Teaching And Learning Process In Virtual Higher Education: A Literature Review

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Abstract

The teaching-learning process in virtual education during the last three years has taken a 360 degree turn because of the Covid-19 pandemic. In this period, the education sector in its various levels moved from the face-to-face stage to the virtual stage with the use of different tools that allow both the teacher and the student to carry out this process. The objective was to identify the current

state of theoretical and methodological development of teaching and learning in virtual higher education. For this purpose, bibliometric analysis and an analytical review of the literature were conducted. As a result, it was found that for the last 3 years, researchers have given greater importance to this topic in their studies; among the countries that have had the most participation in this field of study are Spain, Colombia, Ecuador, and Peru; the types of documents most written were articles, followed by conference papers; and the areas that have given greater importance to this topic are the social sciences and computer sciences; in addition, the advances of technology in the education sector and the applications in developed countries stand out. Finally, it was concluded that although technology is indeed a useful tool for the educational sector, those who wish to use it must consider the factors that affect its good performance.

Keywords: teaching, learning, virtual education, higher education.

Resumen

El proceso de enseñanza aprendizaje en la educación virtual durante los 3 últimos años ha dado un giro de 360 grados, ya que a raíz de la pandemia del Covid-19, el sector educación en sus diferentes niveles paso de la etapa presencial a la etapa virtual y con ello a la utilización de las diferentes herramientas que le permitan tanto al docente como al estudiante llevar a cabo este proceso. Se planteo como objetivo: Identificar el estado actual del desarrollo teórico y metodológico de la enseñanza aprendizaje en la educación superior virtual. Para ello se realizó un análisis bibliométrico y una revisión analítica de la literatura. Como resultado se obtuvo que hace 3 años los investigadores le tomaron mayor importancia, entre los países que más participación tuvieron España, Colombia, Ecuador y Perú, los tipos de documentos más escritos fueron los artículos seguido de los documentos de conferencia; y las áreas que han tomado mayor importancia a este tema son las ciencias sociales y las ciencias de la computación; además resalta los avances que ha tenido la tecnología en el sector educación y que países desarrollados lo hacen uso desde hace un buen tiempo. Finalmente se concluyó que si bien es cierto la tecnología es una buena herramienta dentro del sector educativo, pero quienes desean utilizar en el proceso de enseñanza aprendizaje tiene que tener en cuenta que existen factores que afectan en buen desempeño del mismo.

Palabras clave: enseñanza, aprendizaje, educación virtual, educación superior

1. Introduction

During the last two years, as a result of the COVID-19 pandemic, companies and institutions, in general, have had to stop their activities, while others have had to adopt new ways of working (Gulyás & Kiss, 2023). Universities have adopted the e-learning teaching modality, in addition to the requirements that universities must meet in order to provide a quality service (Imran et al., 2023). This transformation of the approach implies the need to change the methodology (Carrillo & Flores, 2023), both in the definition and planning of courses and in the choice of new teaching strategies that promote meaningful learning throughout the students' professional life (James, 2023; López-Carril et al., 2022; van Tartwijk et al., 2023).

One of the sectors that has had to respond urgently to this crisis is education (Lennox et al., 2021), where researchers, professors, students, and the administrative staff that support their activities have affirmed that professional training does not stop and that learning is not postponed (Atarama, 2020).

In this sense, the COVID-19 pandemic has had a significant impact on college students (Hu et al., 2022) and these sudden changes and disruptions require priority attention to address both the wellness and mental health of college students (Barrera et al., 2020; Liu, 2020). In this context, universities have adapted their teaching methodologies through the Internet and have used technology to continue teaching (Barrera et al., 2020; Gómez & Escobar, 2021; Judith, 2020), with a particular interest in the challenges related to the effectiveness of virtual education, as well as its availability and accessibility in all countries (Barreda-Ángeles et al., 2023; Saleh et al., 2023).

Teaching, in relation to learning, encompasses the actions taken by the teacher with the purpose of presenting situations that provide students with opportunities to gain experience (Lawson et al., 2023). On its part, learning is the set of activities conducted by students with the objective of achieving outstanding results or changes in their intellectual, emotional-volitional, and psychomotor behavior with certain levels of success (Molina, 2019).

In the educational context, authors observe that most countries in the region have taken significant measures in response to the crisis, involving the interruption of classes in person at all levels (Choi et al., 2021; Recch et al., 2023). This has generated three main areas of attention: the introduction of distance education methods, using

various formats and platforms (with or without technology) (Lytras et al., 2022; Outoukarte et al., 2023), the support and active participation of the teaching staff and educational communities, and special attention to the health and wellbeing of students (Unidas, 2020).

Today, many companies are applying technology in education for several reasons (Molleví Bortoló et al., 2023). Digital tools, which derive from the use of technology, refer to various resources in the IT and technological context (Antonietti et al., 2022; Bui, 2022; Karaca et al., 2022), which are usually programs, also known as software, that allow some form of interaction and development, or sometimes physical devices (hardware). These digital tools, such as Google Drive, Office 365, Evernote, Dropbox, and Edmodo, among others, can serve as visual aids, incorporate virtual reality, and even offer the possibility of adding bots or virtual assistants to help in the daily tasks of a teacher (Videgaray, 2020).

According to the students, online education has more disadvantages than advantages (Stecuła & Wolniak, 2022; van de Werfhorst et al., 2022). The lack of technological devices and Internet access is emphasized as an obstacle that generates frustration and discomfort, as well as difficulties in the learning process (Al-Badi & Khan, 2022). In addition, mention is made of the excessive load of subjects and activities, with more than 60 homework assignments in a month, which students perceive as a lack of sensitivity on the part of professors to the current situation (Xu, 2023). Social distancing also causes anxiety due to isolation and difficulties in concentrating on learning (Alshammari et al., 2022). However, among the positive aspects is the use of technology, which facilitates the learning process and allows the continuity of studies (Santos et al., 2021).

Globalization and the technification of societies have led to the proliferation of Information and Communication Technologies (ICT), which has allowed the emergence of virtual education as a methodological alternative to meet the challenges of universal and flexible education in a constantly growing demographic context (Douglass et al., 2023; Moe et al., 2020; Román-Calderón et al., 2021). Despite the associated myths and prejudices, virtual education is presented as a solution that broadens access to marginalized groups or groups with specific time and space needs (Gandolfi et al., 2021), while improving the quality of educational services through the use of technology in the teaching-learning processes and fostering innovation in contemporary educational practices (Ayala Pezzutti et al., 2020).

In the current context of teaching and learning, digitization is taking place, requiring schools at all levels to adapt to be part of a fully digital future (Fütterer et al., 2023; Oke & Fernandes, 2020). The change in the way of acquiring knowledge has abruptly come to society, together with technological innovation and communications (Vuchkovski et al., 2023), which has given rise to new lexicons and expressions, such as social networks, blogs, bloggers, games, virtual worlds, among others. These indicate that society is adopting a digital language with a new form of symbolic communication (Prinz, 2020).

In Peru, as in other countries, face-to-face education was suspended due to the pandemic in order to avoid contagion (Olivos Rossini et al., 2015; Ventura-León et al., 2022), which led to the implementation of virtual education as the only available option (Mousa & Arslan, 2023), however, there are inequalities in access to quality education in the country due to factors such as coverage, type of management of educational institutions, geographic area, infrastructure and availability of information and communication technologies (ICT) (Arapa et al., 2021; Sanfo & Malgoubri, 2023). Although educational coverage in Peru covers almost 99% of the school-age population, it does not guarantee equal opportunities (Carrillo-Larco et al., 2022), ICTs are fundamental for virtual education, but their availability in Peruvian households varies (Bohak Adam & Metljak, 2022; Brahma et al., 2023; Herrera-Pavo, 2021).

In this context, diverse options have been used, such as virtual education platforms, videoconferencing applications, instant messaging, e-mail, and educational programs broadcast on television (Coyne et al., 2018; Fanning et al., 2023; Kuhn, 2022). Each of these alternatives is linked to the geographic characteristics of the schools, the socioeconomic context of the students and their families, and the degree of digital competence (Mergoni et al., 2023; Tengtrakul & Peha, 2013; Wu et al., 2022). The latter refers to the ability to understand and effectively use information technologies, as well as the ability to respond critically to the demands of an increasingly sophisticated information environment (Gómez A & Escobar M, 2021).

Therefore, the purpose of this research is to analyze the state of the art by reviewing the theoretical and methodological development of other research related to the teaching-learning process in virtual higher education. The importance of the research lies in the fact that it will serve as a guide for other researchers who are interested in learning about the tools used during the development of the teaching-learning process.

2. Analytical review of the literature

According to Oweis et al. (2022) and Smith et al. (2021), the study compiles a broad sample of scientific articles related to virtual education from different databases and academic sources. Bibliometric techniques are applied to examine and analyze various aspects of research in this field. In terms of publication trends, the study identifies a significant increase in the number of articles published on virtual education in recent years, suggesting a growing interest in this area of research. In addition, it is observed that research in virtual education is carried out in a wide range of academic disciplines, such as education, psychology, and computer science, among others. As for the most relevant journals in the field of virtual education, the study identifies the most cited and high-impact publications.

These journals are usually specialized in education or educational technology and are considered important sources for the dissemination of research in this field. In addition, the study examines the most researched topics in virtual education. This provides insight into the topics of interest and the most active areas of research in the field. Some common themes include instructional design in virtual environments, online interaction, assessment, and quality of virtual education, among others.

In the same way, Lorena (2022) conducted a bibliometric analysis of the articles indexed in Scopus during the COVID-19 period (2020-2021), selecting a total of 477 publications. In relation to the results obtained, the most used keyword was Covid-19 (n = 292). The year 2021 presented the highest production of scientific publications with a total of 306 documents. The United States stood out as the country with the highest scientific production (n = 204) and as the country with the highest collaboration between different nations (n = 152). In terms of subject areas, Medicine registered the highest number of publications (n = 282). The most frequent type of publication was the article, with a percentage of use of 59.12%.

On the other hand Hebebci, (2021) reports the growing number of publications related to virtual education is evidence of the importance that this field has acquired in various disciplines since the beginning of the COVID-19 pandemic. According to the analysis of the distribution of research, the United States, the United Kingdom, and Spain have played prominent roles in studies on virtual education during the pandemic, with the United States being the most productive country in this regard. In relation to the most relevant journals, Sustainability Switzerland tops the list with the highest number of articles published in the area of study, followed by the Journal of Chemical Education and ACM International Conference Proceeding Series. Multiple areas of knowledge have been identified

in which papers are published in this field, with a notable presence of research in social sciences, medicine, computer science, and engineering. Through keyword co-occurrence analysis and clustering discussion, research hotspots in virtual education, studies during the pandemic have been identified, focusing on online learning, education, and e-learning.

During the period from 2020 to 2021, a close publication in several articles has been observed. The United States stands out notably from other countries in terms of number of articles. Approximately 30% of the articles in this field are attributed to the United States, followed by Brazil, Russia, and Turkey. The three journals with the highest volume of articles are “The Journal of Chemical Education,” “Education Sciences” and “Education and Information Technology.” On the other hand, the most cited journals include “The Journal of Chemical Education,” “Journal of Surgical Education” and “Education Sciences.” The most cited countries are the United States, England, Saudi Arabia, and Austria, respectively. In terms of keywords most frequently used by authors, “COVID-19,” “distance learning,” “self-instruction” and “internet/web-based learning” stand out. The countries with the highest number of research collaborations are the United States, the United Kingdom, Canada, and China. In addition, the results of common citation analysis in the journals “Journal of Chemical Education,” “Computer & Education” and “Computers in Human Behavior” are highlighted (Hernández, 2021).

Also, Menjivar Valencia et al. (2021) show that the production of studies has experienced a progressive increase each year, with 2020 as the year of greatest production. The institutions with the highest production and the most cited authors are in Northern European countries. This geographical region shows a greater interest in the educational use of virtual reality. In addition, there has been an increase in research conducted by institutions in China and Canada in recent years.

However, Comas-González et al. (2017) mentioned that, in order to carry out this study, search strings with time restrictions and inclusion and exclusion criteria were established. In addition, bibliometric maps were used, and keyword data were collected using the “Strength of Association” technique with the help of VOSviewer® software. The analysis of the bibliometric maps reveals a close relationship between virtual education and immersive environments. These new educational approaches allow students to strengthen their learning through the technology provided by virtual platforms. Such platforms stimulate the senses, capture the attention of new generations, and

encourage the development of new skills and potentialities. Virtual environments facilitate the development of multiple competencies, including social aspects, by providing a collaborative environment where students can interact with each other.

3. Materials and Methods

The research was carried out in two stages. In the first stage, a bibliometric analysis of teaching and learning in virtual higher education was conducted, and in the second stage, an analytical review of the most relevant literature on the teaching and learning process in virtual higher education was carried out.

The bibliometric analysis involves the application of mathematical and statistical principles to written sources available in databases (Diéguez-Santana & González-Díaz, 2023). These databases contain metadata and elements such as information on authors, publication titles, document types, languages, abstracts, and keywords or descriptors (Escorcia, 2008; López et al., 2009). This methodology is increasingly used to examine the state of research on different phenomena, making it possible to identify the categories of analysis in which there is a greater presence of authors, the areas of knowledge interested in the subject, the leading authors, the countries involved, the types of publications and the institutional affiliations of the authors.

Unlike in previous years, when it was necessary to invest a lot of time and resources to manually classify the information, nowadays, technological advances have improved data processing, and more accurate and reliable information is obtained (Cancino et al., 2017).

Bibliographic research was conducted using the Scopus database to explore the teaching and learning process in virtual higher education. In April 2023, a search protocol was applied using the following structure: (TITLE-SUMMARY-KEY WORDS (“higher education”) AND TITLE-SUMMARY-KEY WORDS (“virtual education”)). A total of 235 records were found, which were subjected to a bibliometric analysis that examined the evolution of publications by year, authors, areas of knowledge, and countries involved.

The information was exported in CSV format (comma-separated values) and integrated into the VOS Viewer program to carry out a co-occurrence analysis of key terms. This made it possible to explore the thematic associated with the teaching and learning process in virtual higher education.

In order to carry out an analytical review of the most relevant documents, access was gained to their full text, which made it possible to identify categories such as theoretical approaches to the phenomenon and theoretical and methodological models related to the teaching and learning process in virtual higher education.

3. Results

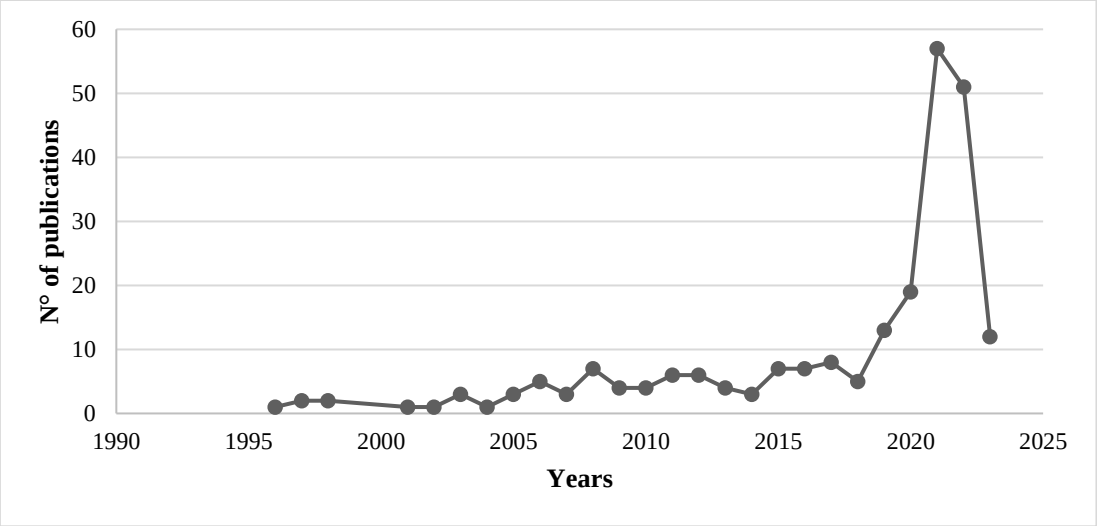
This section presents the results of the study based on the bibliometric analysis of the topic of virtual higher education. Following the methodological approach previously described the information available in the Scopus database was collected and organized using a search criterion that allowed to obtain of relevant metadata for the analysis. The data used for the bibliometric analysis cover the period from 1996 to April 11, 2023, and the results obtained are as follows.

Concerning the evolution of publications related to the topic under discussion, a significant trend can be observed over time. Figure 1 shows that researchers have shown a growing interest in the topic of virtual higher education since 1996. During the first ten years of analysis, there was a minimal level of interest in the study of this topic, with an average of about 2 published studies. However, in the last ten years analyzed, there has been a considerable increase in scientific production, with an average of approximately 18 published studies.

It is especially relevant to note that, in the last four years, the number of publications has experienced a remarkable increase, reaching an average of approximately 35 studies. This indicates a significant increase in the attention and interest of researchers in virtual higher education. This increase may be associated with several factors, such as technological progress, greater accessibility to digital resources, and the growing importance of distance education.

These results reflect the importance and relevance that the topic of virtual higher education has acquired in the academic community in recent years. They also show a constant growth in the number of studies conducted, which indicates a continuous interest in understanding and improving teaching and learning processes in the virtual context.

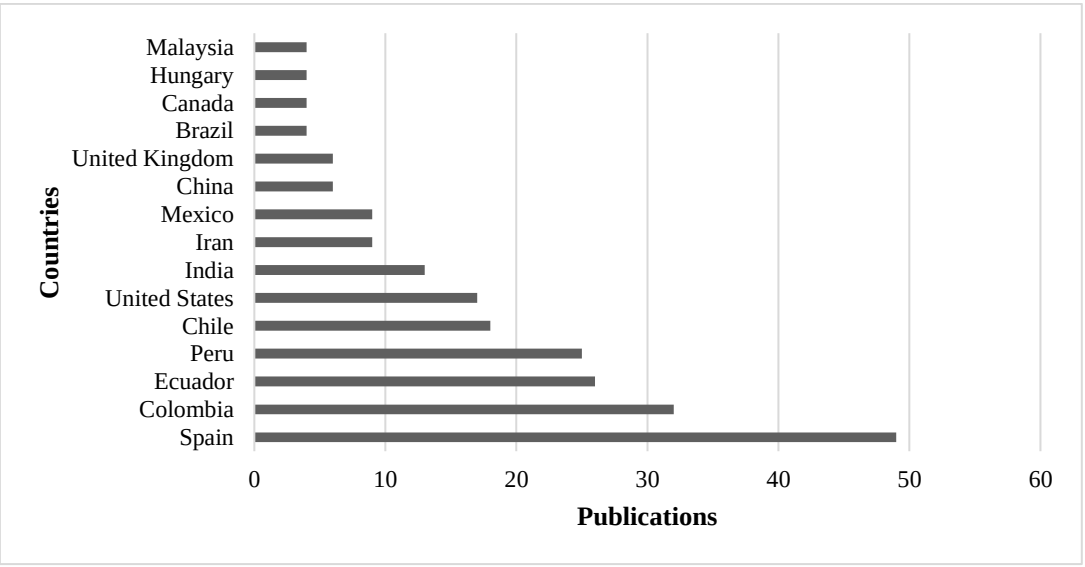
Figure 1 Annual publications in Scopus 1996 - April 2023



Source: Scopus database

The study of virtual higher education has aroused interest at diverse levels. Figure 2 shows outstanding participation in studies on this topic by countries such as Spain, Colombia, Ecuador, and Peru. Another group of countries, such as Chile, the United States, India, Iran, and Mexico, have also shown a certain presence in research on virtual higher education. In Latin America, there is a significant presence of countries such as Colombia, Ecuador, Peru, Chile, and Mexico, among others, in the sample of studies analyzed.

Figure 2 Publications by country in Scopus 1996 - April 2023



Source: Scopus database

Note: The 15 most relevant countries in publications are presented out of a list of 57.

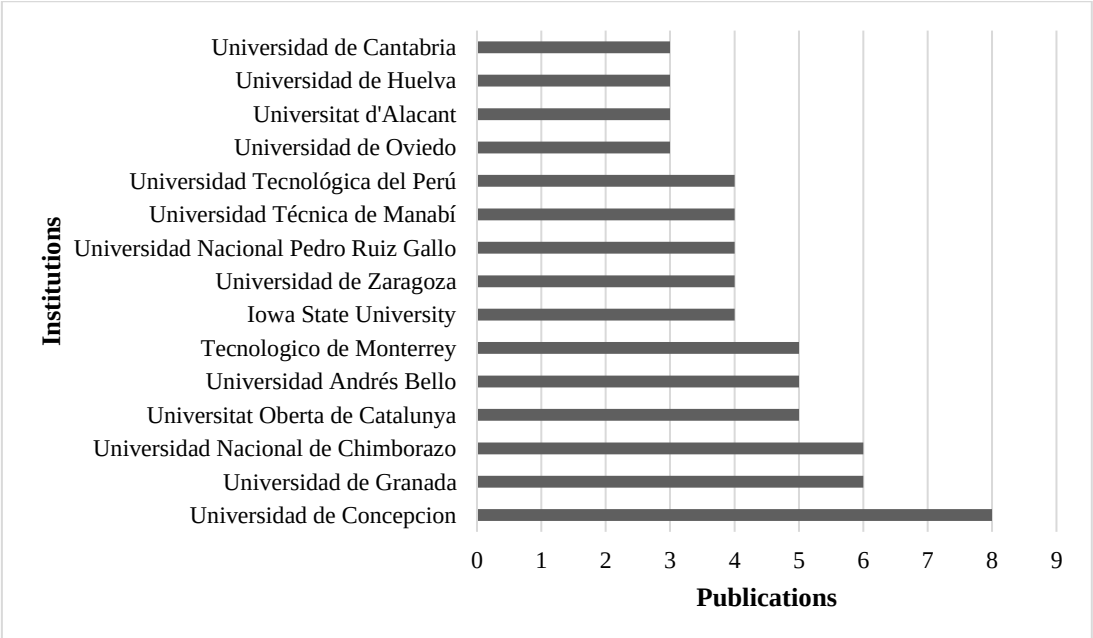
Figure 3 shows that there are several institutions affiliated with Scopus that have carried out outstanding research in the field of virtual higher education. Among these institutions are the University of Concepción, the University of Granada, and the National University of Chimborazo, which have shown a strong interest in this topic and have contributed significantly to scientific production.

In a second group are institutions such as the University of Catalonia, the Universidad Andres Bello, and the Tecnológico de Monterrey, which have also carried out relevant research in the field of virtual higher education. These institutions demonstrate the commitment and dedication of several Latin American universities in the generation of knowledge in this field.

A third group of institutions includes Iowa State University, the University of Zaragoza, and the Universidad Nacional Pedro Ruiz Gallo, among others. These institutions, together with those mentioned above, have contributed significantly to research on virtual higher education and have demonstrated their commitment to the improvement of educational processes in the digital environment.

These results are clear evidence that Latin American universities affiliated with Scopus play a relevant role in research on virtual higher education. Their active participation and contribution to this field demonstrate the commitment of these institutions to the generation of knowledge and their interest in improving the quality of education in the virtual environment.

Figure 3 Publications by institutional affiliation of authors from 1996-April 2023



Source: Scopus database

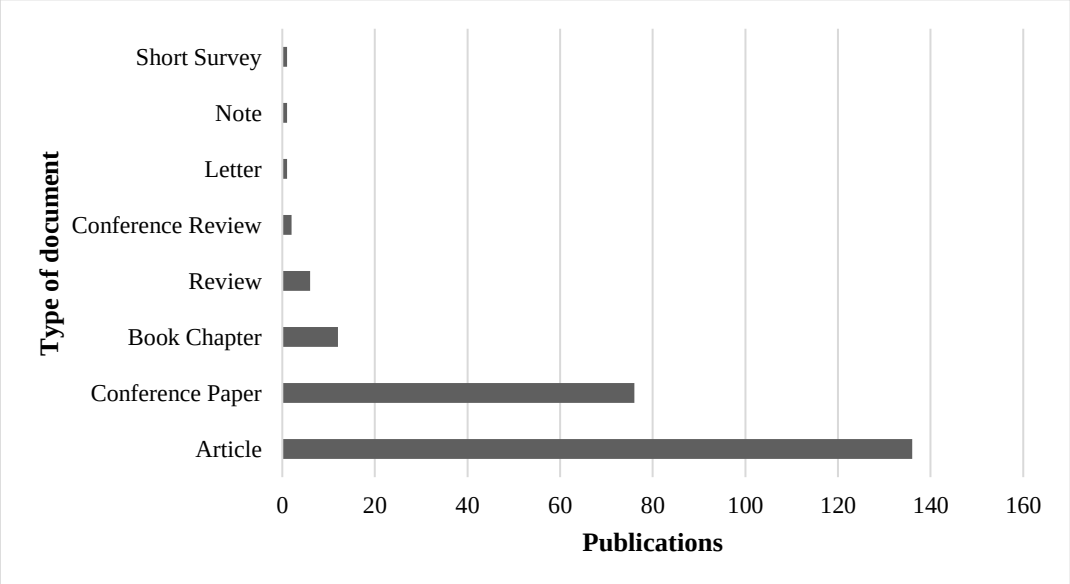
Note: The 15 institutions of affiliation of the most relevant authors in publications out of a list of 160 are presented.

Figure 4 reveals that studies related to virtual higher education have been conducted in the form of articles, with a total of 136 research papers identified. Also, 76 conference papers, 12 book chapters, and 6 reviews were found. These results highlight the importance of articles as fundamental reference sources for the study of the topic addressed in this article, closely followed by conference papers.

The abundance of articles on virtual higher education demonstrates the wide availability of scientific and scholarly information in this area. These articles often provide detailed and rigorous research, offering a solid basis for the analysis and understanding of virtual higher education. Conference papers also play a relevant role, as they often present research in development or preliminary results, allowing keeping abreast of the most recent developments in the field.

In addition, book chapters and reviews complement the range of resources available for the study of virtual higher education. Book chapters offer more extensive and in-depth approaches to specific aspects of the topic, while reviews provide a critical synthesis of the existing literature, providing an up-to-date overview of the subject matter.

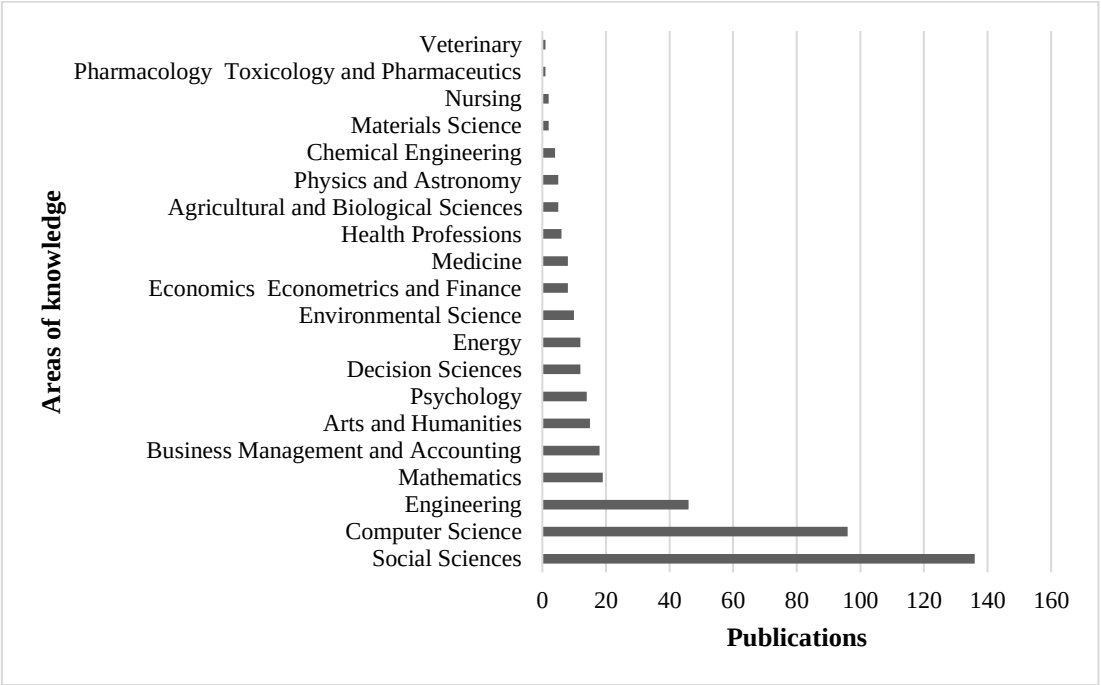
Figure 4 Publications by type of document from 1996 to April 2023



Source: Scopus database

Figure 5 reveals the areas of knowledge that have carried out the greatest amount of research on virtual higher education. In the first place, the area of social sciences stands out, with a total of 136 studies conducted. It is closely followed by the field of computer science, with 96 studies, followed by engineering, with 46 studies. In a second group are disciplines such as mathematics, business, management and accounting, arts and humanities, psychology, and decision sciences, among others. These findings highlight the diversity of areas of knowledge that have addressed the issue of virtual higher education, which shows the multidisciplinary interest in this area and the breadth of perspectives from which it has been investigated.

Figure 5 Publications by area of knowledge 1996- April 2023



Source: Scopus database

To generate the visual information in the form of graphs, the keywords used and their origin by countries were considered, considering the highest frequency in the document records of the analyzed database. Through the graphic representation or visual maps of the records, we sought to highlight interesting results related to the theme, based on the co-occurrence of the keywords.

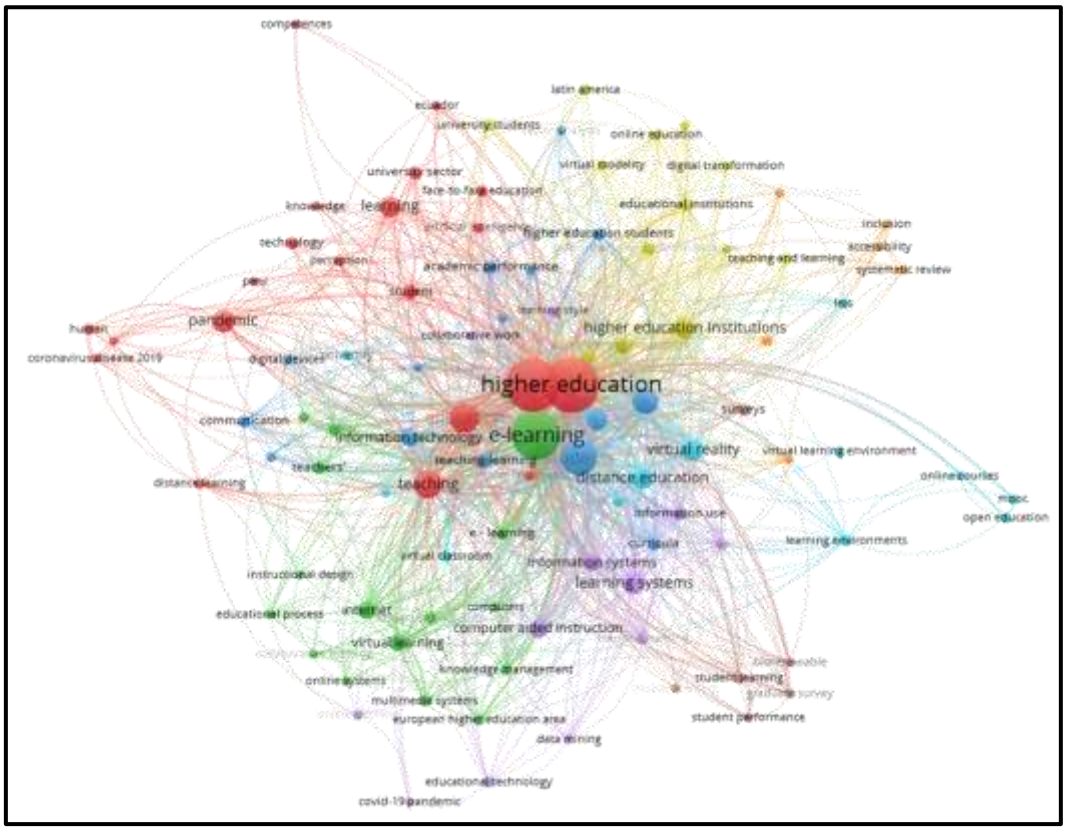
Figure 6 shows the semantic relationship in the theoretical-conceptual approach to virtual higher education, revealing significant trends that reflect the interest in certain subtopics present in the scientific literature analyzed in this study. Topics such as virtual learning, the use of information, virtual laboratories, teaching,

students, virtual reality, virtual modalities, and collaborative learning, among others, are highlighted, as shown in Figure 7.

Regarding the countries with the greatest presence in the mentions of scientific articles, there is an outstanding presence in Latin America and Europe, among others. These results reinforce the importance and global reach of research on virtual higher education, with significant contributions coming from different regions of the world.

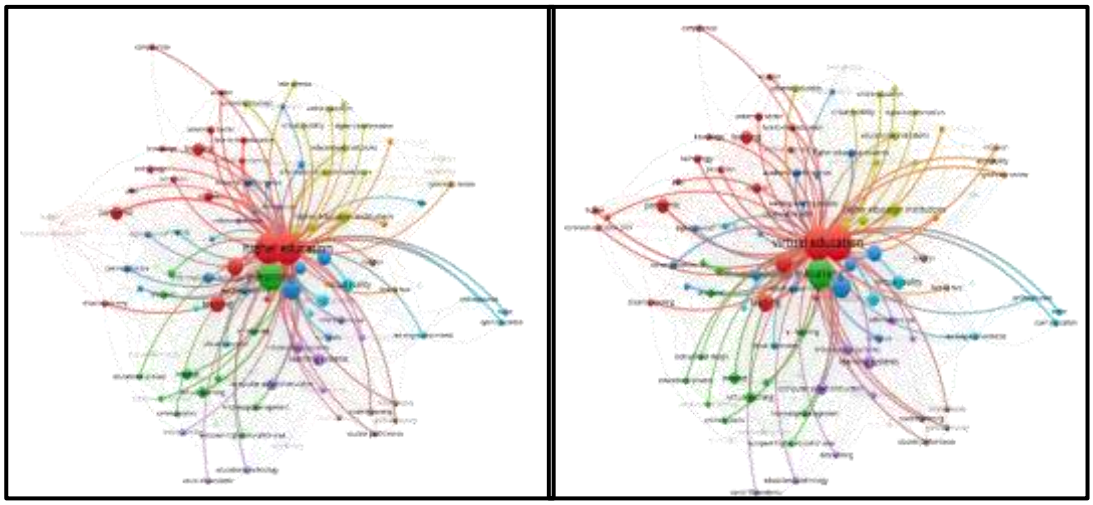
The use of graphics and visual representations allows for clearer and more concise visualization and understanding of research findings. These graphical representations facilitate the identification of patterns, trends, and relationships between key concepts, offering an overview of the subject and highlighting relevant aspects for a more detailed analysis.

Figure 6 Semantic map on the study of virtual higher education



Source: Scopus database processed with free software VOSViewer.

Figure 7 Semantic map of relationships in the study of higher education



Source: Scopus database processed with free software VOSViewer.

4. Discussion

A close relationship between virtual education and the use of emerging technologies such as virtual reality is evident, indicating the potential of these tools to enhance the learning experience in virtual environments.

In relation to the countries with the greatest presence in research on virtual higher education, the participation of countries such as Spain, Colombia, Ecuador, Peru, Chile, the United States, India, Iran, and Mexico stands out as mentioned by Espina-Romero (2022), Hebebci (2021) and Hernández (2021). These countries show significant interest in the subject and have contributed a considerable number of studies. In particular, universities affiliated with Scopus, such as Universidad de Concepción, Universidad de Granada, Universidad Nacional de Chimborazo, Universidad de Catalunya, Universidad Andres Bello, Tecnológico de Monterrey, Iowa State University, Universidad de Zaragoza and Universidad Nacional Pedro Ruiz Gallo, as stated by Menjivar Valencia et al. (2021) in which these authors mention that universities have demonstrated a strong commitment and dedication in research on virtual higher education.

In terms of the areas of knowledge that have addressed the issue of virtual higher education, a diversity of disciplines are involved, as can be seen in the following examples (Hebebci, 2021; Oweis et al., 2022) in which the authors mention that the area of social sciences tops the list with the highest number of studies, followed by computer

sciences and engineering. Also highlighted are areas such as mathematics, business, management and accounting, arts and humanities, psychology, and decision sciences, among others. This multidisciplinary approach demonstrates the interest and breadth of perspectives from which virtual higher education has been investigated.

In terms of scientific production in the context of the COVID-19 pandemic, there has been a significant increase in the number of studies on virtual education. Countries such as the United States, United Kingdom, Spain, Brazil, Russia, and Turkey have played prominent roles in research during this period. Journals specializing in education and educational technology, such as Sustainability Switzerland, Journal of Chemical Education, and ACM International Conference Proceeding Series, have been identified as important sources for the dissemination of research in this field.

The results show a significant trend in the increase of publications on virtual higher education over time and this can be supported by Espina-Romero (2022) and Oweis et al. (2022). The researcher's growing interest in the subject, especially in the last few years, is evident. It also highlights the participation of different countries and universities, especially in Latin America and Europe, in research on virtual higher education. The areas of knowledge involved are diverse, reflecting the multidisciplinary approach in this area. Scientific production during the COVID-19 pandemic has also experienced a considerable increase, with the outstanding participation of several countries and specialized journals. Overall, these findings highlight the importance and relevance of virtual higher education in the academic community and evidence a continued interest in understanding and improving teaching and learning processes in virtual environments.

According to the co-occurrence analysis shows the relationship of meaning in the theoretical-conceptual framework of online higher education is exposed, evidencing important trends that reflect the interest in certain secondary aspects present in the scientific research examined in this study. This can be contrasted with (Comas-González et al., 2017; Hebebci, 2021) highlighting topics such as distance education, data utilization, virtual simulators, pedagogy, learners, augmented reality, online learning options, and student collaboration.

5. Conclusions

The growing importance of virtual higher education in the academic community, the continuous interest in improving teaching and learning processes in the virtual context, the outstanding participation of countries and universities in research on virtual higher education, and the diversity of academic disciplines involved in the study of this topic were found.

Regarding the growing trend in scientific production, there is a significant trend in the evolution of publications related to virtual higher education over time. In the last ten years analyzed, there has been a considerable increase in scientific production, with an average of approximately 18 studies published; especially in the last four years, there has been a notable increase in the number of publications, reaching an average of approximately 35 studies, which indicates a growing interest and attention on the part of researchers towards virtual higher education.

About the participation of countries and universities, the participation of countries such as Spain, Colombia, Ecuador, Peru, Chile, the United States, India, Iran, and Mexico in the studies on virtual higher education is noteworthy. In Latin America, there is a significant presence of countries such as Colombia, Ecuador, Peru, Chile, and Mexico. In addition, several institutions affiliated with Scopus are identified that have conducted outstanding research in the field of virtual higher education, such as the University of Concepción, the University of Granada, the National University of Chimborazo, the University of Catalonia, the Andres Bello University, the Tecnológico de Monterrey, the Iowa State University, the University of Zaragoza and the Pedro Ruiz Gallo National University, among others. These institutions demonstrate the commitment and significant contribution of various universities in the generation of knowledge in the field of virtual higher education.

Finally, in relation to the diversity of knowledge areas, it is observed that research in virtual higher education is conducted in a wide range of academic disciplines. The most prominent areas of knowledge in the production of research on virtual higher education include social sciences, computer science, engineering, mathematics, business, management and accounting, arts and humanities, psychology, and decision sciences, among others. This reflects the multidisciplinary interest in the field of virtual higher education and the variety of perspectives from which research has been conducted.

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