immersive, semi-immersive, and fully immersive VR	Mesh retopology applied to three dimensional (3D) models of cultural heritage for interactive visualization enhancement in VR and augmented reality	The developed models for interactive museums have high quality and low cost. VR allows users to have an interactive visualization of virtual objects.
Codina et al., 2022	Fully immersive VR	Polyhedral with Neotrie VR immersive VR software, an experience with prospective teachers	NeoTrie VR improves the identification of polyhedral, reduces errors and promotes significative learning.
Paíno and Rodríguez, 2020	Fully immersive VR	From passive to experiential spectator: VR in sports information	The immersive narratives transform spectators in active participants. Priority is given to the experience over the information. Promotes advanced interaction.
Rodriguez et al., 2024	Fully immersive VR	Immersive VR and its influence on physiological parameters in healthy people	The VR intervention showed significant physiological increase. High satisfaction among patients, safety and minimum adverse effects.
Rubio et al., 2023	Non-immersive and fully immersive VR	VR teaches cardiopulmonary reanimation in primary education. A comparative study.	Key ideas of how non-immersive VR minimizes the risks of medicine practicum in real environments and maximizes the acquisition of competencies and skills. Benefits of fully immersive VR to enhance collaborative and individualized learning.
Yarin and Garrana, 2023	Non-immersive VR	VR and its effect on spatial ability: a case study	How the use of VR in non-immersive 3D activities helped students develop their spatial ability and their capacity to

		focused on the teaching of descriptive Geography.	comprehend and retain knowledge as well as students' commitment.
Moral et al., 2023	Non-immersive VR	Use of VR in Geometry to develop spatial skills.	How immersive contexts of VR help the comprehension of spatial abilities and improve students' errors.
Rivera et al., 2019	Non-immersive VR	Digital application as didactic tools to study Medic Parasitology.	Efficacy of non-immersive VR applications in motivating students to study parasitology.
Markowitz et al., 2018	Fully immersive VR	Immersive VR Field Trips Facilitate Learning About Climate Change	Utility of fully immersive VR to evaluate social and psychological phenomena in education. Low-cost experiments based on VR that resemble real-life experiences.
Bonilla and Fajardo, 2020	Semi-immersive VR	The movie without frames: a scale proposal for implication narratives in VR .	Benefits of semi-immersive VR to improve students' interests and cooperative learning.
De Fino et al., 2022	Semi-immersive VR	Dissemination, assessment, and management of historic buildings by thematic virtual tours and 3D model	Semi-immersive VR helps with security and control in practical and theoretical learning.
Colussi and Reis, 2020	Semi-immersive VR	Immersive journalism. A narrative analysis of VR.	Benefits of using VR in educational contexts.
Herranz de la Casa et al., 2019	Semi-immersive and fully immersive VR	VR in 360º videos in enterprise and institutional communication.	Use of VR in education, communication, and marketing. Suggests devices to use when creating immersive contexts.
Christopoulos et al., 2024	Semi-immersive VR	The Impact of Immersive VR on Knowledge Acquisition and Adolescent Perceptions in Cultural Education.	Advantages of using semi-immersive VR in different fields.
François et al., 2021	Fully immersive VR	VR as a versatile tool for research, dissemination, and mediation in the humanities	The use of fully immersive VR to digitally reconstruct an XVIII theater avoids possible dangers to people.
Campo et al., 2021	Fully immersive VR	Immersive VR in older people: Case study	Positive, entertaining and useful experience. Participants were willing to repeat the experience and to recommend it.
González and Mesías, 2023	Fully immersive VR	VR for the teaching and learning of perspective in drawing	Design an innovative methodology based on VR to teach perspective in artistic drawing. Improve visual perception and spatial comprehension through immersive experiences. Improvement of chronic perspective, motivation and self-learning. More effective in improving grades compared to traditional methods.
Hernández and Garcia, 2023	Fully immersive VR	I enjoy 360° video news more but understand them less! Gratification gained in VR journalism research	360° offers enjoyment and satisfaction. Traditional formats are more effective in transmitting knowledge and comprehension without differences between creativity and empathy.
Marin and Gea, 2022	Non-immersive and fully immersive VR	The virtual and augmented reality in secondary education class	VR is a tool that improves learning, motivation, and creativity among students. However, this is not fully integrated in the institutions yet.

3. Results

The VR immersion levels refer to the capacity of the system to generate the feeling of being physically present in a virtual environment. This concept integrates three fundamental factors, namely, 1) sensory participation, which refers to the stimulation of the user's senses; 2) interaction, which allows the manipulation of objects and navigation in virtual environments; and 3) realism, which refers to the fidelity of how virtual elements are represented (Vergara et al., 2017). These aspects are materialized through a combination of specific hardware and software, which determines how much a person can experience and interact with the virtual environment (Tepe et al., 2018).

Teachers are helped by VR to use a constructivist methodology (Marougkas et al., 2023). Using different electronic devices, students can experiment with immersive experiences that resemble the real world. In other words, by using VR, teachers can move from their traditional classes to more dynamic and interesting ones. These classes promote students' active participation and collaboration, which is the basis of constructivism. Considering the importance of VR, it is vital to highlight the relationship between VR and education.

According to the analyzed studies, VR has three clearly defined immersion levels: non-immersive, semi-immersive, and fully immersive. Each level determines how users perceive, interact, and take part in the virtual environments. This directly impacts students' learning process, information retention, and practical application (Rojas et al., 2022). The different levels of immersion also offer diverse possibilities to transform the educational process, adapting to the current digital ecosystem's different contexts and learning needs.

In the following section, the researchers present a detailed analysis of each VR immersion level, characteristics, benefits, and specific applications.

3.1 Non-Immersive VR

Non-immersive VR maintains the users' awareness of their physical world without complete immersion in the virtual environment (Berkman & Akan, 2019). This level prioritizes visualizing the information in two dimensional or 3D formats. Content interaction is essential and does not require specialized devices (Lampropoulos & Kinshuk, 2024). The interface is presented through conventional computer screens and the interconnection is done through standard peripherals, such as a keyword, mouse, or controllers. This facilitates implementation and accessibility.

In this context, non-immersive VR is an accessible and economical option for educational institutions since it does not require specialized or expensive devices. Additionally, teachers only need a computer to use the non-immersive VR in their classes to connect theory with practice in different areas. In this way, they can improve the learning process to benefit their students.

Benefits of the Non-Immersive VR

This level, though non-immersive, offers significant benefits for education. First, it helps increase the students' participation and motivation because they can experience interactive learning experiences that traditional teaching methods cannot provide. As a result of the exposure to non-immersive VR, students can increase their retention and comprehension of complex topics since they can visualize and manipulate theoretical concepts in a virtual environment.

Additionally, teachers can use non-immersive VR to facilitate personalized learning, which can adapt to students' experiences, needs, and learning styles. Non-immersive VR also promotes collaborative learning, allowing students to work in groups in virtual spaces. This improves students' social skills and group work (Merchant et al., 2014). Teachers can adapt the academic content according to students' learning styles. This adaptation also motivates students to continue learning autonomously and focus more on their personal learning interests due to the access and flexibility that non-immersive VR offers. Another benefit of non-immersive VR revolves around accessibility. Marougkas et al. (2023) mentioned that people who use this technology can access it anywhere and at any time. Teachers can implement non-immersive VR in their classes using only a standard computer without the need for expensive devices.

Though this level of VR is beneficial, it also has limitations. For example, some teachers lack knowledge in this area and need proper training. There is also a risk that teachers may depend excessively on VR to teach their academic content. Table 2 shows the most relevant benefits of using non-immersive VR in educational contexts.

Table 2: Benefits of implementing non-immersive VR in education non-immersive VR use

Implementation	The technical implementation of this level of VR only requires computers with basic performance specifications. This facilitates its installation and configuration (Tepe et al., 2018). However, content development needs specific programming skills, which vary according to the desired degree of realism and complexity of the virtual experience (Vergara et al., 2017).
Accessibility	Students can access it from any computer. It allows users to interact with the virtual environment at any moment and place without the need to be physically present in the educational institution (Marougkas et al., 2023). This versatility facilitates its implementation in diverse contexts, both academic and professional.
Costs	One of the most significant advantages of non-immersive VR is that it does not require specialized equipment, such as VR visors (head-mounted display—HMD). This allows educational institutions to implement non-immersive VR without costly hardware investments (Rodriguez et al., 2022). Resource optimization also extends to the physical space and infrastructure since it can be implemented in laboratories or existing computer classrooms. This results in benefits, particularly for institutions with limited economic resources.

Efficient and safe learning environment	The non-immersive VR facilitates a safe practice of procedures and maneuvers, which can be risky in real environments (Rubio et al., 2023). These VR-controlled environments allow users to develop specific competencies through repetition and trial and failure without compromising their security (Rojas et al., 2022).
Comprehension, retention, and compromising	The multi-dimensional visualization that offers non-immersive VR lets students explore objects from different angles and interact with them in virtual environments. This creates a more complete and significant learning experience (Yarin & Garrana, 2023). The advantages of non-immersive VR transcend the limitations of traditional didactic resources and facilitate students' comprehension of complex concepts that are difficult to represent (Marougkas et al., 2023) in real-life scenarios. If the environment integrates dares, riddles, levels, and challenges, the learning process becomes more attractive and motivational to students (Merchant et al., 2014; Moral et al., 2023; Rivera et al., 2019).

Non-Immersive VR Use

Non-immersive VR can be used in three main areas, namely, a) scientific education, b) technical formation, and c) educational gamification. In scientific education, virtual laboratories can use non-immersive VR to conduct experiments in safe and controlled environments, such as in chemistry and biology. In these two fields, non-immersive VR facilitates the visualization of molecular structures, such as the human body systems (Markowitz et al., 2018). In the technical field, mainly engineering, non-immersive VR allows the creation and analysis of complex designs such as electric circuits, offering an accessible space to manipulate 3D models (Vergara et al., 2017).

Integrating gamification elements in virtual environments improves students' motivation, engagement, academic performance, and information retention (Lampropoulos & Kinshuk, 2024). This convergence of 3D visualization, practical experimentation, and ludic elements transforms traditional teaching. Further, gamification allows the incorporation of rewards and feedback through challenges, thus stimulating autonomous learning.

Current studies show that non-immersive VR can help overcome traditional teaching methods and physical barriers that negatively affect education. Tepe et al. (2018) highlighted that, for this type of VR, teachers need basic-performance-computers which allow them to create digital laboratories, interactive simulators, gamification, and other activities. Additionally, integrating 3D models into non-immersive VR and gamification increases students' participation and, thus, academic success. This level of VR can be integrated into other fields in the long term, increasing its benefits for a more diverse population. However, teachers must have specific programming skills (Vergara et al., 2017).

3.2 Semi-Immersive VR

The semi-immersive VR presents an equilibrium between the digital and physical environments. This offers students a more immersive experience, facilitating significant and functional interactions (Bonilla & Fajardo, 2020; Fino et al., 2022). This characteristic is especially valuable in educational contexts where there is a need to interact with the content without requiring maximum realism (Colussi & Reis, 2020). The equipment needed to implement this level is big screens, overhead projectors, and sound systems with amplification and positioning. Together, these devices create moderated immersion. This type of immersion helps teachers to achieve learning outcomes effectively in education (Berkman & Akan, 2019 ; Herranz de la Casa et al., 2019).

Benefits of the Semi-Immersive VR

This level offers an intermediate point between the non-immersive and fully immersive levels, creating a balance among accessibility, interaction, and cost-benefit (Bonilla & Fajardo, 2020). Semi-immersive VR is a feasible alternative for educational institutions that aim to incorporate innovative technologies without incurring excessive expenses. Its most distinctive advantage in education is that teachers can carry out prolonged learning sessions with students since it reduces secondary effects, such as dizziness or visual fatigue, which are problems commonly associated with fully immersive VR. In Table 3, the researchers present the main benefits of this level of VR education.

Table 3: Benefits of the semi-immersive VR

Improved interaction	The users experience more significant interaction. This experience enriches students' learning moments by allowing more flexible and active participation (Bonilla & Fajardo, 2020). Students can manipulate objects and explore scenarios that are rendered in real-time. This helps students understand complex concepts and their practical application in real-life scenarios.
Accessibility	For this level, users need a space to integrate the necessary resources to create a semi-immersive environment. Teachers use overhead projectors or big screen sizes to create a setting in which students feel part of the virtual environment (Caballero et al., 2023) while being aware of their physical environment.
Cost	Implementing this level of VR is accessible for educational institutions and teachers who aim to improve their teaching without the need for highly specialized and costly software (Caballero et al., 2023). This allows students to experience different and innovative manners of learning. Additionally, the affordability of this technology facilitates its implementation in schools with limited budgets.
Security and Control	This level of implementation provides a controlled environment that effectively merges theoretical and practical learning (De Fino et al., 2022). This characteristic allows students to experience and develop skills in an environment that eliminates physical risks and, at the same time, optimizes the effectiveness of the learning process.
Collaborative learning	Semi-immersive VR allows students to participate and interact simultaneously in the virtual environment and with 3D objects. This promotes group work and collaborative learning (Bonilla & Fajardo, 2020). Since students know their physical space, they can practice actual actions and improve their focus and control of simulated situations, resulting in significant learning.

Contextual diversity	Due to the versatility of semi-immersive VR, multiple studies conclude that its application in various fields, namely cultural education, professional development, medicine, rehabilitation, and entertainment, is practical (Christopoulos et al., 2024). This shows that this technology can prepare students to be successful professionals.

Semi-Immersive VR Use

Semi-immersive VR has significant advantages in education. For example, teachers can create virtual laboratories in which students can conduct experiments in safe and controlled scenarios. Also, teachers can organize virtual visits to museums and create complex scientific simulations (Ramos & Júnior, 2024) using a limited budget. Teachers can construct learning objects and move from traditional learning resources to interactive materials. These materials may enable students to engage in activities that simulate real-life situations, fostering problem-solving relevant to their future professional lives.

In fields such as engineering, mechanics and aviation, semi-immersive VR enables students to engage with complex machines models and practice tasks such as assembling or simulating the operation of industrial plants. This helps them improve students' comprehension and technical skills (Freina & Ott, 2015). In military education, students can virtually experience how to manage emergencies and training in security. Since semi-immersive VR recreates real-life situations in controlled environments, learners enhance their capacities for making fast and effective decisions under pressure.

Semi-immersive VR is a versatile and powerful tool that helps students improve their technical and cognitive skills to face real-life situations professionally. This is because learners can virtually experience scenarios that can, in real life, be complex, expensive, and dangerous to recreate, thus making it difficult for students to be a part of it.

3.3 Fully Immersive VR

Fully immersive VR is the highest level of this technology, in which all users are immersed in digital environments that simulate reality in high definition (François et al., 2021). In these environments, students can have more authentic virtual experiences. This facilitates the exploration of concepts and theories more tangibly, compared to the previous levels. This complete immersion is achieved by integrating specialized hardware, such as HMD visors, tactile feedback gloves, movement sensors, and interactive platforms. These devices isolate the perception of the physical world together, replacing it with synchronized virtual stimuli (Berkman & Akan, 2019).

Popular HMD devices are Oculus Quest, HTC Vive Pro, and HoloLens because they allow users to be completely immersed in virtual environments (Herranz de la Casa et al., 2019). It is essential to highlight that developing these experiences requires specialized platforms integrating 3D models, audiovisual elements, and advanced programming. This results in the highest cost of implementation compared to the other levels of VR. Research shows that people use development engines, such as Unity Engine, and specific platforms, such as WebVR, CoSpaces, and ARTutor, for this level. Each engine offers specific capacities for creating virtual environments (Caballero et al., 2023).

Table 4: Benefits of the fully immersive VR

Retention and comprehension improvement	Using this level, teachers can potentially increase the retention of information and comprehension of complex concepts among their students. This is possible because learners can interact directly with the content in a 3D environment (Merchant et al., 2014).
Security	This level allows teachers to facilitate professional skills development in controlled environments, eliminating the risks that occur in real-life situations among students (González & Mesías, 2023). This is a valuable characteristic, particularly in medicine, aviation, and engineering (Rojas et al., 2022). It also allows users to explore scenarios that are usually inaccessible or high-risk. These scenarios may include historical sites, unique environments, and military training that expand the possibilities of having experiential learning (François et al., 2021).
Cost	Implementing this level of VR requires a significant investment due to the high cost of specialized hardware such as HMD visors, sensors, and haptic devices. However, the investment is justified due to the high impact on students' learning and experiences, especially in cases in which real-life experiences can be more expensive and risky (Caballero et al., 2023).
Personalized and collaborative learning	At this level, teachers can create adaptive learning experiences in which students can advance at their own pace and deepen complex contexts due to repetitive practice (Rubio et al., 2023). Moreover, using this technology, teachers can promote collaborative learning among their students by interacting and solving problems, improving their communication, and working in groups (Vergara et al., 2017).
Inclusion of people with disabilities	This level of immersion offers accessible and personalized experiences that overcome the physical, sensorial, and cognitive limitations that may occur in the real world. This level is used in rehabilitation, motor training communication, hearing impairment, intellectual disabilities, evaluation, diagnosis, etc. (Rojas et al., 2022).

Fully immersive VR utility

In higher education, fully-immersive VR facilitates the comprehension of complex anatomy concepts (Mendoza et al., 2023). Rivera et al. (2019) highlighted that, through this technology, students can explore and analyze the human body and its components without needing real bodies, which are challenging to find. Regarding critical medical skills, university students can practice cardiopulmonary resuscitation effectively. In psychology, students can use controlled experiences to develop clinical skills (Seivane & Brenlla, 2022).

4. Discussion

Fundamentally, VR is an innovative tool that allows teachers to move from traditional methodologies to advanced and interactive ways of teaching. All levels of the implementation of VR are, in general, beneficial for education; however, there are advantages and disadvantages. For instance, regarding accessibility and cost, Rodríguez et al. (2022) mentioned that non-immersive VR is the most accessible due to its low cost but offers a limited full immersion level. Semi-immersive VR presents an equilibrium between price and interactivity, offering better interaction than non-immersive VR, yet it is not as complete as fully immersive. Ramos and Júnior (2024) stated that this tool allows simulations in a safe and controlled environment in which students can be engaged in complex simulations in short or controlled periods that facilitate decision-making and cooperation. Fully immersive VR, according to Caballero et al. (2023), offers high realistic experiences. However, for it to work properly, it is necessary to have specialized hardware, which is expensive to implement, making it less accessible due to the high cost associated with the devices.

Using VR at any immersion level in educational institutions is always cheaper than creating physical laboratories. For instance, Seivane and Brenlla (2022) highlighted that through using fully immersive VR, students can interact with the parts of the human body and carry out experiments without risking the patients' safety.

Additionally, VR can be applied in different fields of education (Vergara et al., 2017); VR has been used in scientific education, vocational formation, and educational gamification, particularly in areas such as chemistry and biology. Freina and Ott (2025) added that VR also prepares students to face real-life problems in engineering, mechanics, aviation, and military education.

5. Conclusion

This systematic literature review evidenced the transformative impact that VR has in the teaching-learning process and its growing integration into different academic disciplines. The three levels of immersion presented in this paper have various degrees of interaction, characteristics, and specific applications in education. For instance, non-immersive VR provides interactive and personalized learning experiences at a low cost. Semi-immersive and fully immersive VR offer simulations with high fidelity, allowing students to understand complex concepts and significantly increase students' motivation and knowledge retention. The practical implementation of these two levels, however, faces significant challenges. For example, there is a need to purchase expensive specialized hardware and teacher training.

Each immersion level presents unique benefits. Therefore, school stakeholders must carefully select the VR implementation level they want to use according to their needs and resources. In this way, they will facilitate innovation in a digital world that is increasing daily. The future perspectives for VR in education are promising so there is a need to develop more accessible and economical solutions to increase its adoption in diverse educational contexts and institutions.

In this context, more research should be conducted about the use of each of the VR immersion levels in education and teaching methodologies. Also, researchers may investigate ways to reduce the cost of fully immersive VR, so educational institutions with limited economical resources can take advantage of this technology and offer students innovative learning experiences. Furthermore, it is necessary to study the long-term effects that the use of VR can have on students.

Acknowledgments. This is part of the research project entitled CORI-UNAE-2022-1 "BIOCHEM-ARSIMLAB". funded by the Universidad Nacional de Educación, Azogues, Ecuador.

6. References

Alemán, M. (2023). Retopologia de malha aplicada a modelos 3D de património cultural para melhorar a visualização interativa em rea. *Ge-Conservacion*, *24*(1), 87–98. https://doi.org/10.37558/GEC.V24I1.1147

Apolo, D., Garcia, P., Sáenz, A., Quiróz, M., & Cordova, M. (2018). *Investigación sobre representaciones sociales e imaginarios sociales en universidades de posgrado de Ecuador. Una revisión sistemática*. Ediciones USTA. https://doi.org/10.2307/j.ctvckq982.9

Berkman, M. I., & Akan, E. (2019). Presence and Immersion in Virtual Reality. In N. Lee (Ed.), *Encyclopedia of Computer Graphics and Games* (pp. 1–10). Springer International Publishing. https://doi.org/10.1007/978-3-319-08234-9_162-1

Bonilla, D., & Fajardo, H. G. (2020). El cine sin encuadre: Propuesta de Escala de Implicación Narrativa en Realidad Virtual. *Anuario Electrónico de Estudios en Comunicación Social Disertaciones*, *13*(2). https://doi.org/10.12804/revistas.urosario.edu.co/disertaciones/a.8252https://doi.org/10.12804/revistas.urosario.edu.co/disertaciones/a.8252

Caballero, J. A., Rojas, J. R., Sánchez, A., & Lázaro, A. F. (2023). Revisión sistemática sobre la aplicación de la realidad virtual en la educación universitaria. *Revista Electrónica Educare*, *27*(3). https://doi.org/10.15359/ree.27-3.17271

Campo, P., Cancela Carral, J. M., Machado de Oliveira, I., & Rodríguez-Fuentes, G. (2021). Realidad Virtual Inmersiva en personas mayores: estudio de casos. *Retos*, *39*, 1001–1005. https://doi.org/10.47197/retos.v0i39.78195

Christopoulos, A., Styliou, M., Ntalas, N., & Stylios, C. (2024). The Impact of Immersive Virtual Reality on Knowledge Acquisition and Adolescent Perceptions in Cultural Education. *Information*, *15*(5). https://doi.org/10.3390/info15050261

Codina, A., Rodríguez, J. y Morales, C. (2023). Neotrie VR, Realidad Virtual inmersiva para el aprendizaje de la geometría 3D. En Cuevas, C., Martínez, M., Páez, R. y Hernández, J. (Coords.). *Investigaciones y Experiencias en Enseñanza de las Ciencias y la Matemática*. Universidad Autónoma del Estado de México y de Aldus. http://ri.uaemex.mx/bitstream/handle/20.500.11799/138309/Invest_Exper_Ensenanza_Cs_Mate.pdf?sequence=1

González, P., & Mesías, J. M. (2023). Virtual Reality for the teaching and learning of perspective in drawing. *Edutec, Revista Electrónica De Tecnología Educativa*, (83), 188–207. https://doi.org/10.21556/edutec.2023.83.2681

Colussi, J., & Reis, T. A. (2020). Periodismo inmersivo. Análisis de la narrativa en aplicaciones de realidad virtual. *Revista Latina de Comunicación Social*, 77. https://doi.org/10.4185/RLCS-2020-1447

Espinoza, K. E., Apolo, D. E., Sánchez, R. N., & Bravo, B. F. (2024). Laboratorios digitales y plataformas de acceso abierto: Retos y propuestas para la democratización del aprendizaje. *Edutec, Revista Electrónica de Tecnología Educativa*, *87*. https://doi.org/10.21556/edutec.2024.87.3069

De Fino, M., Bruno, S. y Fatiguso, F. (2022). Divulgación, Evaluación y Gestión de Edificios Históricos Mediante Visitas Virtuales Temáticas y Modelos 3D. *Virtual Archaeology Review*, *13*(26), 88–102. https://doi.org/10.4995/VAR.2022.15426

François, P., Leichman, J., Laroche, F., & Rubellin, F. (2021). Virtual reality as a versatile tool for research, dissemination and mediation in the humanities. *Virtual Archaeology Review*, *12*(25). https://doi.org/10.4995/var.2021.14880

Freina, L., & Ott, M. (2015). *A literature review on immersive virtual reality in education: state of the art and perspectives.* eLearning and Software for Education (eLSE), Bucharest (Romania). https://doi.org/10.12753/2066-026X-15-020

Herranz de la Casa, J. M., Caerols, R., & Sidorenko, P. (2019). La realidad virtual y el vídeo 360º en la comunicación empresarial e institucional. *Revista de Comunicación*, *18*(2). https://doi.org/10.26441/RC18.2-2019-A9

Hernández-Rodríguez, J. C., & García-Perdomo, V. (2023). ¡Disfruto más, pero comprendo menos, las noticias en video 360! Gratificaciones obtenidas en la investigación del periodismo de realidad virtual. *Cuadernos Info*, (56), 313–333. https://doi.org/10.7764/cdi.56.60193

Lampropoulos, G., & Kinshuk. (2024). Virtual reality and gamification in education: A systematic review. *Educational Technology Research and Development*, *72*(3), 1691-1785. https://doi.org/10.1007/s11423-024-10351-3

López Belmonte, J., Pozo Sánchez, S., Morales Cevallos, M. B., & López Meneses, E. (2019). Competencia digital de futuros docentes para efectuar un proceso de enseñanza y aprendizaje mediante realidad virtual. Edutec: Revista electrónica de tecnología educativa, 67, 1–15. https://doi.org/10.21556/edutec.2019.67.1327

Marín, V., Sampedro Requena, B. E., & Vega Gea, E. (2022). La realidad virtual y aumentada en el aula de secundaria. *Campus Virtuales*, *11*(1), 225–236

Markowitz, D. M., Laha, R., Perone, B. P., Pea, R. D., & Bailenson, J. N. (2018). Immersive Virtual Reality Field Trips Facilitate Learning About Climate Change. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.02364

Marougkas, A., Troussas, C., Krouska, A., & Sgouropoulou, C. (2023). Virtual Reality in Education: A Review of Learning Theories, Approaches and Methodologies for the Last Decade. *Electronics*, *12*(13). https://doi.org/10.3390/electronics12132832

Mas, M., Bendicho, V., Tercero, J., Valdelomar, J. y Maschner, H. (2022). Proyectos de Digitalización y Realidad Virtual en el Patrimonio Arqueológico. El Caso del Yacimiento. Vir*tual Archaeology Review*, *13*(26), 135–146. https://doi.org/10.4995/VAR.2022.15004

Mendoza, G. A. A., Lewis, F., Plante, P., & Brassard, C. (2023). Estado del arte sobre el uso de la realidad virtual, la realidad augmentada y el video 360° en educación superior. *Edutec, Revista Electrónica de Tecnología Educativa*, *84*. https://doi.org/10.21556/edutec.2023.84.2769

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*, 29–40. https://doi.org/10.1016/j.compedu.2013.07.033

Moral, S. N., Sánchez, M. T., & Romero, I. (2023). Uso de realidad virtual en Geometría para el desarrollo de habilidades espaciales. *Enseñanza de las Ciencias. Revista de investigación y experiencias didácticas*, *41*(1). https://doi.org/10.5565/rev/ensciencias.5442

Paíno, A., & Rodríguez-Fidalgo, M. I. (2020). Del espectador pasivo al experiencial: La realidad virtual en la información deportiva. *Index comunicación*, *10*(1), 219–240. https://doi.org/10.33732/ixc/10/01Delesp

Ramos, R. C., & Júnior, W. L. B. (2024). Realidade virtual na educação Fundamentos, Dispositivos, Aplicações e Inovação no Ensino. *RCMOS – Revista Científica Multidisciplinar O Saber*, *1*(1), Article 1. https://doi.org/10.51473/rcmos.v1i1.2024.540

Rivera, N., García, P., & Hernández, A. A. (2019). Las aplicaciones digitales como herramienta didáctica para el estudio de la Parasitología Médica. *Investigación en Educación Médica*, *8*(31). https://doi.org/10.22201/facmed.20075057e.2019.31.18121

Rodriguez, D. V., Arias, P. F., Iglesia, C. D. S. D. L., & Sancho, A. A. (2022). Virtual reality: sustainable technologies. *DYNA*, *97*(5), 556–560. https://doi.org/10.6036/10482

Rodríguez, G., Campo, P., Souto, X. C. y Carral, J. M. C. (2024). Realidad virtual inmersiva y su influencia en parámetros fisiológicos de personas sanas. *Retos*, *51*, 615–625. https://doi.org/10.47197/RETOS.V51.101164

Rojas, M. A., Palos, P. R., & Folgado, J. A. (2022). Systematic literature review and bibliometric analysis on virtual reality and education. *Education and Information Technologies*, *28*(1), 155–192. https://doi.org/10.1007/s10639-022-11167-5

Rubio, M. T. P., Ortiz, J. J. G., Guardiola, P. L., Artero, P. M. A., Castellón, M. B. S., Cervantes, A. B. O., & Ríos, M. P. (2023). Realidad virtual para enseñar reanimación cardiopulmonar en el Grado de Educación Primaria. Estudio comparativo. *RIED-Revista Iberoamericana de Educación a Distancia*, *26*(2). https://doi.org/10.5944/ried.26.2.36232

Seivane, M. S., & Brenlla, M. E. (2022). Aplicaciones de la realidad virtual en el campo de la evaluación psicológica: Una revisión sistemática. *Aloma: Revista de Psicologia, Ciències de l'Educació i de l'Esport*, *40*(2). https://doi.org/10.51698/aloma.2022.40.2.21-31

Tepe, T., Kaleci, D., & Tüzün, H. (2018). Virtual Reality Applications in Education. In N. Lee (Ed.), *Encyclopedia of Computer Graphics and Games* (pp. 1–7). Springer International Publishing. https://doi.org/10.1007/978-3-319-08234-9_166-1

Urrútia, G., & Bonfill, X. (2010). Declaración PRISMA: Una propuesta para mejorar la publicación de revisiones sistemáticas y metaanálisis. *Medicina Clínica*, *135*(11), 507–511. https://doi.org/10.1016/j.medcli.2010.01.015

Vergara, D., Rubio, M. P., & Lorenzo, M. (2017). On the design of virtual reality learning environments in engineering. *Multimodal Technologies and Interaction*, *1*(2). https://doi.org/10.3390/mti1020011

Yarin, Y., & Garrana, H. (2023). La realidad virtual y su efecto en la habilidad espacial: Un caso de estudio enfocado en la enseñanza de la geometría descriptiva. *Revista de Educación a Distancia (RED)*, *23*(73). https://doi.org/10.6018/red.540091