



## Effectiveness of the metaverse classroom in higher education: A scoping review

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### ABSTRACT

#### Article History

Received: 8 September 2025

Revised: 14 January 2026

Accepted: 6 March 2026

Published: 26 March 2026

#### Keywords

Augmented reality  
Learning experiences  
Students  
Virtual environments  
Virtual learning  
Virtual reality.

In the field of higher education, the metaverse has garnered significant interest due to its potential to transform traditional classroom environments into immersive and interactive virtual spaces. The concept of the metaverse classroom is an integrated digital environment where students can engage in real-time interactions through three-dimensional simulations, personalized learning pathways, and collaborative social interactions. Its effectiveness is crucial for university students to adapt to a changing, more globalized, and interactive work environment. This exploratory review aimed to examine the evolution of the scientific literature on the metaverse classroom and to assess its effectiveness in higher education. A search was conducted using the Prisma-ScR extension, which facilitated the identification of relevant studies in electronic databases and the establishment of eligibility criteria. Fourteen papers were included in the final review. The findings indicated that there is limited literature specifically addressing the term "metaverse classroom." The year 2024 recorded the highest number of publications, followed by 2025. It was determined that the metaverse classroom is effective in higher education, as it enables students to develop creative media within virtual environments and simulated scenarios, and to collaborate in the virtual world. These virtual environments, as part of metaverse teaching, can enhance students' emotional engagement, concentration, and comprehension, thereby promoting more effective learning. The creation of a classroom within the metaverse enhances the learning experience and encourages educators to utilize innovative technological tools to achieve a more interactive and effective educational process.

**Contribution/Originality:** This study contributes to enriching the scarce existing literature on the subject by describing the role of the metaverse classroom in higher education. Furthermore, it establishes its effectiveness in the teaching-learning process, as it provides tools that favor the use of creative media in virtual environments, simulated situations, and collaboration.

## 1. INTRODUCTION

The metaverse, as a social phenomenon, has a relatively recent development; however, it has made significant progress due to its contributions in various fields, including medicine, education, marketing, and entertainment. This contribution is accompanied by a new paradigm that enables interaction between different digital technologies

within an immersive virtual reality environment (Cristache et al., 2024; De Felice, Rehman, Petrillo, & Baffo, 2023; Dwivedi et al., 2022).

Among the various fields currently benefiting from the advantages of the metaverse is education. In this sector, the metaverse is breaking into a reality where traditional paradigms prevail, which has caused significant disruptions due to the advent of remote and online learning (Hussain, 2023; Zaidi, Adnan, Lewis, & Fatima, 2024). Online learning allows the education sector to focus on integrating immersive technologies into curricula to make learning engaging and fun for students. In that sense, for Tyagi, Singh, Puri, and Tyagi (2023), the metaverse constitutes one of these approaches, since its main objective is to engage the student in an immersive experience that allows him/her to enjoy learning.

For Lewis, Popov, and Fatima (2024), the metaverse is a three-dimensional (3D), dynamic, immersive, and interconnected virtual space that, in addition to fostering student interaction, promotes interaction with digital content in real time. It also uses virtual reality (VR), augmented reality (AR), and mixed reality (MR) to create learning experiences whose main characteristic is their versatility. This experience features multiple users, such as avatars, who, in addition to interacting, create artificial societies in an online environment (Díaz, Saldaña, & Rodríguez Ávila, 2020; Li & Yu, 2023).

Specifically, in higher education, the metaverse plays a leading role in areas such as health, architecture, engineering, and graphic design, among others. Thus, for example, in architecture and engineering, it is difficult for students to understand how the construction process of the structure, foundations, facades, etc., occurs, since these elements are hidden in the buildings. In addition, their training is supported by didactic materials that use images and texts, which, in practice, are inadequate for architecture students (Onecha, Cornadó, Morros, & Pons, 2023). In this case, use is made of a seemingly obsolete process, which can be improved by digitizing architectural training and incorporating augmented reality tours of building sites in a metaverse environment (Nedeva, Dineva, & Atanasov, 2025; Onecha et al., 2023).

As well as Engineering and Architecture, many other professional careers will benefit from the potential that the metaverse has to significantly improve teaching-learning practices at the higher education level. However, for this to happen, universities must reinvent a more modern classroom, incorporating the metaverse into their curricula through VR and online learning platforms (Damaševičius & Sidekerskienė, 2024; Jiao, Dewitt, & Abdul Razak, 2024). Another advantage of the metaverse is that it serves as a platform for hosting virtual classrooms, offering interactive learning experiences, and facilitating training simulations in fields such as those mentioned above and many others (Onecha et al., 2023).

These new learning situations provided by the metaverse have generated a series of terms that include the physical-digital context in which this process originates. Some authors use "metaverse classroom" (Yeganeh, Fenty, Chen, Simpson, & Hatami, 2025), "immersive virtual learning environments" (Jantakoon, Wannapiroon, & Nilsook, 2019), "metaverse learning environment" (Gao, Yunus, & Rafiq, 2024), or "virtual learning environments" (Neifachas, Butvilas, & Kovaitė, 2022). Regardless of the name assigned to it, the metaverse is used to set up classrooms and make lectures more immersive; moreover, the realistic environments and interactive features of metaverse platforms also create a more stimulating learning experience, where students can have the freedom to conduct self-directed learning (De Matías Batalla & Bueno Pedrero, 2023; Lam & Kiu, 2024; Lepez, 2022).

However, despite the benefits of the literature, few studies have been conducted on the definition and characterization of the so-called "metaverse classroom." That is, the literature shows various investigations into the metaverse, but in a general sense; some of them relate to virtual commerce, the twin, and 3D virtual worlds, for example. However, there are few studies or literature reviews aimed at analyzing and establishing the effectiveness of the metaverse classroom in higher education to provide broader information to the academic world on the topic. Added to this is the increasingly rapid introduction of the metaverse at all educational levels, especially in higher education and distance education.

In these areas, its role goes beyond traditional virtual classrooms, as it provides, according to Yeganeh et al. (2025), immersive, interactive, and collaborative digital spaces for students to actively participate and achieve experiential learning. Faced with this accelerated process, research is needed to examine and establish the effects and practices of this area, which is so important for achieving meaningful learning. Based on this, this review aims to elucidate the use that has been given in the scientific literature, specifically, to the so-called metaverse classroom, and the effectiveness of its application in higher education. Because this term is a recent one (Yeganeh et al., 2025) a scoping review is proposed to explore the evolution of the scientific literature on the metaverse classroom and establish its effectiveness in higher education.

## 2. METHOD

An exploratory review was conducted with the general objective of examining the literature related to metaverse classrooms. Scoping or exploratory reviews (Grant & Booth, 2009) are generally used to synthesize evidence when there are high levels of uncertainty regarding what is known about a particular topic or problem (Arksey & O'Malley, 2005; Peters et al., 2020) as is the case when examining the notions studied about metaverse classrooms.

To execute such a review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews extension (PRISMA-ScR) was followed (Tricco et al., 2018). This included reporting on the electronic databases consulted, study eligibility criteria employed, etc. The first stage of the study involved formulating the research question; then, the search for the most relevant studies began, selecting research, organizing the data, and synthesizing the findings (Arksey & O'Malley, 2005). The research questions that guided this review were the following: What have been the definitions of the metaverse classroom in the literature, and are metaverse classrooms effective in higher education?

### 2.1. Search Strategy

The search process was exhaustive and systematic, incorporating various academic databases to identify the most significant literature published between 2020 and 2025. This time period was chosen due to the recent use of the term "metaverse classroom" and because the first relevant studies on this topic began to emerge in 2010. The databases selected were Web of Science (WoS), Scopus, ERIC, and SciELO. This choice was due to their extensive coverage of refereed journals, conference proceedings, and scholarly articles (Baas, Schotten, Plume, Côté, & Karimi, 2020; Packer, 2024; Prancutê, 2021). For the search strategy, a combination of keywords, Boolean operators, and filters was used, all with the aim of refining the results and obtaining the most relevant studies linked to the topic. Thus, the terms and keywords used in the search included "metaverse classroom," "metaverse learning environment," "metaverse," "strategies," "effectiveness," and "higher education."

It is necessary to clarify that initially, it was planned to work only with the term "metaverse classrooms." However, since this is a new concept, it was decided to use keywords that are indistinctly related to "metaverse classrooms" (Table 1) and thus search for the titles and summaries of all the records indexed by the search engines.

**Table 1.** Search strings used for searching academic databases.

Database	Search string
Scopus	(Metaverse classrooms OR "virtual worlds" OR "immersive virtual spaces" OR "multi-user virtual environment") AND (metaverse OR "higher education" OR "virtual reality")
WoS	"Metaverse classroom" (Metaverse OR "higher education" OR effectiveness OR "virtual classrooms" OR "immersive reality")
ERIC	"Metaverse classroom" (Metaverse OR "higher education" OR effectiveness OR "virtual classrooms" OR "immersive reality")
SciELO	("Metaverse classroom" OR "higher education") AND (Metaverse, OR "immersive virtual spaces" OR "Higher education") AND (Effectiveness)

## 2.2. Eligibility Criteria

The initial phase of the literature selection process focused on three key inclusion and exclusion criteria (Table 2).

**Table 2.** Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Language	Spanish, English, or Portuguese	Language other than Spanish, English, or Portuguese
Time frame	Studies published between 2020 and 2025	Studies published outside the established period
Quality assurance	Peer-reviewed articles published in reputable academic journals	Papers resulting from conferences, doctoral theses, and book chapters
Scope	Studies focused on higher education	Primary and secondary education
Type of research	Qualitative, quantitative, mixed, and reviews	Studies without methodology
Thematic focus	Studies on the metaverse in higher education	Studies focused on the metaverse that are not related to higher education.

## 2.3. Compilation, Summary, and Communication of Results

Two of the four investigators were responsible for collecting and selecting the studies. Subsequently, the other two reviewed and eliminated duplicate studies; this process was carried out through classification by title, abstract, and full text. In the final stage, the 14 articles were subjected to an exhaustive review that included a quantitative and a qualitative descriptive analysis. Regarding any disagreements among the reviewers that arose at this stage of the process and on which consensus was not reached, it was agreed to resolve them through discussion or, if necessary, to incorporate a fifth reviewer.

Regarding the quantitative analysis, it allowed us to identify the scope, characteristics, methods, and distribution of the included articles, while the qualitative analysis grouped the main themes based on the objective and research questions. A table was also designed to summarize the main results; it also compiled information on the authors, the year and country of publication, the journal, the type of study, the methodology, and the language of publication, aspects relevant to research question number one. The results were analyzed and discussed narratively and descriptively to answer the second question posed.

## 3. RESULTS

A total of 268 studies were found that referred to the use of the “metaverse classroom” using the search terms mentioned above. Zotero software was used to identify and eliminate 11 duplicate studies. This process resulted in 257 articles, which underwent the screening proposed in the Prisma-ScR methodology. At this stage, 106 documents were eliminated after screening of title and abstract because they were not within the established period and were not published in English, Spanish, or Portuguese. Then, 151 publications were selected, of which 137 were eliminated after applying the exclusion criteria. Finally, only 14 studies published in English between 2020 and 2025 were included in the review. The selection diagram used, as well as the exclusion criteria considered, are presented Figure 1.

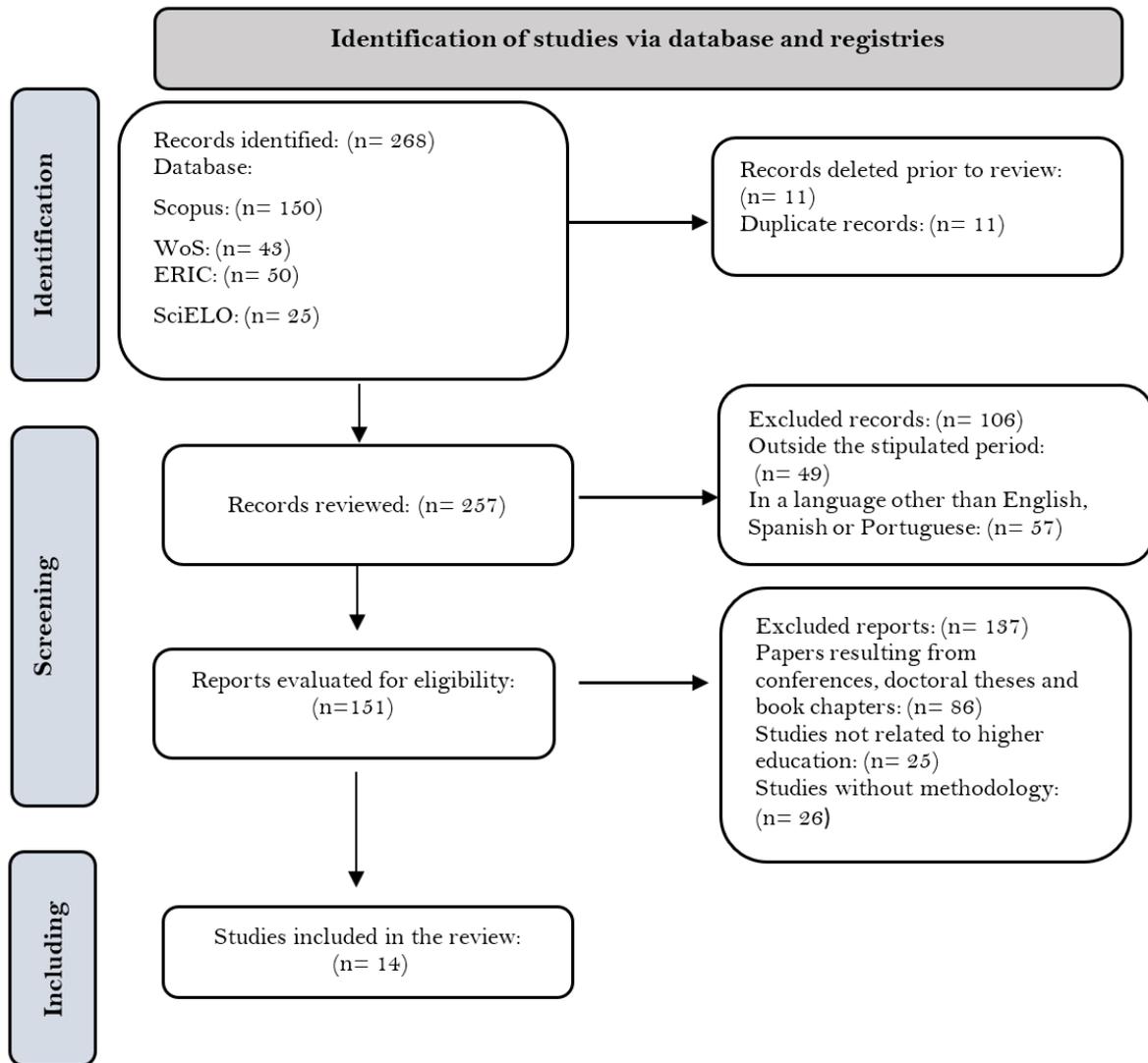


Figure 1. Flowchart of the selection criteria process of the included studies.

The review determined that there is limited literature addressing the term "metaverse classroom"; specifically, 12 publications explicitly mentioned it, while 2 discussed related concepts such as "metaverse methodologies" and "metaverse applications." The term is relatively recent, which is why the publication period was set between 2020 and 2025. A significant portion of the articles was authored by Europeans, accounting for 5 of them (35.71%). Additionally, 4 articles originated in Asia, 2 in Latin America, with one study conducted in Russia, and another involving three authors from Asia, Latin America, and Europe. Regarding research approaches, 42.85% of the articles employed a quantitative methodology, 21.42% used qualitative and mixed methods (3 each), and 14.28% were reviews, including a case study analysis of the documents. When considering only quantitative and mixed-method studies, 6 (42.85%) involved university students as samples, while 4 studies (28.57%) focused on professors from the respective institutions.

Similarly, the databases with the highest number of publications referring to the metaverse classroom and the effectiveness of its application in higher education were Scopus and ERIC, with 3 each, representing 21.42%. However, it was found that 5 studies were published in journals with double indexing (Scopus/WoS), which constituted 35.71% of the total number of articles. The year 2024 was the year with the highest number of publications referring to metaverse classrooms, with 5 studies (35.71%), followed by 2025 with 4 studies (28.57%). Finally, 12 studies were published in English, which represents 85.71% of the total number of documents analyzed (Table 3).

Table 3. Characteristics of the studies.

Author(s)/Year/Country	Methodology	Sample	Journal	Database	Language
Sá and Serpa (2023). Europe	Qualitative	Content analysis	<i>Sustainability</i>	Scopus/WoS	English
Yong, Lee, and Kim (2022). Korea, Philippines, Peru, Turkey	Quantitative	360 participants	<i>Cypriot Journal of Educational Science</i>	ERIC/WoS	English
Yeganeh et al. (2025). United States	Quantitative	28 participants	<i>Future Internet</i>	Scopus/WoS	English
Hwang and Lee (2024). South Korea	Mixed	30 students	<i>SAGE Open</i>	Scopus/WoS	English
Hanbay-Tiryaki and Balaman (2025). Turkey	Qualitative	5 participants (Teachers)	<i>International Journal of Contemporary Educational Research</i>	ERIC	English
Sisamud, Chatwattana, and Piriyaawong (2023). Asia	Quantitative	5 experts	<i>Higher Education Studies</i>	ERIC	English
Liang, Li, Zhang, Fan, and Luo (2023). China	Case Study	31 students	<i>Journal of Educational Technology Development and Exchange</i>	Scopus	English
Tsappi, Deliyannis, and Papageorgiou (2024). It does not indicate	Review		<i>Technologies</i>	Scopus/WoS	English
Fan et al. (2025). China	Quantitative	930 university students	<i>PLoS ONE</i>	Scopus/WoS	English
Gündüz and Sincar (2024). Europe	Qualitative	13 professors	<i>International Journal of Contemporary Educational Research</i>	ERIC	English
Oliveira et al. (2024). Brazil	Documentary review		<i>EDUR Educação em Revista</i>	SciELO	Portuguese
Lozano-Ramirez (2025). Mexico	Quantitative	68 teachers	<i>Digital Journal of University Teaching Research</i>	Scopus	Spanish
Suiçmez and Ozansoy (2024). Cyprus	Mixed	39 teacher candidates	<i>Sustainability</i>	Scopus/WoS	English
Amirbekova, Shertayeva, and Mironova (2024). Kazakhstan	Quantitative	236 students	<i>Front. Educ</i>	Scopus	English

#### 4. DISCUSSION

Although there are few studies related to the use of the term "metaverse classroom" and its effectiveness in higher education, it was observed that the metaverse classroom differs from the traditional classroom in many ways, as it is a virtual space whose digital tools are used by both teachers and students; in this space, physical and virtual reality intertwine (Sá & Serpa, 2023). This definition is expanded in the study by Yong et al. (2022), who managed to establish that the metaverse classroom is a virtual space in which virtual enhanced physical reality and virtual space (AR, VR, artificial intelligence, and big data) meet. At the educational level, these spaces use technology platforms and digital tools to help build knowledge and interactive experiences, conduct situational analysis, drive feedback, run distance classes supported by videoconferencing, design story-based actions, provide immersive experiences, and implement games to optimize skills and strategic thinking. Some metaverses that combine VR, AR, mirror worlds, and the internet of things, specifically in higher education, are the Meta classroom and training in various areas, such as those referring to marine knowledge, military, industry, sports, and aviation (Lozano-Ramirez, 2025).

The implementation of metaverse-related strategies and spaces in higher education offers students novel experiences across different areas of knowledge in a unique way, allowing them to immerse themselves in a rich learning environment. This contrasts with traditional education, which primarily favors representation, contemplation, and construction of knowledge in the student body (Hanbay-Tiryaki & Balaman, 2025). In this regard, Hwang and Lee (2024) analyzed the experiences of 30 students concerning the creation of the metaverse

classroom in the technological acceptance and affordances of prospective English teachers. To do so, the authors relied on the Frame VR metaverse platform, which allows users to freely upload a wide range of content, including photographs, music, PDFs, 360 photos and videos, whiteboards, and 3D model files. The different utilities of this platform are ideal for future teachers to design various learning activities in their virtual classrooms; it also facilitates active learning, as students, represented by 3D avatars, experience a sense of togetherness and presence through social interaction.

The study by Yeganeh et al. (2025) in the United States proposed a transformative metaverse classroom model, called the Multi-Layer Immersive Learning Environment (Meta-MILE), which was developed. The researchers collaborated with students in a computer design course to examine aspects such as student comfort, familiarity, motivation, and perceptions of the importance of immersive technologies for industrial applications. The model features a multi-layered structure that ensures each critical component of a digital classroom is valued and included in the goal of creating a comprehensive learning environment. Furthermore, its multi-layered structure allows for addressing different challenges that virtual education can pose. Each layer focuses on a specific aspect of virtual learning, ensuring stability, inclusion, and adaptability. Its integration also helps bridge gaps between traditional virtual learning environments and the constantly evolving metaverse ecosystem. The researchers concluded that the proposed model enables instructors to use advanced dashboards, analyze information obtained in real time, and provide various professional development opportunities to enhance the immersive classroom process. All these benefits position the metaverse classroom to generate real educational experiences characterized by equity and dynamism, aligning with the demands of 21st-century learning (Yeganeh et al., 2025).

Thus, implementing a metaverse classroom model can generate enormous benefits for educational institutions; furthermore, its adoption would lead to changes in teaching strategies and practices, infrastructure investment, and curriculum design. To achieve this, educational institutions must allocate resources to obtain technology that is compatible with different systems, create secure networks, and provide ongoing training for teaching staff. Similarly, teaching methods must shift from traditional approaches to other models guided by gamification, experiential learning, and personalized feedback. This seeks to place the student at the center of the educational process, as they will be able to actively interact with the content instead of passively receiving information (Yeganeh et al., 2025).

In teaching, the metaverse facilitates the creation of interactive three-dimensional digital environments and has the ability to immerse students in immersive learning. This technology has begun to be gradually promoted in Chinese universities. In educational settings, the metaverse is believed to possess the technological characteristics of the 3Is: immersion, interaction, and imagination. The immersion and interaction perceived in metaverse teaching significantly improve learning effectiveness. It is evident, then, that metaverse teaching, characterized by highly realistic virtual environments and greater interactivity, can foster students' emotional connection, greater concentration, and understanding of the topics taught (Fan et al., 2025).

Liang et al. (2023) used the Virbela platform to design and implement a psychology course in the metaverse for undergraduate students. This course aimed to observe and evaluate how much participants learned and to explore each participant's experiences in the metaverse classroom. A knowledge test consisting of multiple-choice questions was also employed to assess the instructional effectiveness of student learning in this environment. The results revealed characteristic aspects, as students reported that their experience with the metaverse was quite positive; however, regarding learning outcomes, these were not as satisfactory as anticipated. The authors suggest that this result could be associated with variations in social, cognitive, and teaching presence. Specifically, the social functions and teaching spaces provided by the platform may have fostered a high perception of social and teaching presence, potentially enhancing motivation and the learning experience. Conversely, cognitive presence might have been impacted by teacher-centered instruction and limited time for group discussions, factors that hindered the development of higher-level thinking skills. Another possible explanation is the novelty effect; although the use of

these platforms may generate increased interest among students, it can also serve as a distraction, leading to disruptions in their learning process.

The teacher's perspective was also analyzed in the documents found. In this regard, it was established that, in some cases, teachers presented a significant deficiency in their understanding of sustainable education centered on metaverse tools. Thus, the study conducted by Suiçmez and Ozansoy (2024) highlighted the need to develop, in future educators, a series of competencies and skills necessary to work with digital tools and platforms. One aspect that should be highlighted is that related to future teachers belonging to Generation Z, who have little knowledge about the metaverse and educational sustainability, which requires improving education in these areas. Many students argue that traditional education should be fully integrated with technology; this would lead to greater importance for metaverse applications in motivation and innovative education. Therefore, it is essential to include the digital transformation of society in educational policies, as the results demonstrate the importance of adopting a new teaching style based on the metaverse. In short, the adaptation of new teachers to metaverse education is crucial.

Sisamud et al. (2023) studied the results of implementing a project-based learning model using design thinking through the metaverse to empower Buddhist innovators. This learning model organizes learning activities through the metaverse. The purpose of the project was to encourage students to develop innovation skills using the latest information technologies to disseminate Buddhism to new generations, gain access to Buddhism, and perpetuate the traditions of the Thai people. It was evident that integrating the project-based learning process with a design thinking process, as well as clear steps and processes, can guide learning through the metaverse classroom. Furthermore, it allows students to awaken their creativity by using 3D virtual environments in simulations and participate in the virtual world; in addition, they will be able to disseminate Buddhism and various Buddhist activities.

The effectiveness of the metaverse classroom was demonstrated in the studies reviewed here. The virtual setting provided by the metaverse classroom allows, among other things, educational actors to acquire digital identities using VR, AR, the Internet of Things, and blockchain. These technologies enable interaction in formal and informal teaching situations in the virtual world. In this way, it is possible to overcome a series of barriers or limitations that characterize traditional educational spaces, such as time and space. With these technologies, each participant can learn physically and virtually in an open, shared space, also increasing their motivation (Sá & Serpa, 2023). Similarly, the combination of AR and VR fosters communicative competence among students. When it comes to learning chemistry in the metaverse, the use of these technologies positively impacts students' self-realization, self-concept, motivation, and ability to plan their learning. In other words, immersive technologies offer greater benefits compared to traditional tools in terms of motivation and skill development (Amirbekova et al., 2024).

Virtual environments incorporate important changes in the traditional paradigm of higher education, adopting a more interactive and experiential type of learning. This approach can improve student engagement and increase the effectiveness of pedagogical strategies, allowing instructors to use more dynamic and engaging strategies for a diverse student population and a constantly changing work environment (Tsappi et al., 2024). Following the COVID-19 pandemic, university institutions were forced to examine the effectiveness of metaverse platforms in creating their campuses in virtual environments.

Examples include Mozilla Hubs and Spatial. The result was the creation of "metaversities," digital twins of university environments that provide immersive and interactive experiences. All of this is aimed at helping future professionals adapt to more remote and virtual work modalities, making information on the performance and use of avatars crucial. In virtual jobs, avatars represent employees in the metaverse; therefore, higher education training can generate important information about how to manage performance, employee engagement, and training effectiveness, among other aspects.

## 5. CONCLUSIONS

The review demonstrated the effectiveness of the metaverse classroom in higher education, as well as the limited use of the term so far in the literature on metaverse research in the educational sector. This aspect was observed in the time frame of the publications, since 2024 presented the highest number of publications (5 = 35.71%), followed by 2025 with four studies (28.57%). Likewise, the positive impact of metaverse teaching on learning effectiveness was evidenced, especially regarding the perception of immersion and interaction in metaverse teaching. Virtual environments are highly realistic and feature greater interactivity, so metaverse classroom environments can foster greater student concentration and comprehension, thus increasing learning effectiveness.

Metaverse classrooms encourage group activities and interactions between teachers and students, and enable a better learning experience by using, for example, 3D spatial design and immersive multimodal platforms. They also offer parallel or synchronous learning experiences that overcome time and space constraints; therefore, teachers can use the metaverse learning space to provide their remote students with an immersive and interactive learning environment. This aspect is quite beneficial in regions where educational resources are limited and generates a more inclusive and accessible learning environment.

**Funding:** This study received no specific financial support.

**Institutional Review Board Statement:** Not applicable.

**Transparency:** The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

**Competing Interests:** The authors declare that they have no competing interests.

**Authors' Contributions:** All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

**Disclosure of AI Use:** The authors declare that they did not use AI to edit and refine the study. The entire review was reviewed and verified by the authors.

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