The Digital Transformation of Universities in Latin America, changes in the Teaching-Learning process after the Pandemic

Section A-Research paper

The Digital Transformation of Universities in Latin America, changes in the Teaching-Learning process after the Pandemic

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Abstract

A documentary review was carried out on the production and publication of research papers concerning the study of the variable Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic in Latin America. The purpose of the bibliometric

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analysis proposed in this document is to know the main characteristics of the volume of publications registered in the Scopus database during the period 2016-2021 in Latin American countries, achieving the identification of 87 publications. The information provided by the said platform was organized through tables and figures categorizing the information by Year of Publication, Country of Origin, Area of Knowledge and Type of Publication. Once these characteristics were described, a qualitative analysis was used to refer to the position of different authors on the proposed topic. Among the main findings of this research, it is found that Mexico, with 26 publications, is the Latin American country with the highest production. The Area of Knowledge that made the greatest contribution to the construction of bibliographic material referring to the Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic was social sciences with 56 published documents, and the Type of Publication that was most used during the period indicated above was the Journal Article, representing 52% of the total scientific production

Keywords: digital transformation, higher education

1. Introduction

Digital transformation is a phenomenon that has occurred in recent decades and consists of adapting as many processes as possible to emerging technologies, to be in line with social evolution and industry 4.0; as expected, higher education must be in line with what society demands as students are digital natives, so it is increasingly common to use digital tools in educational processes. This transformation has been accelerated by the pandemic declared by COVID-19 in early 2020, which forced higher education institutions to adopt the online educational model as the only alternative to continue with the pedagogical processes without putting at risk the general welfare and complying with biosecurity standards. Therefore, this transition was forced, evidencing shortcomings in the educational system taking into account that teachers did not have the necessary digital skills to develop classes mediated by information and communication technologies (ICT), including students, despite being more familiar with the technological environment, they have more knowledge about social networks and entertainment platforms than educational spaces and videoconferencing platforms, so these skills were learned in the process, being also necessary training for all educational actors.

When changing the traditional 100% face-to-face modality to a 100% virtual modality, there were difficulties when using strategies in the teaching and learning process, since the same strategies applied as in the traditional model had different needs in the online model, which affected the quality of the education provided. This was improved over time by identifying the pedagogical shortcomings and using changes in these processes seeking to have the same results as in the traditional methodology, being a problem in emerging countries to use these strategies of synchronous and asynchronous classes because most vulnerable populations did not have internet connectivity or digital tools necessary to enter the educational platforms.

Thanks to the above, it can be said that the pandemic played an important role in the implementation of ICT in higher education, bringing with it challenges such as changes in the strategies used in the teaching-learning processes as new needs arise that must be covered to provide quality education. Therefore, it is important to know terms of bibliographic resources, the current state of research on the Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic. Therefore, a bibliometric analysis of the scientific production registered in the Scopus database during the period 2020 and the first semester of 2022 is proposed

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to answer the question: How has the production and publication of research papers related to the study of the variable Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic in the period 2020-2022?

2. General objective

To analyze from a bibliometric and bibliographic perspective, the production of high-impact research papers on the variable Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic during the period 2020 and first semester of 2022.

3. Methodology

Quantitative analysis of the information provided by Scopus is performed under a bibliometric approach to the scientific production regarding the Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic. Likewise, it is analyzed from a qualitative perspective, examples of some research papers published in the area of the study mentioned above, from a bibliographic approach to describe the position of different authors on the proposed topic.

The search is performed using the tool provided by Scopus and the parameters listed in Table 1 are established.

3.1 Methodological design

	PHASE	DESCRIPTION	CLASSIFICATION
PHASE 1	DATA COLLECTION	Data was collected using the Scopus web page search tool, through which a total of 87 publications were identified.	Published papers whose study variables are related to Management Accounting for Decision Making. Research papers published during the period 2020-first semester 2022. Limited to Latin American countries. Without distinction of the area of knowledge. Without distinction of type of publication.
PHASE 2	CONTRUCCION DE MATERIAL DE ANALISIS	The information identified in the previous phase is organized. The classification will be made through graphs, figures and tables based on data provided by Scopus.	Word Co-occurrence. Year of publication Country of origin of the publication. Area of knowledge. Type of publication

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PHASE 3	REDACCION DE LAS CONCLUSIONES Y DOCUMENTO FINAL	After the analysis carried out in the previous phase, we proceed to the drafting of the conclusions and the preparation of the final document.	

Table 1. Methodological design.
Source: Own elaboration (2022)

4. Results
4.1 Co-occurrence of words
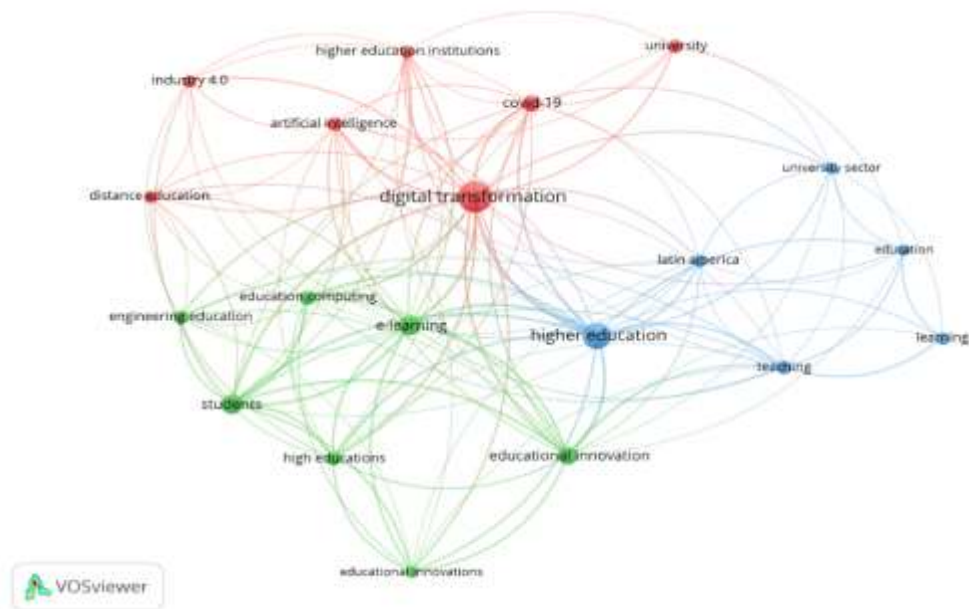Figure 1 shows the co-occurrence of keywords within the publications identified in the Scopus database.

Figure 1. Co-occurrence of words
Source: Own elaboration (2022); based on data provided by Scopus.

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As shown in Figure 1, the most used keyword in the research related to the variables under study is the digital transformation which is all the actions that society has been taking to digitize all processes making them faster and more accessible, so education has also adopted certain strategies to integrate ICT to pedagogical processes, as an abrupt transition resulting from the pandemic declared in 2020 by adopting the virtual model. There are keywords such as higher education, virtual education and educational innovation which refer to the transition adopted by universities in the use of ICT as an innovation strategy that allows for making it more inclusive and of higher quality. This as mentioned above was seen with the greater force since 2020 with the online educational model mediated by ICT and that meant the re-definition of education and the parameters in which it was given by presenting different needs in this model, although higher education had had technological advances it was not prepared to implement a 100% digital strategy. Finally, industry 4.0, distance education and the university sector are keywords that shed light on what will be the educational model to be in line with what industry 4.0, based on the use of emerging technologies, requires in the processes of professional training with defined technological skills.

4.2 Distribution of scientific production by year of publication

Figure 2 shows the distribution of scientific production according to the year of publication, taking into account the period from 2020 to 2022.
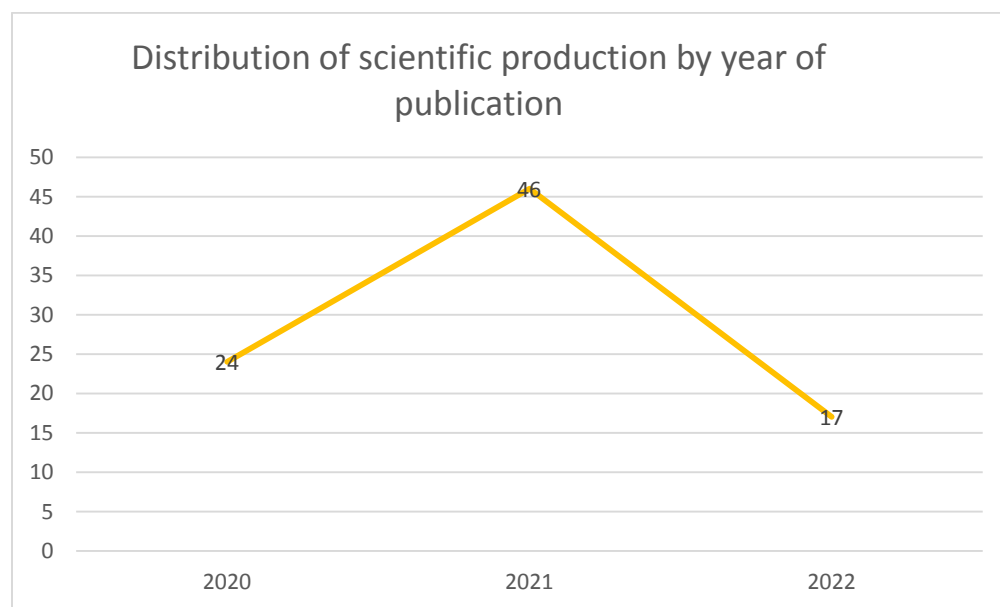

Figure 2. Distribution of scientific production by year of publication.
Source: Own elaboration (2022); based on data provided by Scopus.

2021 is the year with the highest number of publications related to the variables under study, presenting 46 publications within which is the paper with the title "A systemic perspective to understand the digital transformation in higher education: panorama and the subregional context in Latin America as evidence" (Suárez *et al.*, 2021). This document has as its main objective to understand the digital transformation in higher education from a systematic review of the current literature taking into account that universities are educational entities in line with emerging educational trends also highlighting the role of managerial decisions in the correct application of

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these innovations. This article concludes by highlighting the role that universities play in social transformation, which is why they are called upon to innovate by using ICTs in the adaptation of their processes.

In second place is 2020 with 24 documents registered in Scopus, among which is the title "Remote teaching before COVID-19: Teaching experiences in four subjects at UAM-I" (Padilla-Zúñiga *et al*., 2020). This paper aims to document how was the process of transition to virtual classes at the Metropolitan Autonomous University (UAM) in the way of adapting undergraduate and graduate courses that could be taught remotely through the experiences of four teachers who teach the subjects: Chemical Transformations of the General Core of Subjects. Introduction to the Sciences of Nano materials, an elective subject of the Bachelor's Degree in Chemistry, Inorganic Chemistry I and Electrical Circuits of the Bachelor's Degree in Electronic Engineering where they explain how the teaching-learning processes took place in the higher education faculty of basic sciences being the experimental part very important of which was deprived having uncertainty regarding the laboratory practices necessary for a full understanding of the knowledge that was intended to be studied in the curriculum, in addition to determining how they were replaced by virtual educational platforms.

4.3 Distribution of scientific production by country of origin.

Figure 3 shows the distribution of scientific production according to the nationality of the authors.
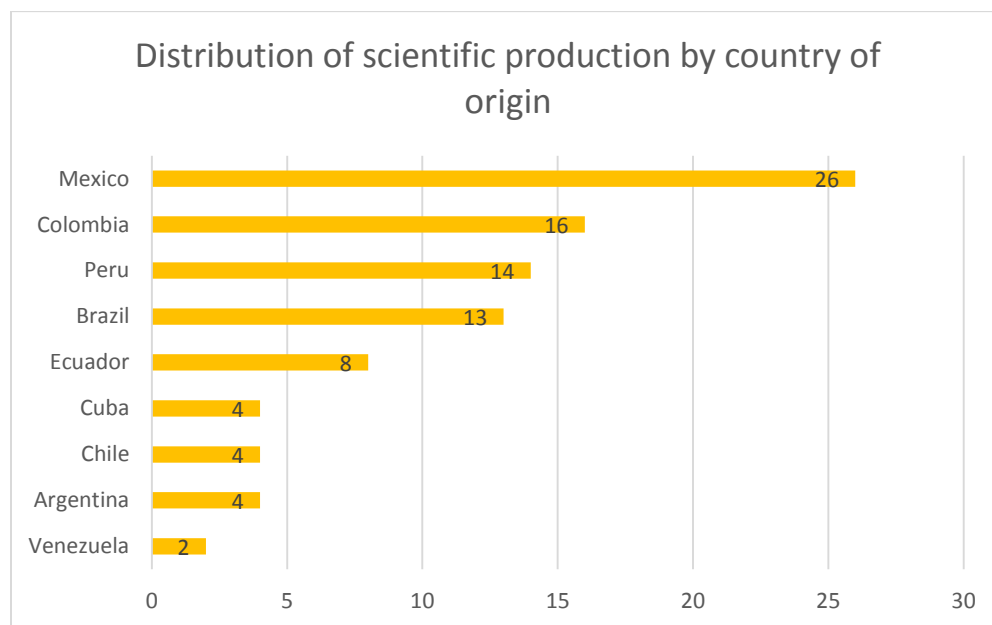

Figure 3. Distribution of scientific production by country of origin.
Source: Own elaboration (2022); based on data provided by Scopus.

Mexico is the Latin American country with the highest scientific production related to the study of the Digital Transformation of universities and the changes in the Teaching-Learning processes presenting 26 papers, among which is the title "A Flexible Teaching Model with Digital Transformation Competencies for Structural Engineering Courses" (Rodriguez-Paz *et al*., 1374 - 1380). This document aims to as best practices, according to the perception of students, applied during periods of confinement by teachers and present a hybrid model for the gradual return to the classroom. All this leads to the conclusion that there are subjects that from the students' perspective,

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so universities should not close themselves to the possibilities of online education or the hybrid model that allows having the theoretical and the experimental component to guarantee quality education from the use of ICTs having also the training in technological skills which are of great importance nowadays.

At this point, it is worth noting that the production of scientific publications, when classified by country of origin, presents a special characteristic and that is the collaboration between authors with different affiliations to both public and private institutions, and these institutions can be from the same country or different nationalities so that the production of an article with co-authorship of different authors from different countries of origin allows each of the countries to add up as a unit in the general publications. This is best explained in Figure 4, which shows the flow of collaborative work from different countries.
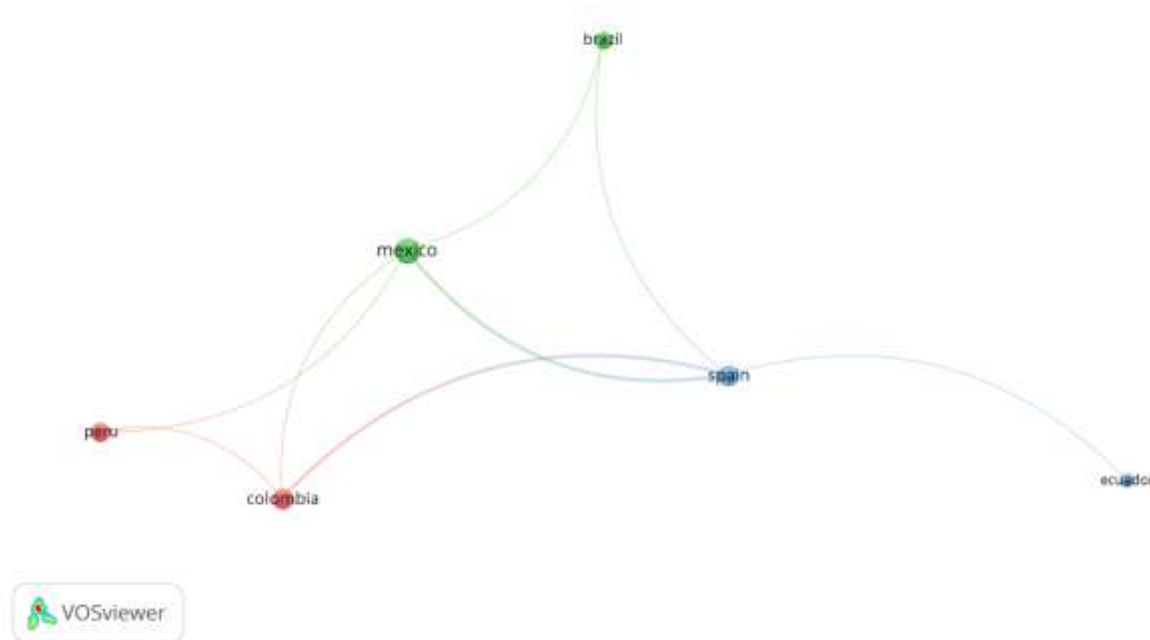

Figure 4. Co-citations between countries.
Source: Own elaboration (2022); based on data provided by Scopus.

As mentioned above, Mexico is the country with the largest number of publications related to the variables under study, with collaborative documents affiliated to institutions in countries such as Spain, which does not belong to Latin America. This demonstrates the interest of other countries in learning about the digital transformation in higher education in Latin America and the change in pedagogical strategies. In second place is Colombia with 16 documents within which exist in co-authorship with Peru and Spain conducting comparative studies with countries in the region that allow determining the progress of each country in technological innovations in the educational system; within these documents is "Digitalization strategy for the laboratories of the National University of Colombia: evaluation and implementation" (J.E. *et al*., 2021) the main objective of this document is to present the results found in the diagnosis carried out in the laboratories of the

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University through the Ingenialab and MinasLab strategies, which resulted in a strategy to evaluate and implement change management in the laboratories at a national level, taking digitalization as a necessary innovation in the educational field that allows communication from different points instantaneously. For this reason, it is necessary the development a platform that can be used by all universities creating a standardized knowledge that allows using ICT to share experiences and determine the improvements that are needed in virtual reality platforms to replace face-to-face practices in laboratories allowing the support between universities from research.

4.4 Distribution of scientific production by area of knowledge

Figure 5 shows how the production of scientific publications is distributed according to the area of knowledge through which the different research methodologies are executed.
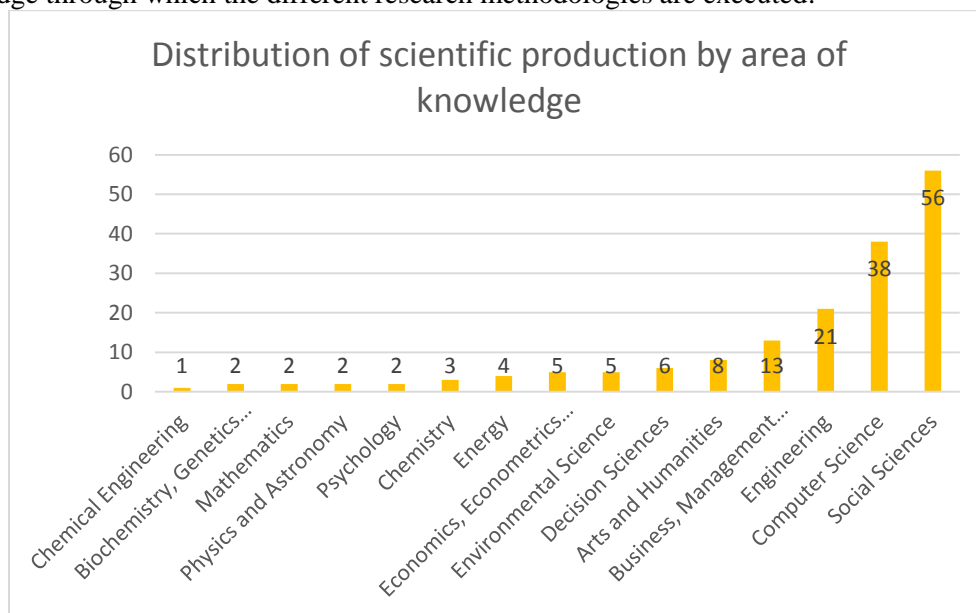

Figure 5. Distribution of scientific production by area of knowledge.
Source: Own elaboration (2022); based on data provided by Scopus.

Social sciences are the area of knowledge with the largest number of contributions through the theories that are framed in it, in the search for new knowledge about the Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic presenting 56 documents, within which is the title "Challenges of universities facing the knowledge society, the digital era and electronics for professional training" (Rodriguez *et al*., 2021). This document determines the new challenges, demands and commitments faced by university institutions in charge of training professionals in the so-called knowledge society, digital and electronic era where the need to have educational systems that are in line with social evolution was evidenced, allowing this to be a comprehensive training of professional by what the labor market requests regarding the competencies and skills that are requested.

In second place is computer science where 38 documents were written following the guidelines of the topics related to this area within these is the paper entitled "Strategic technological management: Use of the ecosystem of the social web 2.0 in higher education" (Hernández Suárez *et al*., 2021). This document aims to analyze the strategic technological management of teachers at the

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Universidad Francisco de Paula Santander in the uses of the social web 2.0 in the pedagogical processes for which a survey was conducted with 40 teachers, a study by which it was possible to determine the benefits of applying the web 2.0 to the educational model allowing the development of new skills, which are in high demand in the labor market, also identified certain challenges in this application, the main one is the lack of technological capabilities of the educational actors which causes this model to have shortcomings and affect the quality of higher education.

4.5 Type of publication

Figure 6 shows how the bibliographic production is distributed according to the type of publication chosen by the authors.
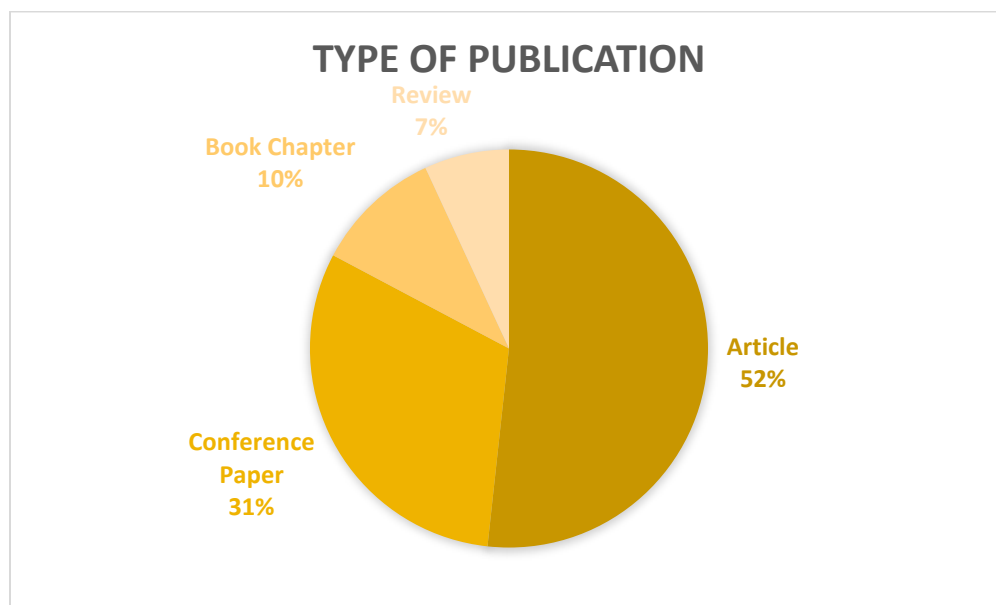

Figure 6. Type of publication
Source: Own elaboration (2022); based on data provided by Scopus

As shown in Figure 6, within the different types of publications, 52% of the total number of documents identified through Phase 1 of the Methodological Design, correspond to Journal Articles, in second place are conference proceedings, which represent 31% of the documents registered in this study, among which is the one entitled "Industry 4. 0: an integrated distance learning solution" (Nuñez & Padilla, 2020). This document presents a review of the current state of reality and proposes an integrated distance learning solution with three intertwined domains: people, processes and technology concerning Industry 4.0 taking into account that technological tools, clouds and web 2.0 are key components for an integrated distance learning solution being necessary the training of educational actors in technological competencies that help to design teaching-learning strategies according to the needs that were created in the use of digital platforms.

In third place are the book chapters, which represent 10% of the publications analyzed in this study. Finally, the review articles represent 7% of the documents registered in this research, within which is the one entitled "Digital transformation in higher education institutions: a systematic review of the literature" (Castro Benavides *et al*., 2020). This document aims to determine the distinctive characteristics of the implementation process of digital transformation that has been carried out in

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Higher Education Institutions, taking into account the advances of Industry 4. 0 and what this implies in higher education, so 19 articles published in the period 1980-2019 were analyzed where it could be determined that ICT is an emerging field in higher education and is the basis of the future education system taking into account the importance of training educational actors on digital competencies.

5. Conclusions

Thanks to the bibliometric analysis proposed in this research, it can be determined that Mexico is the Latin American country with the largest number of bibliographic records in the Scopus database during the period between 2020 and the first half of 2022 with a total of 56 documents. The scientific production related to the study of the Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic has presented an important growth during the above-mentioned period, going from 24 publications in 2020 to 17 units only in the first semester of 2022. This indicates the importance that the digital transformation represents in the educational innovations since 2020 with the pandemic that forced the transition to an online educational model as a way to continue with the pedagogical processes without putting public health at risk.

Digital transformation is a phenomenon that has been seen with greater presence in the last decade with the industry 4.0 which is the digitization of all processes allowing to have control over these and also being accessible at any time and place. The university is by nature a transformer in society and must be in line with its evolution, so ICT are increasingly common in their educational processes. This transition occurred abruptly in early 2020 where as a result of COVID 19 was declared a pandemic in all countries. For this reason, ICTs are currently a relevant aspect of the educational system as it was the way to continue with the educational processes during the health crisis, which translates into a change of teaching and learning strategies to ensure quality education. All of the above allows this article to conclude by highlighting the importance of knowing the theory or bibliographic resources that seek to awaken the interest of higher education institutions in implementing ICT in their educational processes taking into account the needs and the ideation of new pedagogical strategies according to the educational model. That is why it highlights the need for studies such as the one presented in this document, which make a tour of those texts that address the aforementioned topic, to give the reader a broad view of the current situation of the literature on the Digital Transformation of Universities and changes in the Teaching-Learning process after the Pandemic.

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