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IMPACT OF VIRTUAL REALITY TECHNOLOGIES ON INCLUSIVE AND PARTICIPATORY EDUCATION

IMPACTO DE LAS TECNOLOGÍAS DE REALIDAD VIRTUAL EN LA EDUCACIÓN INCLUSIVA Y PARTICIPATIVA

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Abstract

Virtual reality technologies are revolutionizing how people interact, and education is no exception. This offers great possibilities for promoting inclusive education, where students with special abilities are included. Therefore, this study examines the implications of virtual reality technologies for participatory and inclusive learning, as well as their benefits and challenges. Methodologically, a qualitative approach is used, employing a systematic review. The sample consists of 24 studies from indexed journals using the PRISMA model. The instrument includes Boolean operators. It is concluded that virtual reality technologies promote inclusion and educational participation, allowing students, especially those with disabilities, to learn under equal conditions. These technologies allow adapting academic content to the needs of students, making courses more dynamic. In addition, their use allows students to develop their cognitive skills. There are also challenges to overcome, such as training teachers in their use, designing policies to address accessibility and affordability barriers, and safeguarding the personal data of students using such technologies.

Keywords: Virtual reality, participatory education, inclusive education, students with disabilities

Resumen

Las tecnologías de realidad virtual están revolucionando cómo las personas interactúan y la educación no es una excepción. Esto ofrece grandes posibilidades para promover la educación inclusiva, integrando a estudiantes con necesidades especiales. Así, el estudio examina las implicaciones de tales tecnologías en el aprendizaje participativo e inclusivo, sus beneficios y desafíos. Metodológicamente, se utiliza un enfoque cualitativo mediante una revisión sistemática. La muestra consta de 24 estudios de revistas indexadas con el modelo PRISMA. El instrumento incluye operadores booleanos. Se concluye que las tecnologías de realidad virtual promueven la inclusión y la participación educativa, permitiendo que los estudiantes, especialmente aquellos con discapacidad, aprendan en igualdad de condiciones. Estas tecnologías permiten adaptar el contenido académico a las necesidades, haciendo los cursos más dinámicos. Su uso permite desarrollar sus habilidades cognitivas. También existen desafíos como la capacitación docente en su uso, el diseño de políticas sobre barreras de accesibilidad y asequibilidad, y la protección de los datos personales de los estudiantes.

Palabras clave: *Realidad virtual, educación participativa, educación inclusiva, estudiantes con discapacidad.*

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1. INTRODUCTION

Digital transformation with immersive technologies is presented as a wide range of possibilities for neurodiverse people or people with intellectual disabilities. Virtual reality (VR) technologies offer interesting and novel resources that focus on mental, sensory, social, and movement processes, helping to support learning for individuals with atypical characteristics. For example, specialists have developed VR learning tools that contribute to the cognitive experiences of students with dyslexia, dysgraphia, and dyscalculia. Such tools have even been tested with people with mental disabilities. These technologies have also been applied to students with obsessive-compulsive disorder (OCD) and attention deficit hyperactivity disorder (ADHD), among others (Creed et al., 2024).

It can also be said that VR spaces allow people to participate in circumstances to which they would not normally have access. Such as the case of people with motor disabilities, which restrict their mobility, or the situation of people living in dangerous areas, which, in terms of cost and safety, prevent them from moving around. It is in these contexts that well-thought-out and designed VR environments can give the impression of being in the world, which makes users feel that they have been transported to different areas without missing out on experiences that ordinary people have (Richter et al., 2023).

Now, it is generally in the educational field where the benefits of VR technologies stand out, as they can be used to optimize academic comprehension, store information, and improve student participation in increasingly virtualized environments (Morales Cadena et al., 2024). Therefore, information and communication technologies (ICTs) such as these can become inclusive tools (Murrugarra Retamozo, 2024a). That is, ICTs are no longer designed solely for entertainment, but also for education, which in turn serves to promote their accessibility to people who may have some type of disability (Murrugarra Retamozo, 2024b).

Thus, if VR technologies are implemented in education, they can, at the same time, encourage student participation. For example, what makes VR technologies so attractive for participatory learning is the sense of reality they provide, even though they are unreal (simulated) environments. This virtual world is designed by computer science, which uses a set of electronic visualization devices to help people enter an unreal, but lifelike, environment. Another characteristic of VR is the interactivity factor, where the user can move, generate reactions, and modify their environment instantly (Galeote Barquín, 2020).

Considering this, it is important to define what VR technologies are. According to the FEMEVAL guide (2019), VR refers to a three-dimensional digital space generated by computers or other information systems, designed to allow the user to experience a sense of immersion in an environment that appears real and with which they can interact at different levels.

The main purposes of this technology are:

a. To recreate a scenario that imitates a specific physical reality as accurately as possible and that functions as a substitute for it.

b. To design a fictional but plausible environment where the boundaries between reality and imagination are blurred, creating an experience in which both worlds intertwine.

In the educational environment, there are two types of VR technologies being used, and these are classified according to their hardware, as described in Table 1.

Table 1. Classes of VR Archetypes by Hardware

Desktop VR	It is used by a single individual or a group of individuals. The virtual environment is displayed utilizing a computer, and individuals can generate interactions with the use of the mouse, thus immersing themselves in the 3D experience.
Immersion RV	Here, individuals can wear a VR headset or goggles, motion detectors, and data mitts, which help the user achieve a significant proportion of immersion in reality.

Note. Prepared by the author based on Toala Palma et al. (2020).

Despite the possibilities that VR technologies can offer in education (desktop or immersive) due to their inclusive characteristics, there are still shortcomings in the educational systems of several States for their implementation, such as the lack of public investment or scarce government policies (Acho Ramírez et al., 2021).

In addition, it should be considered that implementing VR environments requires not only a budget but also logistical and technological infrastructure adjustments in educational centers. In addition, the main stakeholders involved in this virtual education system must have their needs and goals met, requiring that the form of learning in VR environments meet their requirements. This is important because technologies such as VR will make it possible to achieve the academic objectives of educational institutions and ensure that the performance and participation of students are the best, which will allow them to realize their personal life plan, work plan, and socio-cultural plan (Abril Lancheros, 2023).

Based on the above, the following research questions are formulated: a) What is the impact of VR technologies on participatory and inclusive learning? b) What are the benefits that VR technologies have on inclusive education? c) What are the challenges that VR technologies have for inclusive education?

1.1. Inclusive education

The concept of inclusive education aims for students' experiences to be specialized according to their abilities and ways of learning. At the same time, this approach seeks to ensure that all students receive an equal education opportunity regardless of where they come from. Such methodology is based on the principle that students deserve a quality education (Ortí Martínez, 2024).

Likewise, it must be considered that inclusive education arises as a way to dignify learning, which is based on five components as suggested by Urías Arbolaez (2024), which are:

- **a.** Modern human rights ethics, where it is argued that the concept of the right to education must go hand in hand with the concept of social justice.
- **b.** The social approach is framed in the social model of people with disabilities, who are often excluded from society.
- **c.** The organizational framework that supports institutional progress, seen as a universal purpose that encompasses efficient educational centers, school redesign, and optimization.

d. The archetypes of participatory communities focused on counteracting differences and discrimination. This involves self-help programs and support networks among communities, students, teachers, etc.

e. The personalized and inclusive approach is the basis for a methodology that supports student integration.

Similarly, five aspects must be put in place if inclusive education is to be promoted. The first aspect has to do with the formulation of innovative educational policies that produce relevant transformations in inclusion. The second aspect has to do with optimizing initial education with the participation of families. The third aspect is centered on applying strategies that invigorate teacher training, which should consider inclusive and diversity-based tactics. The fourth aspect emphasizes highlighting the cultural environment. Finally, the fifth aspect is focused on optimizing the disposition, behaviors, and postures that society has towards people with special needs and abilities, or who belong to different ethnicities, etc. (Marchesi et al., 2019, cited in Pérez Valles & Reeves Huapaya, 2023).

In the establishment of these five aspects of inclusive education, the technological factor should not be forgotten, since teaching is now carried out using digital media. If the inclusive approach is inserted from the beginning in the electronic teaching devices, it ensures that students participate and have access in the preliminary stages of the design process of these technologies (Wehrmann & Zender, 2023).

In this context, VR is presented as an inclusion option, which, in the case of some limitations, allows students to optimize their intellectual, oral, social, emotional, and behavioral skills. In other words, innovative technologies such as these can provide students with an education according to their learning rhythms and according to their particular requirements (Murrugarra Retamozo, 2025). The above can be done under an entertainment concept to enhance student motivation to acquire new knowledge, which supports an educational environment that fosters interactive learning (Arata Hernández et al., 2021).

In the case of VR in education, immersion and inclusive interaction is supported by four criteria, which are: (i) the moral need for technologies to be universally accessible, (ii) the capacity of VR as a support and rehabilitation tool, (iii) the commercial advantages of having a large number of users, and (iv) an optimal design that helps VR technologies to be usable by all (Dudley et al., 2023).

As a correlation of the above, VR technologies must be designed with a universal access approach, for which the principles of universal design for learning (UDL) in technologies should be followed, as shown in Table 2.

Table 2. Principles of Universal Design for Learning (UDL) in VR tools

Principle No. 1: Provision of numerous channels of representation	• It provides multiple ways of perceiving information. That is, information can be obtained from various sensory media (acoustic, ocular, etc.). • It provides several alternatives for language and symbolic images. It fosters understanding between several languages, constituting a powerful means for language acquisition; it materializes, at the same time, notions by different means. • It provides alternatives for apprehension. It enables relevant learning to take place through visualization and interrelation, which is important because it helps to evoke and transfer information to the real world.

Principle No. 2: Encouraging diverse mechanisms of action and manifestation	• It offers several physical ways of action. It helps to generate interaction with the existing components, and it also allows the context of action or learning to be transformed. • It offers possibilities for externalization and fluidity of communication. • It offers alternatives for executive work. It allows for feedback on what has been learned. In addition, the information is adequately structured and ordered, with clear goals.
Principle N° 3: Provision of various forms of involvement	• It provides possibilities for engaging interest through collaborative work and helps learning to unfold in a personalized way. • It provides ways to maintain commitment and options for effort and consistency. • It provides alternatives for self-regulation. This, in turn, helps improve students' self-esteem and self-perception, which keeps them more motivated.

Note. Prepared by the author based on Díaz (2022), cited in Romero Esquinas (2024).

1.2. Involving teachers in inclusive and participatory education with VR technologies

VR has not only allowed students to disseminate and discuss the concepts learned, fostering more communication and knowledge development, but also, teachers have found a way to make their classes more dynamic and interactive. This has generated an environment in which education becomes personalized according to the needs of each student (Arroyo Paz, 2023).

Additionally, many teachers believe that the use of VR technologies will help to make progress in the aspects of inclusive and equitable education. Moreover, VR would help to counteract the detriment of learning new knowledge that students currently experience, since they are technologies that have been proven to increase student participation and engagement (Uzza et al., 2022).

On the other hand, if the implementation of VR technologies in educational spaces is to be considered, it is essential to have teachers' perspectives, since results have long shown that their participation is essential. In addition, as VR technologies are different from any other ICT, teachers will have to support their students, both in their use and understanding. It should also be noted that such a novel circumstance will make teaching more difficult, especially in the spectrum of education for people with special abilities, so teacher participation is essential (Dechsling et al., 2024).

For example, Stavroulia et al. (2025) have argued that the integration of VR into teacher training should not only focus on inclusion but also on the active participation and professional development of teachers. This is because immersive experiences allow for the recreation of complex classroom scenarios, offering safe spaces for practice and reflection without the risks of the real environment. Furthermore, it has been found that co-creating virtual environments with teachers ensures that the tools meet their real needs, strengthening their sense of ownership and increasing the effectiveness of the learning process. Based on this, it can be said that VR becomes a key resource for promoting participation and enriching teacher training, going beyond mere technological integration. However, Rodríguez-Cano et al. (2022a) have also pointed out that its implementation faces challenges such as a lack of teacher training and limited applied research on its effectiveness in inclusive interventions.

1.3. Benefits of VR technologies for inclusive and participatory education

At the educational level, VR can design supervised, reproducible, and reliable learning spaces for students to learn with the necessary care, which they often would not find. In the realm of inclusive education, VR deploys important considerations that enable the creation of engaging and accessible educational experiences for learners with a wide range of abilities (Varuna Tehlan Dahiya, 2024).

Moreover, there is evidence that employing VR as a pedagogical tool increases students' academic accountability. This is mainly because technological advances have transformed the ways of teaching, making it possible to privilege how the student learns with the technological devices around them. In addition, the inclusion of multimedia devices constitutes an outstanding way to improve the comprehension of information and thus optimize learning levels (AlAli & Wardat, 2024).

In addition, VR technologies, such as the metaverse, being universalized in their use, allow students to take advantage of such environments to have immersive learning that helps them to socialize. This will be important when, in the future, students must go out to the labor field and work in collaborative teams. It is believed that the VR phenomenon will serve to prepare introverted people or people with autism (ASD) in the future when they have to enter the working world. This option for this group of people is feasible due to the immersive characteristics of these technologies, which will help them to interact and communicate with other people in real time, making people develop or enhance their social skills at work (Hutson, 2022).

Also, the three-dimensional feature of VR helps those with accessibility impairments gain closer to knowledge. This proximity to their interests reinforces their productivity associated with their retention capacity, their inventiveness, and perception, which influences their oral performance, or on their ability to solve problems due to the degree of motivation provided by the visual. On the other hand, VR technologies can also be conceived as novel tools for teachers to contribute to the specialized education of their students (Rodríguez Cano et al., 2021).

For example, for students with ASD, VR learning spaces cover educational and design goals. Such virtual environments can offer manageable and personalized conditions with accessibility and controllable sensory tools. In that way, students will be able to participate and interact by practicing their social unfolding in a safe and predictable way (Bradley & Newbutt, 2018, cited in Bravou et al., 2022).

To provide more detail on this aspect, according to Lozano-Álvarez et al. (2025), VR creates interactive and multisensory environments, which increase motivation and facilitate the personalization of activities according to each student's cognitive abilities. The authors also argue that, in the educational field, VR has shown improvements in attention, narrative memory, and inhibitory control. Based on this, seven key areas have been identified for designing VR activities: phonological awareness, working memory, attention, visual and auditory perception, semantic-syntactic-lexical development, and motor skills related to laterality and directionality. These dimensions allow for the structuring of interventions that respond to the specific needs of students, contributing to inclusion and meaningful learning (Rodríguez-Cano et al., 2022b).

The following Table 3 shows the advantages of applying VR technologies in education with an inclusive approach.

Table 3. Benefits of VR Technologies in Inclusive and Participatory Education

VR technologies enable the development and enhancement of empathy	Immersive experiences based on VR or augmented reality hold immense potential for fostering a deep sense of empathy for disability. By creating virtual worlds that authentically replicate the everyday struggles and triumphs of people with disabilities, these technologies have the extraordinary ability to transport users into the very heart of their experiences, forcing them to see the world through a different perspective.
VR technologies make it possible to experience real sensations	One of the most notable advantages of immersive VR experiences lies in their ability to evoke an authentic sense of presence and embodiment. Users are not mere observers, but active participants, fully immersed in simulated environments that accurately emulate physical and sensory reality. This deeply immersive encounter can elicit powerful emotional responses, dismantle prejudices and fostering a new appreciation for the challenges faced by people with disabilities.
VR technologies enable personalized experiences	VR technologies provide experiences to interact in a personalized way, allowing users to connect with what virtual space offers. For example, users can perform different activities, overcome barriers, and face problems like those experienced by students with disabilities. The most beneficial aspect of this is that users, by learning through VR what people with disabilities face, develop empathy and become sensitized to different contexts. Another benefit of this technology is that immersive experiences have a component of realism, which in turn enables users to immerse themselves in different situations freely. In general, VR provides users with a deep understanding of the adversities that people with disabilities go through.

Note. Prepared by the author based on Pinto Coelho et al. (2023).

1.4. Challenges of VR technologies in inclusive and participatory education

There are several challenges to overcome in the application of VR in the educational environment. For example, prolonged use of VR tools by students can lead to an unpleasant experience. One of the consequences is the loss of concentration, which limits experiencing the benefits provided by VR, which in the long term will impair the learning process (Ancioto et al., 2018, cited in Sousa Ferreira et al., 2021). Likewise, in the case of students with sensory difficulties, the use of VR spaces can be complex, making it essential to incorporate extra assistance methods to ensure accessibility (Chalkiadakis et al., 2024).

Additionally, another challenge for the implementation of VR in educational institutions is its poor linkage to academic curricula, which makes it difficult for this technology to adhere to training dynamics. It is believed that such obstacles highlight the urgency of proposing a more methodical and equitable perspective so that VR can change the current educational paradigms (Mora Zambrano, 2024).

In general, and after presenting the challenges, it can be said that there are still skeptics who do not believe that VR is the best ally for inclusive learning, and, therefore, have remained cautious in their opinion of implementing this technology in the educational system. However, to do so, the following is suggested: a) the students with whom the tests are to be initiated would have to be chosen by therapists who know how VR technologies are applied, furthermore, b) the students will have to come into contact with VR technologies progressively, having to be monitored by a psychologist in charge of tracking their progress of interaction with such technologies.

All this is done to see if the profile of students with special needs or disabilities fits with the VR technologies they wish to institute (Chițu et al., 2023).

It is also important to note that some international institutions are reporting on and investigating the landscape of VR technology implementation in education, as shown in Table 4. This is essential for its full integration to potentially become a reality in the future.

Table 4. Perspectives of international institutions on the incorporation of VR technologies in inclusive and participatory education

Next generation virtual worlds: Societal, technological, economic and policy challenges for the EU.	This report emphasizes that VR tools can make education more effective and inclusive by facilitating access to personalized and collaborative experiences, even for students with physical or geographical limitations. However, it also warns of ethical and technical challenges related to equity, data protection, and reducing digital divides (European Commission: Joint Research Centre, 2023).
Extended reality: opportunities, success stories and challenges (health, education): final report	According to this report, VR helps students develop both technical and soft skills. It also allows them to collaborate virtually and access educational experiences that would otherwise be unavailable to them, such as virtual laboratories and simulated field trips. Furthermore, the report emphasizes the technology's potential to make a significant contribution to inclusive education by providing opportunities for students with cognitive, physical, and learning disabilities, enabling their remote participation and adapting to their specific needs. However, it also mentions barriers such as the high cost, the lack of teacher training in these technologies, and the need for further research to analyze their long-term effects and their proper integration into educational curricula (European Commission: Directorate-General for Communications Networks, Content and Technology & Visionary Analytics, 2023).
Hasmik Baghdasaryan: Bringing chemistry to life through virtual labs	UNICEF has highlighted the case of Baghdasaryan, a high school student in Armenia, who, along with her team, developed VR Labs, an initiative awarded by Generation Unlimited, to bring the high school chemistry curriculum to rural and urban schools with limited resources through VR. Their project stemmed from their experience in the "Green Chemistry" club, where they identified that many schools lacked physical laboratories. They decided to use VR because it is a more accessible, engaging, and educational method than alternatives such as traditional videos, home-based experiments, or mobile laboratories. While they acknowledge that VR does not completely replace in-person experiments, they emphasize that it allows students to conduct them virtually, increasing their motivation and accessibility. Furthermore, the technology is seen as an effective solution for overcoming logistical, economic, and infrastructure barriers in remote communities (UNICEF Armenia, 2021).

Digital pedagogies for building peaceful & sustainable societies	The report highlights that VR has become one of the most promising technologies for transforming education, offering immersive, interactive, and multisensory experiences that allow students to "live" the content instead of simply reading about it. This is because these tools facilitate deeper, more personalized, and collaborative learning by simulating complex environments such as laboratories, heritage sites, or even social situations that foster empathy and critical thinking. The report also mentions that VR can complement traditional teaching, optimize conceptual understanding, and develop 21st-century skills through active methodologies such as experiential and project-based learning. Regarding inclusive education, the document explicitly addresses it within the framework of SDG 4, specifying that technologies like VR can ensure equitable and personalized access, which is beneficial for students with diverse needs and backgrounds (UNESCO MGIEP, 2018).

Note. Prepared by the author based on European Commission: Joint Research Center (2023), European Commission: Directorate-General for Communications Networks, Content and Technology & Visionary Analytics (2023), UNICEF Armenia (2021), & UNESCO MGIEP (2018).

Based on the above, the objective of this study is to examine the implications of VR technologies in participatory and inclusive learning, including their benefits and challenges.

2. MATERIALS AND METHODS

The study has a qualitative approach that allows the researcher to have a sophisticated and valuable understanding of a particular issue through an interpretive analysis. The use of such an approach is because its nature helps to fix patterns and themes that do not need to be quantified (Oranga & Matere, 2023). This is reflected in this study in the decision-making of which documents to use for the systematic review technique.

Systematic review is employed in this research because prior information in the form of documents helps to access a quality data source. For example, examining writings such as scientific works and articles brings the advantage of data robustness (Morgan, 2022). In this case, the document review is linked to the implications of VR tools in inclusive education.

Regarding the research design, it is that of the hermeneutic perspective, which entails conducting an in-depth study of the environment according to the initial manuscripts, and not just a succinct examination of the text (Chang, 2022). This is critical for interpreting examining how VR tools are contributing to inclusive and participatory education.

2.1. Population and sample

The composition of the population is 1037 research papers from indexed journals, of which the sample consists of 24 papers, according to the following criteria: a) identification, b) review, c) eligibility, and d) inclusion.

2.2. Instrument

Boolean operators are used as the first data collection instrument. There is also a paraphrase sheet where the main contributions of research on the impact of VR technologies on participatory and inclusive learning are synthesized.

2.3. Data collection and analysis

The research collection is based on the following databases: Google Scholar, Scopus, SciELO, and Web of Science. The total amount of research collected from these sources is 1037. The way of selecting the articles is through the generation of Boolean operators inserted in the MyLoft tool (Calderón Loyola & Nieto Rivas, 2024). The use of Boolean operators is appropriate because their use is simple and less time-consuming. With this, higher quality citations are acquired, optimizing the tracking of scientific data (Carranza Cortés, 2018).

The evaluation and synthesis of the results is structured using a PRISMA model (Figure 1), because its schematization is intended to support scientists who apply systematic reviews, so that they can transparently record the reasons for the review, what the researchers did, and what they found (Page et al., 2021).

The criteria of a) identification, b) review, c) eligibility, and d) inclusion facilitated the selection of articles, both in Spanish and English. The range of articles chosen is those published between 2023 and 2024, belonging to the areas of education and technology, inclusive education, and social sciences. There is a discarding of repeated, unimportant studies or those outside the aforementioned areas.

2.4. Exclusion criteria

The application of the PRISMA model is based on specific criteria at each stage to support the relevance and quality of the studies included in the review. Each stage is explained below:

- **Identification:** Duplicate articles and those without full-text access are removed. Documents that are not peer-reviewed research are also excluded.
- **Screening:** Studies that do not address VR technologies in educational contexts are excluded, as well as those focused on areas outside of education, technology, inclusive education, or the social sciences.
- **Eligibility:** Articles that do not meet the established time frame (2023-2024) or that are written in languages other than Spanish or English are excluded. Works that do not present results or analyses relevant to participatory and inclusive learning are also excluded.
- **Inclusion:** Only peer-reviewed research that explicitly addresses the implications, benefits, and challenges of using VR technologies in inclusive and participatory educational processes is considered.

The research search plan, using Boolean operators, is shown in Table 5.

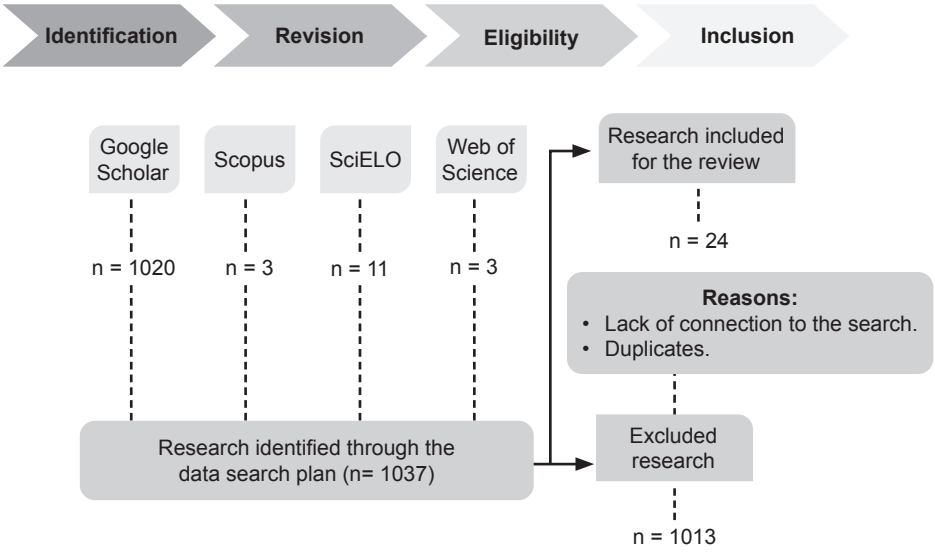
As a last step, there is a comparison of the results with other research in scientific journals, which helps to generate discussion and draw conclusions.

Table 5. Data Search Plan

ID	Date	Database	Boolean operators' equation	Number of results found
1	31/01/2025	Google Scholar	("virtual reality" OR "realidad virtual") AND (educación inclusiva OR inclusive education) AND (implicaciones OR implications OR efectos OR effects) AND (investigación OR research) AND ("2023" OR "2024") AND (participación estudiantil OR "student engagement")	1020

2	02/02/2025	Scopus	((“virtual reality” OR “realidad virtual”) AND (educación inclusiva OR inclusive education) AND (implicaciones OR implications OR efectos OR effects) AND (investigación OR research) AND (PUBYEAR = 2023 OR PUBYEAR = 2024) AND (participación estudiantil OR “student engagement”))	3
3	02/02/2025	SciELO	(“virtual reality” OR “realidad virtual”) AND (educación inclusiva OR inclusive education) AND (implicaciones OR implications OR efectos OR effects) AND (investigación OR research) AND (2023 OR 2024) AND (participación estudiantil OR “student engagement”)	11
4	04/02/2025	Web of Science	(TS= (“virtual reality” OR “realidad virtual”) AND TS= (educación inclusiva OR inclusive education) AND TS= (implicaciones OR implications OR efectos OR effects) AND TS= (investigación OR research) AND PY= (2023 OR 2024) AND TS= (participación estudiantil OR “student engagement”))	3
	Total			**1037**

Figure 1. PRISMA Flow Diagram



As a result of applying these PRISMA model criteria, of the 1037 studies initially identified, 1013 studies were excluded for not meeting the aforementioned criteria, leaving 24 articles for the final review.

3. RESULTS AND DISCUSSION

Since the objective of this study is to examine the implications of VR technologies in participatory and inclusive learning, including their benefits and challenges, this section outlines the results, which are broken down into the benefits and challenges of VR technologies in inclusive education. These are presented in Tables 6 and 7,

respectively, based on the data collection plan. The discussion compares the results from Tables 6 and 7 with the findings of another research on the topic.

Table 6. Benefits of VR Technologies in Inclusive and Participatory Education

ID/Database	Authorship	Contribution
1- Google Scholar	Prakash (2023).	The metaverse, based on VR, is able to provide students with some kind of disability, the possibility of having inclusive access to the educational world. Such is the case of virtual classrooms in which the contents are subtitled, or there are sign language interpretations, and many other ways to support and include students with hearing or visual impairments.
2- Google Scholar	Morales Caguana (2024).	One of the key benefits of VR is that it encourages learning to be individualized, adjusting to the demands and particularities of each student. VR enables those with disabilities to actively and reliably engage in learning.
3- Google Scholar	Verdugo Guamán & Ramón Pacurucu (2024).	3D VR is used to promote inclusion by achieving effective results in its use, as it has been proven to generate exciting, valuable, and cooperative learning. In this way, diversity is included, and differences are transformed into opportunities.
4- Google Scholar	Moreira Parrales et al. (2024).	VR can mimic various environments and social realities, which helps learners investigate and perceive different socio-cultural landscapes and contexts. This can be especially convenient when dealing with sensitive or historically relevant issues, making navigation in virtual spaces promote empathy and multicultural understanding.
5- Google Scholar	Urquizo Esparza et al. (2024).	VR technologies are able to promote inclusion and are also useful in providing personalized support and adapting to curricular content. This enables students to achieve both individualized and meaningful learning.
6- Google Scholar	Alemán Arróliga (2024).	Incorporating VR technologies in education can optimize the kind of learning students receive by adding hands-on tasks. This helps those students to be better prepared to face circumstances that occur in the real world in the future.
7- Google Scholar	Guaillas Guaillas (2024).	The use of VR tools shows that academic productivity and motivation improve significantly with their use. Students who use VR tools find lectures more engaging and therefore participate more frequently. All the positives of this are reflected in their grades and in their willingness to learn computer courses more enthusiastically. In addition, the use of VR technologies makes learning more dynamic and collaborative.
8- Google Scholar	Paredes Córdova (2024).	VR provides immersive practices that meet the needs of those students who have specific needs. Likewise, VR has a series of benefits that help train future workers with creative profiles, who will be able to offer social and economic growth to society. They are also tools that bring students and teachers closer together when face-to-face attendance is not feasible.
9- Google Scholar	Hernández Lugo (2024).	VR technologies have the potential to enable educational content and teaching tactics to be adjusted, allowing student learning to be individualized. For example, in the educational area, digital wellness applications have been integrated to help provide emotional and psychological support to students, which facilitates an inclusive and empathetic educational environment.

10- Scopus	Gómez Rodríguez & Buitrago Reyes (2024).	It is known that VR technologies provide valuable experiences for the instruction of students with an inclusion factor. This makes it necessary to continue improving the educational conditions of students with disabilities, so that their learning is aligned (in equity) with that of students without disabilities.
11- Scopus	Ceccacci et al. (2024).	VR technologies have a reputation for being developed from a tactical perspective to improve students' social, educational, cognitive, and motivational skills. For example, in the case of students with dysgraphia, the use of VR will make them aware of their academic progress from an early age. If such skills are reinforced, students will be able to actively and consciously engage in their learning process, which will have the potential to develop serenely to achieve academic goals that they otherwise would not be able to. In addition, the technological scenario provided by the implementation of VR for the educational sector has the advantage of going hand in hand with the principle of distributed educational responsibility (which includes the educational institution, family members, society, and agents that promote inclusive education).
12- Web of Science	Tene et al. (2024).	Immersive VR technologies are guaranteed to transform STEM education in terms of increasing the level of student participation and productivity. In addition, if educational experts and researchers continue to develop VR technologies with a focus on inclusion, flexibility, and ethical aspects, STEM education can become more dynamic, individualized, and efficient.

VR technologies, such as the metaverse, have been found to promote the integration of students with disabilities. An example of this is virtual classrooms where students with visual or hearing limitations can interact (Prakash, 2023). This is because VR has an inclusive approach that helps all students to participate in classes without distinction (Verdugo Guamán & Ramón Pacurucu, 2024). It is precisely this inclusive characteristic of VR that, therefore, leads to its continued use in the educational area, serving to achieve equitable teaching for those with special needs (Gómez Rodríguez & Buitrago Reyes, 2024). Such findings are consistent with what Navas Bonilla et al. (2025) expressed regarding the fact that learning technologies generate a change in the educational environment, making it more inclusive and closer to the different student contexts. Therefore, it can be said that interactive VR technologies make it possible to close the gaps that exist for people with disabilities, allowing their learning on equal terms. This also makes it possible to reinforce the capabilities of each student in the educational sector, which are varied.

Likewise, it has been noted that an important advantage of VR technologies is that they promote personalized learning, allowing students with disabilities or in different contexts to learn with them at their own pace (Morales Caguana, 2024). Added to this is the ability of these tools to adjust academic content considering the diversity of students (Urquizo Esparza et al., 2024). Another advantage found is that these technologies serve to improve educational strategies, adding, for example, emotional support, which fosters an empathetic environment (Hernández Lugo, 2024). According to Marougkas et al. (2023), this is good, since when individualized approaches to virtual spaces are designed and executed, students have the option of acquiring more effective learning. And to achieve this, the preferences, tastes, abilities, and needs of each learner must be considered. The consequences of the aforementioned will make students develop learning with positive results, which will increase their cognitive abilities, reinforce their educational experience, and discard the disappointments that the traditional educational system can bring.

Next, it has been found that the immersive and imitative capabilities of VR environments help students relate to various socio-cultural contexts, which promotes an empathetic knowledge of the different realities that exist (Moreira Parrales et al., 2024). In addition, thanks to the pedagogical aptitude of VR technologies, students can practice how in the future it would be to interact in real scenarios, being ready to face the real world (Alemán Arróliga, 2024). Thus, it is these strategic characteristics of VR that will help students to perform optimally socially, interpersonally, and educationally. Additionally, the personalized characteristics of such technologies will allow students to measure and be aware of their academic progress. However, to achieve all this, it is necessary to involve families, teachers, and society, who are key players in the promotion and implementation of inclusive education with technologies (Ceccacci et al., 2024). This is consistent with Urhan & Akpinar (2024), who point out that students who use VR technologies perceive that their knowledge is durable, because interacting with such tools makes them feel as if they were interacting in the real world. This leads to the conclusion that VR applications have a favorable effect on education, encouraging students' interest in courses. Therefore, it would be good to continue studying the impact of such technologies on students' attitudes.

Another finding is that the implementation of VR technologies in learning increases the levels of efficiency and stimulation, with students feeling more eager to study the courses developed with these technologies. As a result, courses that incorporate these technologies become more versatile and interesting (Guaillas Guaillas, 2024). For example, in STEM education, VR technologies are a great advantage because they help to make courses more dynamic, flexible, and easier to understand (Tene et al., 2024). Also, according to Paredes Córdova (2024), the reason why courses become dynamic is because of the immersive characteristic of VR, which makes students with different abilities feel comfortable to learn and develop their creative potential as future professionals. This finding is similar to that of Rodriguez (2024), who points out that VR technologies and the active teaching perspective promote the dynamic participation of students, which helps foster their creative and conflict resolution skills, as well as promote teamwork.

Table 7. Challenges of VR Technologies in Inclusive and Participatory Education

ID/Database	Authorship	Contribution
1- Google Scholar	Chinchilla Fonseca et al. (2024).	There is still a lack of clear ideas about how the metaverse works, and there is a need to raise awareness of its potential as an educational tool. Therefore, it is important to educate teachers and students about its use, ensuring that its incorporation serves to meet the variety of users with an inclusive approach, and that it allows these students to become competitive in the future in the working world.
2- Google Scholar	Barrera Andrade et al. (2023).	To assist the learning of students with ASD, a web browser and virtual environment called ZAC Browser has been created. To see if this tool is effective, a series of follow-up and monitoring activities would need to be carried out.
3- Google Scholar	Dávila Panduro (2024).	The development of VR tools in education presents challenges such as ethics in the use of personal data and equitable access. In addition, another challenge is related to the competencies of teachers in the use of VR tools, since it has been found that they require training for their application in the academic environment.
4- Google Scholar	Vidal Turrubiates et al. (2024).	Although VR is shown as a tool capable of making traditional education more effective, its incorporation challenges include equitable access and teacher training. Therefore, it is imperative to develop a strategic plan that analyzes the application of these tools to create inclusive and participatory educational spaces.

5- Google Scholar	Merchán Freire & Valero Díaz (2024).	The costly purchase and maintenance of VR equipment and software are limitations for its implementation in the educational environment. In addition, the scarce technological infrastructure that educational institutions have prevents students from benefiting from innovative ways of learning. Such a context increases educational gaps.
6- Google Scholar	Peña Saldarriaga & Cuzco Silva (2023).	Implementing VR in education has several technical and accessibility challenges that need to be addressed to ensure efficient and equitable learning. This is because VR promises to improve educational experience for students with disabilities. For example, VR glasses have received design suggestions to make them more accessible and affordable for students with motor impairments. However, education in VR environments also has several quality challenges, which, if not addressed, can end up being a factor of exclusion. Therefore, suggestions have emerged such as considering the variety of students, their contexts and abilities, to ensure that the virtual educational materials are according to their needs, and thus ensure quality education.
7- Scopus	Veytia Bucheli et al. (2024).	If educational principles and learning goals are not followed, the incorporation of technological devices in education will not prosper, and therefore, the instructional process of students will be hindered. It should be considered that technologies were not primarily conceived with an educational factor in mind but had to be adjusted to this sector because of the benefits they have provided in other areas. Therefore, the technologies designed for learning must meet academic objectives. In this scenario, the educational area should support the creation of technologies based on the principles of universal learning design, which should be oriented to achieve pedagogical goals and meet student requirements. Along these lines, the educational system must prioritize that the teaching of students and the support to teachers are given in conjunction with the implementation of technological infrastructures.
8- Web of Science	Krishnan et al. (2024).	An issue of concern regarding access to VR technologies is economic inequality, which prevents low-income students from benefiting from these technologies. This problem will mainly affect the education of low-income students, who will not be able to engage in learning sessions. This dilemma should be addressed by the authorities through the design of public policies, which should focus on providing access to these technologies to low-income students.
9- SciELO	Kocasaraç & Mlotshwa (2024).	Teachers have a basic understanding of VR applications in the learning environment, which could be used to design a user agenda to ensure the professional competence of these teachers and to disseminate policy regarding the use of VR in education.
10-SciELO	Villalobos López (2024).	Before integrating VR devices into educational environments, it is necessary to examine the specific characteristics of students and teachers, as well as all the areas involved in the educational process. This will determine the viability of their adoption.
11-SciELO	Naude & Sutherland (2024).	VR offers students the opportunity to develop their thinking with a more innovative component. VR also improves the quality of education because students will develop more innovative and analytical thinking.
12-SciELO	González Bracamonte et al. (2023).	Since VR is an innovative tool, it is essential to continue researching its benefits and capabilities, not only as a tool to help assess student learning, but also as a tool to intervene in the intellectual, social, and behavioral processes of students with ADHD.

It has been found that, although the characteristics of VR technologies can contribute to the education sector, some argue that there are still vague notions of how the metaverse would serve in education. Therefore, it is important to raise awareness

among students and teachers regarding their use and how they can contribute to an inclusive education and be an instrument that enhances students' skills to face the world of work (Chinchilla Fonseca et al., 2024). In this regard, Villalobos López (2024) mentions that for VR technologies to be implemented, it is first necessary to evaluate the demands and needs of students and teachers to see how their incorporation is feasible. Vidal Turrubiates et al. (2024) are of a similar opinion, stating that it is necessary to design a plan to train teachers in the use of these technologies and to improve accessibility.

This would be feasible to achieve since teachers have elementary knowledge about VR applications, which could help to develop a more compact guide to these technologies in the educational environment (Kocasaraç & Mlotshwa, 2024). These findings are consistent with those of Abimbola Eden et al. (2024), who have stated that, to encourage virtual education with an inclusive and cooperative approach, a synergy is needed involving teacher intervention, the design of an inclusive curricular strategy, the implementation of valuable deliberations, the contribution of positive observations, and the constant training of teachers. This multifaceted perspective will enable teachers to create rewarding experiences for students to succeed academically, socially, and in the workplace.

In addition, it has been found that there are VR applications created for students with ASD to use them, and the challenge here would be to address whether these devices are useful to improve the learning of these students; therefore, after their creation, it would be good to evaluate their usefulness (Barrera Andrade et al., 2023). It is also important to analyze whether the personal data of students using VR technologies is being protected, which is aligned with an ethical use (Dávila Panduro, 2024). The latter coincides with the study by Kulal et al. (2022), who expressed that in VR technologies, there is an exposure of the personal data collected.

This data can be used to identify who the users are and deduce more information about them, which can constitute a risk to the right to privacy. However, there are several ways to solve this exposure of information, such as the use of encryption mechanisms, communication of how the data is being used, and effective application of personal data protection regulations. According to Murrugarra Retamozo (2024c), it would be essential to establish ethical and regulatory strategies to obtain user consent and protect their privacy, preventing digital dangers and unauthorized access to any sensitive information circulating on digital platforms (Murrugarra Retamozo, 2022; Murrugarra Retamozo, 2024d; Murrugarra Retamozo, 2023).

In addition to the above, a limitation and challenge to overcome regarding the implementation of VR technologies in education is how expensive it would be to acquire the equipment and take care of it. All of which maintains the gaps in education (Merchán Freire & Valero Díaz, 2024). Yong & Arya (2023) agree, pointing out that VR tools are often not accessible because they do not have adequate parameters to be applied in these contexts. Given the above, Krishnan et al. (2024) indicated that it is true that these economic gaps exist.

However, it is time for the solution to be thought out through the creation of public policies aimed at ensuring that technologies are accessible to the most disadvantaged students. For their part, Peña Saldarriaga & Cuzco Silva (2023) established that the most notorious challenges regarding the implementation of VR technologies in education involve technical issues, such as the scarce technological infrastructure, which, if not solved, will generate exclusion rather than inclusion. Therefore, these challenges must be addressed by thinking about the implementation of VR

technologies according to the characteristics and needs of each student, without neglecting that the design of VR devices must be of high quality.

Finally, it has been proven that with the use of VR technologies, students can develop more critical and innovative thinking (Naude & Sutherland, 2024). Thus, Veytia Bucheli et al. (2024) have suggested that for the implementation of VR technologies to prosper in the educational sector, the principles of universal learning design should be followed. This involves matching the academic curriculum, educational objectives, and teacher training with the modernization of the technological infrastructure of each educational institution; this will make teaching with VR technologies simpler and more feasible.

Although throughout the study it has also been confirmed that, due to the novelty of VR technologies, more studies are required on their advantages in the educational, social, and behavioral domains of students (González Bracamonte et al., 2023). For the time being, it will be important to focus on ensuring that the design of these tools is consistent with teaching that prioritizes their constant evaluation. To this end, it would be essential that, after their application in the educational field, students' opinions are collected, which would allow teachers to know the needs of their students at the time of learning, and thus be able to undertake the necessary improvements (Niu et al., 2021).

4. CONCLUSIONS

Since the objective of this study is to examine the implications of VR technologies in participatory and inclusive learning, including their benefits and challenges, the research findings are presented below.

VR technologies promote educational inclusion and participation, allowing students from different backgrounds and characteristics to learn on equal terms. This is because VR technologies can adapt academic content according to students' needs. In addition, such technologies allow improving educational tactics, which will make students learn more effectively and overcome the shortcomings of traditional educational systems.

Due to the immersive capability of VR technologies, students can understand different contexts, which will serve them in the future when they must interact and participate in the real world. Also, due to the personalized feature of such technologies, students are more motivated to learn, as courses become more dynamic. This is particularly beneficial for students with special abilities because it allows them to actively participate in classes and develop their cognitive abilities.

Among the challenges of implementing VR technologies are the need to train teachers on their use, which will help to teach students how these technologies can be useful in the academic, social, and working world. Another challenge would be to evaluate, after implementing these technologies, whether they are serving as tools to promote inclusion, i.e., whether students are learning with them according to their needs and demands. It is also essential to examine how the personal data of students who access these technologies is being collected and to adapt mechanisms to protect the privacy of the information.

There are limitations such as affordability and accessibility, which means that VR technologies cannot be acquired because of their high cost or because the technical

educational infrastructure is not adequate. Therefore, it would be important to create a plan that advocates VR technologies to be designed according to the different economic and social contexts of students. Also, as it has been proven that these technologies promote the development of inclusive education, innovative and participatory thinking in students, it is imperative that, when developing them, the principles of universal learning design are considered. This, without neglecting periodic evaluations on the usefulness and efficiency of VR, takes into account the opinions of students, teacher intervention, and even those of families.

5. PERSPECTIVES AND FUTURE LINES OF RESEARCH

Future research could explore four key areas: A) Evaluating the long-term impact of VR on reducing educational disparities, considering different socioeconomic contexts. B) Analyzing how the integration of VR can be combined with other inclusive technologies, such as adaptive artificial intelligence, to enhance personalized learning. C) Investigating ethical and regulatory frameworks that guarantee data protection and equitable access, ensuring that technological innovation does not reproduce existing inequalities. Finally, D) further research is needed on the specific role of VR in teacher training, exploring how these immersive experiences can strengthen pedagogical skills, promote active participation, and create more inclusive and collaborative learning environments.

Authors' contribution

The conceptualization, methodology, software, validation, formal analysis, research, resources, data curation, writing – original draft, writing – review and editing, visualization, supervision, and administration of the project were carried out by Brenda Isabel Murrugarra Retamozo.

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Conflicts of interest

The author declares that she has no conflicts of interest.

Data availability

The data supporting this study's findings are available in the article. URLs are available in the references section.

Statement on the use of AI

It is declared that artificial intelligence (LLM language model) was used solely and exclusively to generate the Boolean operator formulas listed in Table 5 (Data Search Plan) to optimize the bibliographic search strategy. Following this, the construction of the operators was manually reviewed to ensure they were correct and relevant. No AI tools were used to generate textual content or alter the writing style.

BIBLIOGRAPHY

Abimbola Eden, C., Nneamaka Chisom, O., Sulaimon Adeniyi, I. (2024). Online learning and community engagement: Strategies for promoting inclusivity and collaboration

in education. *World Journal of Advanced Research and Reviews*, *21*(03), 232–239. https://doi.org/10.30574/wjarr.2024.21.3.0693

Abril Lancheros, M. (2023). La nueva realidad, retos y desafíos. Adaptación a los escenarios de enseñanza y aprendizaje postcovid-19. *PANORAMA*, *17*(33), 1-14. https://doi.org/10.15765/pnrm.v17i33.4135

Acho Ramírez, S., Diaz Espinoza, M., Criollo Hidalgo, V., & García Camacho, O. E. (2021). La realidad de la educación inclusiva en el Perú y los retos desde la virtualidad. *EduSol*, *21*(77), 153- 168. https://repositorio.utp.edu.pe/handle/20.500.128 67/5817

AlAli, R., & Wardat, Y. (2024). The Role of Virtual Reality (VR) as a Learning Tool in the Classroom. *International Journal of Religion*, *5*(10), 2138-2151. https://doi.org/10.61707/e2xc5452

Alemán Arróliga, J. (2024). Innovación en prácticas docentes y desarrollo de competencias digitales en la Universidad Jean Jacques Rousseau. *Revista científica De Estudios Sociales*, *3*(5), 107-134. https://doi.org/10.62407/rces.v3i5.138

Arata Hernández, Y., Salazar Montes, S., & Suárez Prieto, N. S. (2021). *Realidad virtual para la educación inclusiva de estudiantes con discapacidad intelectual* [Trabajo de Grado, Universidad de San Buenaventura]. https://bibliotecadigital.usb.edu.co/entities/publication/0c0d295f-5b08-46c2-84d5-a03f111a6196

Arroyo Paz, A., Mendoza Montoya, J., Valer Vilca, A., & Callapani Condori, E. (2023). *Digital Transformation in Education Sector Using Virtual Reality with Cardboard: A Systematic Review*. In CISETC 2023: International Congress on Education and Technology in Sciences 2023, Zacatecas, México. https://ceur-ws.org/Vol-3691/paper10.pdf

Barrera Andrade, P. A., Chamorro Benavides, N. C., & Espinosa Cevallos, P. A. (2023). El uso de dispositivos tecnológicos como herramientas didácticas inclusivas en niños con discapacidad. *RECIAMUC*, *7*(1), 903-913. https://doi.org/10.26820/reciamuc/7.(1).enero.2023.903-913

Bravou, V., Oikonomidou, D., & Drigas, A. (2022). Applications of virtual reality for autism inclusion. A review. Retos, (45), 779-785. https://recyt.fecyt.es/index.php/retos/index

Calderón Loyola, A., & Nieto Rivas, E. (2024). Implicaciones de la inteligencia artificial en la educación: Revisión sistemática. *Horizontes. Revista De Investigación En Ciencias De La Educación*, *8*(35), 2304–2315. https://doi.org/10.33996/revistahorizontes.v8i35.870

Carranza Cortés, J. (2018). Aplicación de las tecnologías de la información y la comunicación para la búsqueda de información científica en el posgrado de especialidades médicas. *Anestesia en México, 30*(1), 18-25. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2448-87712018000100018&lng=es&tlng=es.

Ceccacci, S., Taddei, A., Del Bianco, N., Giaconi, C., Forteza Forteza, D., & Moreno Tallón, F. (2024). Preventing Dysgraphia: Early Observation Protocols and a Technological Framework for Monitoring and Enhancing Graphomotor Skills. *Information*, *15*(12). https://doi.org/10.3390/ info15120781

Chalkiadakis, A., Seremetaki, A., Kanellou, A., Kallishi, M., Morfopoulou, A., Moraitaki, M., & Mastrokoukou, S. (2024). Impact of Artificial Intelligence and Virtual Reality on Educational Inclusion: A Systematic Review of Technologies Supporting Students

with Disabilities. *Education Sciences*, *14*(11), 1-24. https://doi.org/ 10.3390/ educsci14111223

Chang, Q. (2022). The contribution of a hermeneutic approach to investigate psychological variables in second language acquisition. *Frontiers in Psychology*, *13*, 1-7. https://doi.org/10.3389/fpsyg.2022.1055249

Chinchilla Fonseca, P., Torres Acuña, M., & Artavia Alpízar, M. M. (2024). Realidad Virtual y Aumentada en Psicología: Explorando la Percepción de Estudiantes Universitarios. *Ciencia Latina Revista Científica Multidisciplinar*, *8*(3), 1059-1091. https://doi.org/10.37811/cl_rcm.v8i3.11318

Chițu, I.B., Tecau, A.S., Constantin, C.P., Tescasiu, B., Bratucu, T.-O., Bratucu, G., & Purcaru, I.-M. Exploring the Opportunity to Use Virtual Reality for the Education of Children with Disabilities. *Children*, *10*(3), 1-15. https://doi.org/10.3390/ children10030436

Creed, C., Al-Kalbani, M., Theil, A., Sarcar, S., & Williams, I. (2024) Inclusive Augmented and Virtual Reality: A Research Agenda. *International Journal of Human–Computer Interaction*, *40*(20), 6200-6219. https://doi.org/10.1080/10447318.2023.2247614

Dávila Panduro, S., Macedo Torres, L., López Alvarado, L., & Vásquez Alegría, R. (2024). *Innovación y Eficacia: El Rol del Software Educativo en la Educación Universitaria*. ALEMA Casa Editora-Editorial Internacional S.A.S.D. https:// editorialalema.org/libros/index.php/alema/article/view/39/38

Dechsling, A., Vister, O., Johansen, T., Børtveit, L., Herikstad, Y., & Nordahl-Hansen, A. (2024). Implementing Virtual Reality in Special Education: Teachers' Perspectives. *International Journal of Disability, Development and Education*, 1-16. https://doi.org/1 0.1080/1034912X.2024.2427603

Dr Varuna Tehlan Dahiya. (2024). Virtual Reality And Inclusive Education: A Qualitative Exploration Of Transformative Technologies. *Educational Administration: Theory And Practice*, *30*(4), 2017-2022, https://doi.org/10.53555/kuey.v30i4.1798

Dudley, J., Yin, L., Garaj, V., & Kristensson, P. (2023). Inclusive Immersion: a review of efforts to improve accessibility in virtual reality, augmented reality and the metaverse. *Virtual Reality*, *27*, 2989–3020. https://doi.org/10.1007/ s10055-023-00850-8

European Commission: Directorate-General for Communications Networks, Content and Technology & Visionary Analytics. (2023). *Extended reality: opportunities, success stories and challenges (health, education): final report*. Publications Office of the European Union. https://data.europa.eu/doi/10.2759/121671.

European Commission: Joint Research Centre. (2023). *Next generation virtual worlds: Societal, technological, economic and policy challenges for the EU*. Publications Office of the European Union. https://doi.org/10.2760/51579

FEMEVAL. (2019). *Realidad Virtual y Realidad Aumentada en Prevención de Riesgos Laborales*. https://www.femeval.es/dam/jcr:57a1b2aa-982b-40bd-b0f0-3b3d45bc162b/GUIA_RV_RA_link.pdf

Galeote Barquín, E. (2020). *Realidad Aumentada vs Realidad Virtual: Herramientas Emergentes de Comunicación Arquitectónica*, Universidad Politécnica de Madrid, https://oa.upm.es/66273/

Gómez Rodríguez, D., & Buitrago Reyes, R. (2024). Inserción desde el PEI de la política de inclusión educativa para estudiantes en condición de discapacidad en el ingreso a la universidad. *Revista De La Educación Superior*, *53*(211), 119-144. https://doi.org/10.36857/resu.2024.211.2960

González Bracamonte, Y., Barrero Toncel, V., Yance De la Hoz, W., Vanegas-Beltrán, M., Mieles Barrera, M. D., Cabas Hoyos, K., Moreno García, I., & Fernández Fernández, M. (2023). Eficacia de la Realidad Virtual en la Evaluación y Tratamiento del TDAH: Una Revisión Sistemática de la Literatura. *Diversitas*, *19*(2), 162– 184. https://doi.org/10.15332/22563067.9375

Guaillas Guaillas, R. (2024). *Implementar el Uso De Herramienta Digitales Aplicable al Proceso de Enseñanza Aprendizaje Cognitivo en el Área de Informática* [Trabajo de Investigación de Maestría, Universidad Indoamérica]. https://repositorio.uti.edu.ec/handle/123456789/7448

Hernández Lugo, M. (2024) Modelos mixtos y comunicación: una aproximación al futuro de la integración tecnológica en la Educación Superior. *Ignis*, (18), 67-79. https://revistas.cun.edu.co/index.php/ignis/article/view/1024

Hutson, J. (2022). Social Virtual Reality: Neurodivergence and Inclusivity in the Metaverse. *Societies*, *12*(4), 1-7. https://doi.org/10.3390/soc12040102

Kocasaraç, H., & Mlotshwa, H. (2024). Comparison of virtual reality perceptions of teachers working in Türkiye and South Africa. *South African Journal of Education*, *44*(3), 1-10. https://doi.org/10.15700/saje.v44n3a2390

Krishnan, C., Lamba Sahdev, S., & Mariappan, J. (2024) Navigating complexity: thematic insights into ethical challenges and metaverse integration in Indian education institutions, Cogent Education, *11*(1), 1-17. https://doi10.1080/233118 6X.2024.2428110

Kulal, S., Li, Z., & Tian, X. (2022). Security and privacy in virtual reality:Aliterature review. *Issues in Information Systems*, *23*(2), 185-192. https://doi.org/10.48009/2_iis_2022_125

Lozano-Álvarez, M., Rodríguez-Cano, S., Delgado-Benito, V., & García-Delgado, M. Á. (2025). Implementation and evaluation of a VR/AR-based assistive technology for dyslexic learners: An exploratory case study. *Societies*, *15*(8), 215. https://doi.org/10.3390/soc15080215

Marougkas, A., Troussas, C., & Krouska, A. (2024). How personalized and effective is immersive virtual reality in education? A systematic literature review for the last decade. *Multimedia Tools and Applications*, *83*, 18185–18233. https://doi.org/10.1007/s11042-023-15986-7

Merchán Freire, J., & Valero Díaz, N., (2024) Realidad Aumentada vs Realidad Virtual: Un Análisis Comparativo en la Educación Superior. *Reincisol*, *3*(6), 6025-6048. https://doi.org/10.59282/reincisol.V3(6)6025-6048

Mora Zambrano, E. (2024). Implementación de realidad virtual y aumentada en la educación parvularia: Estrategias para fomentar el aprendizaje inmersivo e inclusivo. *Dominio de las Ciencias*, *10*(4), 1512-1523. https://doi.org/10.23857/dc.v10i4.4137

Morales Cadena, J., Alejandro Muñoz, M., & Moran Borja, L. (2024). Impacto de la realidad virtual en el proceso de aprendizaje en estudiantes de bachillerato.

Revista Arbitrada Interdisciplinaria KOINONIA, *9*(17), 203-220. https://doi.org/10.35381/r.k.v9i17.3176

Morales Caguana, E. (2024). La realidad virtual como estrategia educativa. *Código Científico Revista de Investigación*, *5*(12), 1893-1915. https://doi.org/10.55813/gaea/ccri/v5/n2/641

Moreira Parrales, M., Sánchez Villares, A., Carrera Rosero, E., & Chirao Argos, S. (2024) Integración de IA en el aula: estrategias para que los docentes integren IA en sus métodos de enseñanza matemáticas, optimizando el tiempo y la interacción con los estudiantes. *Revista Social Fronteriza*, *4*(6), e520. https://doi.org/10.59814/resofro.2024.4(6)520

Morgan, H. (2022). Conducting a Qualitative Document Analysis. (2021). *The Qualitative Report*, *27*(1), 64-77. https://doi.org/10.46743/2160-3715/2022.5044

Murrugarra Retamozo, B. I. (2022). *El tratamiento jurídico del cloud computing en Iberoamérica y Perú: protección de datos personales*. COLEX. https://www.colex.es/libros/tratamiento-juridico-cloud-computing-iberoamerica-peru-proteccion-datos-personales-3270

Murrugarra Retamozo, B. I. (2023). *Violencia digital hacia mujeres y niñas: una vulneración a sus derechos*. COLEX. https://www.colex.es/libros/violencia-digital-mujeres-y-ninas-una-vulneracion-sus-derechos-6730

Murrugarra Retamozo, B. I. (2024c). Inteligencia artificial y privacidad en internet: amenazas para los datos personales de los usuarios. *Revista Científica Multidisciplinaria Ogma*, *3*(2), 30-48. https://doi.org/10.69516/9dp8ap45

Murrugarra Retamozo, B. I. (2024d). *Neuroderechos, neurotecnologías e inteligencia artificial: protección de la actividad cerebral humana*. COLEX. https://www.colex.es/libros/neuroderechos-neurotecnologias-e-inteligencia-artificial-proteccion-actividad-cerebral-humana-7637

Murrugarra Retamozo, B. I. (2025) Aprendizaje de idiomas extranjeros con apps basadas en inteligencia artificial: perspectivas de jóvenes universitarios. *WAYNARROQUE. Revista de Ciencias Sociales Aplicadas*, *4*(2), 11–33. https://doi.org/10.47190/rcsaw.v4i2.113

Murrugarra Retamozo, B. I. (2024a). Las TIC y la Inteligencia Artificial en el Aprendizaje de Estudiantes con TEA: Revisión Sistemática. (2024). *INGENIERÍA: Ciencia, Tecnología E Innovación*, *11*(1), 225-240. https://doi.org/10.26495/zqzyb575

Murrugarra Retamozo, B. I. (2024b). Promoción de la Accesibilidad para Personas con Discapacidad a través de las TIC: Perspectivas Educativas. (2024). *Epistemia Revista Científica*, *8*(1), 41-51. https://doi.org/10.26495/re.v8i1.2691

Naude, P., & Sutherland, M. (2024). 2030: Future scenarios for learning and teaching models in higher education. South African Journal of Higher Education, *38*(3), 262-286. https://doi.org/10.20853/38-3-5974

Navas Bonilla, Cdr., Guerra Arango, J.A, Oviedo Guado, D.A & Murillo Noriega, D.E. (2025). Inclusive education through technology: a systematic review of types, tools and characteristics. *Frontiers in Education*, *10*, 1-22. https://doi.org/10.3389/feduc.2025.1527851

Niu, M, Lo, C.H., & Yu, Z. (2021). Embedding Virtual Reality Technology in Teaching 3D Design for Secondary Education. *Frontiers in Virtual Reality*, *2*, 1-11. https://doi.org/10.3389/frvir.2021.661920

Oranga, J., & Matere, A. (2023) Qualitative Research: Essence, Types and Advantages. *Open Access Library Journal*, *10*(12), 1-9. https://doi.org/10.4236/oalib.1111001

Oranga, J., & Matere, A. (2023). Qualitative Research: Essence, Types and Advantages. Open Access Library Journal, *10*(12), 1-9. https://doi.org/10.4236/oalib.1111001

Ortí Martínez, J. (2024). La realidad aumentada y realidad virtual en la enseñanza matemática: educación inclusiva y rendimiento académico. *Edutec, Revista Electrónica De Tecnología Educativa*, (88), 62–76. https://doi.org/10.21556/edutec.2024.88.3133

Page, M., McKenzie, J., Bossuyt, P., Boutron, I., Hoffmann, T., Mulrow, C., Shamseer, L., Tetzlaff, J., Akl, E., Brennan, S., Chou, R., Glanville, J., Grimshaw, J., Hróbjartsson, A., Lalu, M., Li, T., Loder, E., Mayo Wilson, E., McDonald, S., McGuinness, L., Stewart, L., Thomas, J., Tricco, A., Welch, V., Whiting, P., Moher, D., Yepes Nuñez, J., Urrútia, G., Romero García, M., & Alonso Fernández, S. (2021). Declaración PRISMA 2020: una guía actualizada para la publicación de revisiones sistemáticas. *Revista Española de Cardiología*, *74*(9), 790-799. https://doi.org/10.1016/j.recesp.2021.06.016

Paredes Córdova, L. (2024). *Diseño de entornos digitales de aprendizajes para estudiantes con necesidades específicas a nivel de básica superior de la Unidad Educativa "El Porvenir"* [Trabajo de Titulación de Maestría, Instituto Superior Tecnológico Universitario Rumiñahui]. https://repositorio.ister.edu.ec/handle/68000/305

Peña Saldarriaga, A. M., & Cuzco Silva, E. G. (2023). Hacia un Aprendizaje Conectado: Realidad Virtual como Herramienta Transformadora en la Educación de Telecomunicaciones. Código Científico Revista De Investigación, *4*(2), 165–194. https://doi.org/10.55813/gaea/ccri/v4/n2/236

Pérez Valles, C., & Reeves Huapaya, E. (2023). Educación inclusiva digital: Una revisión bibliográfica actualizada. Las brechas digitales en la educación inclusiva. *Revista Actualidades Investigativas en Educación*, *23*(3), 1-24. https://doi.org/10.15517/aie.v23i3.54680

Pinto Coelho, L., Laska Leśniewicz, A., Pereira, E. T., & Sztobryn Giercuszkiewicz, J. (2023). Inclusion and adaptation beyond disability: Using virtual reality to foster empathy. *Medycyna pracy*, *74*(3), 171–185. https://doi.org/10.13075/mp.5893.01386

Prakash, A., Haque, A., Islam, F., & Sonal D. (2023). Exploring the Potential of Metaverse for Higher Education: Opportunities, Challenges, and Implications. *Metaverse Basic and Applied Research*, *2*(40), 1-11. https://doi.org/10.56294/mr202340

Richter, J., Sharabi, L., Luchmun, R., Geiger, T., Hale, A., & Hall, A. (2023). *Virtual Reality as a Tool for Promoting Diversity, Equity, and Inclusion Within the Higher Education Landscape*. In Proceedings of the 15th International Conference on Computer Supported Education (CSEDU 2023), Prague, Czech Republic. https://doi.org/10.5220/0011995900003470

Rodríguez Cano, S., Delgado Benito, V. Casado Muñoz, R., Cubo Delgado, E., Ausín Villaverde, V., & Santa Olalla Mariscal, G. (2021). Tecnologías emergentes en

educación inclusiva realidad virtual y realidad aumentada. Proyecto europeo FORDYSVAR. *International Journal of Developmental and Educational Psychology: INFAD. Revista de Psicología*, *2*(1), 443-450. https://doi.org/10.17060/ijodaep.2021.n1.v2.2093

Rodríguez, J.L. (2024). Virtual reality in the classroom: a dificult but exciting adventure for teachers and students. *Frontiers in Education, 9*, 1-9. https://doi.org/10.3389/feduc.2024.1294715

Rodríguez-Cano, S., Cuesta-Gómez, J. L., Delgado-Benito, V., & de la Fuente-Anuncibay, R. (2022). Educational technology as a support tool for students with specific learning difficulties—Future education professionals' perspective. *Sustainability*, *14*(10), 6177. https://doi.org/10.3390/su14106177

Rodríguez-Cano, S., Delgado-Benito, V., & Ausín-Villaverde, V. (2022). Áreas de desarrollo para intervención en dislexia: una propuesta de realidad virtual. *Ocnos: Revista de estudios sobre lectura*, *21*(1), 1–16. https://doi.org/10.18239/ocnos_2022.21.1.2701

Romero Esquinas, M. H., Hidalgo Ariza, M. D., Muñoz González, J. M., & Ariza Carrasco, C. (2024). La realidad virtual y el diseño universal de aprendizaje: una manera inclusiva y actual de entender la educación. *Revista de Investigación Educativa*, *42*(2), 1-17. https://doi.org/10.6018/rie.564881

Sousa Ferreira, R., Campanari Xavier, R., & Rodrigues Ancioto, A (2021). La realidad virtual como herramienta para la educación básica y profesional. *Revista Científica General José María Córdova*, *19*(33), 223-241. https://doi.org/10.21830/19006586.728

Stavroulia, K. E., Baka, E., & Lanitis, A. (2025). VR-based teacher training environments: A systematic approach for defining the optimum appearance of virtual classroom environments. *Virtual Worlds*, *4*(1), 2-19. https://doi.org/10.3390/virtualworlds4010006

Tene, T., Marcatoma Tixi, JA., Palacios Robalino, MdL., Mendoza Salazar, MJ., Vacacela Gomez, C., & Bellucci, S. (2024) Integrating immersive technologies with STEM education: a systematic review. *Frontiers in Education*, *9*(1410163), 1-20. https://doi10.3389/feduc.2024.1410163

Toala Palma, J., Arteaga Mera, J., Quintana Loor, J., & Santana Vergara, M. (2020). La Realidad Virtual como herramienta de innovación educativa. *EPISTEME KOINONIA Revista Electrónica de Ciencias de la Educación, Humanidades, Artes y Bellas Artes*, *3*(5), 270-286. http://dx.doi.org/10.35381/e.k.v3i5.835

UNESCO MGIEP. (2018). *Digital pedagogies for building peaceful & sustainable societies*. UNESCO Mahatma Gandhi Institute of Education for Peace and Sustainable Development. https://unesdoc.unesco.org/ark:/48223/pf0000265758

UNICEF Armenia. (March 7, 2021). *Hasmik Baghdasaryan: Bringing chemistry to life through virtual labs*. https://www.unicef.org/armenia/en/stories/hasmik-baghdasaryan-bringing-chemistry-life-through-virtual-labs

Urhan, O., & Akpinar, E. (2024). The views of students regarding the use of virtual reality applications in elementary science classes. *Science Insights Education Frontiers*, *21*(1), 3329-3348. https://doi.org/10.15354/sief.24.or550

Urías Arbolaez, G., & Pino Torrens, R. (2024). La educación inclusiva ante los desafíos contemporáneos. *EDUMECENTRO, 16*(1), e2776. de https://revedumecentro.sld.cu/index.php/edumc/article/view/e2776

Urquizo Esparza, R., Balta Sevillano, G., Orihuela Ticona, R., & Garay Urquizo, A. (2024). Estado del Arte de la Educación Inclusiva en la Educación Primaria. *Aula Virtual*, *5*(12), e319. https://doi.org/10.5281/zenodo.12679644

Uzza, A., Kaur, A., Hamdan, A., & Low, Y. (2022). Personalized Experiential Learning Using Virtual Reality to Enhance Imagination and Emotional Connectivity in Skills-Based Courses. 10. Pan-Commonwealth Forum 10 (PCF10), 2022, Calgary, Canada. https://doi.org/10.56059/pcf10.9345

Verdugo Guamán, G., & Ramón Pacurucu, P. (2024). Realidad virtual en 3D: una herramienta inclusiva para la educación. *Mamakuna*, (22), 76–87. https://doi.org/10.70141/mamakuna.22.878

Veytia Bucheli, M.G., Gómez-Galán, J., Cáceres Mesa, M.L., & López Catalán, L. (2024). Digital technologies as enablers of universal design for learning: higher education students' perceptions in the context of SDG4. *Discover Sustainability, 5*, 1-29. https://doi.org/10.1007/s43621-024-00699-0

Vidal Turrubiates, L., Lizcano Sánchez, M., Santiago León, W., & Ronzón Contreras, J. (2024). Análisis y Evaluación del Aprendizaje Mediante Tecnologías Emergentes: Realidad Virtual, Realidad Aumentada e Inteligencia Artificial en Ambientes Educativos. *Revista Pensamiento Transformacional*, *3*(10), 8–23. https://doi.org/10.63526/pt.v3i10.82

Villalobos López, J.A. (2024). Marco teórico de realidad aumentada, realidad virtual e inteligencia artificial: Usos en educación y otras actividades. *Emerging Trends in Education*, *6*(12), 1-17. https://doi.org/10.19136/etie.a6n12.5695

Wehrmann, F., & Zender, R. (2023). Inclusive Virtual Reality Learning: Review and 'Best-Fit' Framework for Universal Learning. *EJEL*, *22*(3), 74-89. https://doi.org/10.34190/ejel.21.6.3265

Yong, X., Chan, G., & Arya, A. (2024). Inclusion in Virtual Reality Technology: A Scoping Review. *International Journal of Human–Computer Interaction*, *41*(5), 2808–2828. https://doi.org/10.1080/10447318.2024.2392967