

INFORMATION AND COMMUNICATION TECHNOLOGIES IN HIGHER EDUCATION IN TIMES OF COVID 19: SYSTEMATIC REVIEW

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ABSTRACT

In this research, a systematic review of various bibliographic sources was carried out, with information and communication technologies (ICT), higher education and the COVID-19 context as variables. The objective of this article is to compile, analyze and expose the sources so that future researchers can feasibly find diverse theoretical resources for their research; in addition, they can find in a simple way how education is affected by COVID-19. For this purpose, research articles from various journals indexed in a database with a recognized academic value called Scopus were reviewed. The research methodology used was the PRISMA-2020 statement, which allows the selection of suitable articles based on three criteria: articles published between 2017 and 2022, published in Spanish or English, and that have considered higher education students or teachers as the object of study. There were initially 45 articles, of which, 15 met the selection criteria. Next, an arduous general and detailed analysis of each source was carried out to extract relevant information, such as concepts and descriptions of the subject matter. Finally, the results and conclusions will be presented in a discussion.

Keywords: *Information and communication technologies, higher education, COVID-19, ICT.*

INTRODUCTION

In recent years, the world has gone through a difficult situation related to the COVID-9 pandemic, a crisis that encompasses different health, economic, social, political, and educational sectors, among others. Education is one of the most affected sectors and has been required to promote the use of information and communication technologies and all its activities. Given the COVID-19

pandemic, schools and universities worldwide have had to close their facilities and move to the virtual environment (Núñez *et al.*, 2022).

Fernández-Quero (2021) mentions that ICT tools alternate the options of students and teachers, especially the fact of being able to mitigate the obstacles generated by the traditional teaching model. Likewise, he considers that few publications related to ICT and education are developed, even though it is an essential and valuable topic to develop classes in the context of virtuality. One of the main limitations faced by educators is the lack of knowledge about the use of technological tools for pedagogical purposes and their effectiveness in knowledge, learning, empowerment and participation that enable teachers and students to have a comprehensive learning formation; and as teachers to fulfill their roles as organizers of intelligence and guide the empowerment and creativity of their students.

Education is undoubtedly one of the most important pillars of humanity; as an example, it was calculated that approximately 1.5 billion students were affected by the closure of institutions due to the COVID-19 pandemic, moving from face-to-face to virtuality abruptly (Unesco, 2020 and Echauri-Galván *et al.*, 2021).

Likewise, Leiva *et al.* (2022) consider that this new reality has led to reconversion of traditional educational roles based on new plans that enable access and manage information through innovative methodologies where the digital era predominates. These information and communication technologies allow not only to develop various tasks in virtual spaces but also to create spaces where information can be exchanged, overcoming the barriers of distance. A clear example in the last 2 to 3 years has been the implementation of platforms such as Zoom, where a connection can be established between two or more people worldwide, thus overcoming the barrier of distance and language.

One of the most critical points of using information and communication technologies is the ability to apply them in many areas, especially in higher education, which, thanks to various platforms, it has overcome the pandemic's disadvantages. The acquisition of ICT skills is a basic requirement in new educational programs worldwide, as students and teachers must use these competencies to perform many functions both as students and in the labor market. Despite the crisis caused by the pandemic, it leaves an essential footprint on higher education development as it has forced the immediate implementation of technology (Infante-Moro *et al.*, 2021).

It should be emphasized that the basic function of ICT is to offer ways to find information. Thus, the user can communicate what he thinks, transforming this into tools of daily use for the development of everyday activities today, from sending an email, having a long-distance video call, or in more specific cases, receiving a master's degree classes from another country. All these situations ask the following question: How long have information and communication

technologies been used? The reality is that they have been used for a long time; however, thanks to the context of the pandemic, this use has been seen in great magnitude (Ramón, 2021).

Castañeda-Trujillo and Jaime-Osorio (2021) argue that there are many gaps in the use of information and communication technologies in higher education because there is a diversity of contexts to which both students and teachers belong. Moreover, not all students and teachers have access to the same conditions required by the higher education environment, such as the basics: the internet; many have economic limitations, and others live in remote areas of the city, making access more complicated. All this has been reflected in higher education in Peru, given that, in the beginning, universities were not prepared to take on the challenge of distance learning, and students did not have the necessary inputs to accept this new modality. However, in the last two years, universities have made a significant effort to provide quality education, implementing platforms in line with the situation, making virtuality a profitable option for teachers, students and universities.

Katz (2021) refers that the use of information and communication technologies in the context of the COVID 19 pandemic has had an impact, given that all schools, universities and institutes did not allow too much time to implement platforms to mimic face-to-face teaching; this is referred to as being able to conduct classes without impediments as if the students and teachers were at the university. However, this has been possible thanks to the rapid action of technology implementation.

Zaiti and Zaidah (2021) refer that the new information and communication technologies have changed the fact of learning and teaching, so they are a great advantage when it comes to the teaching-learning model; all this technology allows to be part of new situations, such as working from home, being part of a meeting through a platform such as Zoom, Microsoft Teams, Google Meet, among others, and one of the most important aspects: to study from wherever people are. The authors discuss the little information that can be found on the subject of ICTs in the educational context of the COVID-19 pandemic, so they consider that systematic reviews are timely.

In the same way, Rangel (2018) states that studying information and communication technologies is essential today since, thanks to these, people can stay communicated and obtain information from anywhere in the world. Moreover, in higher education, ICTs are important tools since they allow the development of the teaching-learning process; this facilitates students to acquire new knowledge more accurately and immediately and always hand in hand with a tutor since technologies should not work alone. Likewise, teachers who handle these technologies play a fundamental role since they acquire these competencies that will facilitate the use of the tools of the virtual space; all this together leads to quality education.

The motivation of this work lies in compiling, analyzing and exposing the sources in the university context through the systematic review of research presented in articles of journals indexed in databases of outstanding scientific value. This review aims to analyze all the bases in university

higher education, oriented to improve the last years' learning. In addition, it is intended to be disseminated as a theoretical reference to become a resource and source of information on information and communication technologies (ICT).

METHODOLOGY

This article identifies the methodological characteristics of scientific research carried out about ICT, considering the databases of outstanding value in the scientific world from which the relevant information tables are derived; it enjoys originality, creativity, critical and reflective judgment, in addition, the variables are recently studied, especially in this pandemic context; the Scopus database was used for the review of the articles.

Likewise, this study was based on the theoretical research model, with the systematic review of research articles in the database of outstanding scientific value: Scopus. The scope of the research is exploratory-descriptive, González *et al.* (2017), (Hernández-Sampieri and Mendoza, 2018). For the analysis of the articles, the PRISMA-2020 guide was used to identify the methodological characteristics, provenance, interest groups, techniques and instruments, dimensions, and data collection procedures on ICT in university education. In addition, the literature review makes it possible to identify how much research has been done on the subject and also provides clarity on different interpretations prior to the development of the work, contemplates different perspectives on the subject under study, and finally serves as a theoretical reference to become a source of information.

Search strategy: This systematic review was conducted using Scopus based on the words ICT AND higher education; ICT AND education; Information and communication technologies AND education; ICT AND higher education; COVID 19 AND ICT; COVID 19 AND information technologies. Various sources were found in Scopus, predominating English-language sources from different countries.

Inclusion criteria: studies published between 2017 and 2022, in Spanish and English having as population and sample higher education students and teachers belonging to different countries of the world.

Exclusion criteria: publications outside the years 2017 to 2022 were considered, as well as journals in languages other than Spanish and English and work with a population and samples other than students and higher education teachers. Likewise, articles that did not allow free access were excluded; in addition, research that did not present similarities in the keywords was discarded; however, if the abstract is convenient for the research, it will be considered.

After an exhaustive search of sources, 45 were found, filtered according to this article's needs and subject matter, leaving 15.

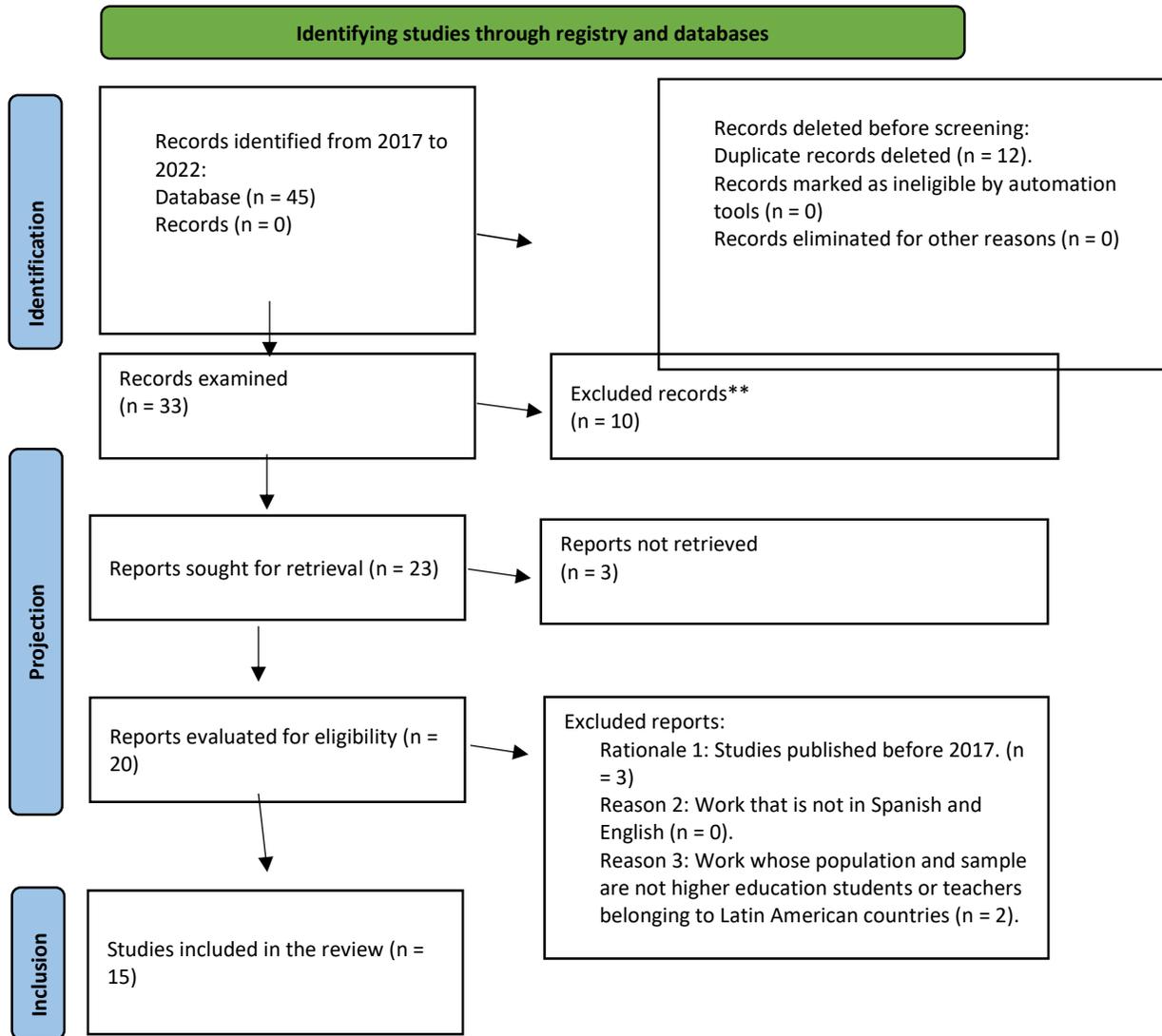
Data extraction: For this research, 15 sources considered relevant and according to the objective were considered. Likewise, to extract the data, each article was analyzed and reviewed for the contributions of the researchers, which are fundamental concepts for this research.

Data analysis: The information was separated into two tables, the first where the names of the authors, date of publication, and journal name can be evidenced; the second where we can appreciate the results of all the proposed research.

The PRISMA 2020 flowchart for new systematic reviews that included databases and registries only will be presented below (Table 1).

Table 1

PRISMA 2020 flow chart.



Source: Adaptation by researchers

RESULTS

Concluding the systematic review analysis, it was found that the most important bibliographic characteristics were framed in a publication range of 2017-2022. The research papers were published in specialized journals in the area of education, generally in Latin American countries, with a predominance of the languages of Spanish and English. This review aims to analyze the use of ICT in higher education to improve student learning.

Table 2

Authors and titles of the selected research, and journals in which they are indexed.

| Nº | Authors/year | Title | Journal |
|----|--|---|---|
| 1 | Echauri-Galván, B., García-Hernández, S. y Fernández-Gil, M. (2021). | Enseñanza virtual de lengua inglesa durante el confinamiento domiciliario: percepciones y reacciones del alumnado en una universidad española | Ikala |
| 2 | Núñez, L., Gómez, C., Barzola, M., Saravia, R., Saravia, O. y Ancajima, V. (2022). | The use of ICT as a palliative of learning difficulties in the social sciences. | Digital Education Review |
| 3 | Leiva, J., Del Olmo, M., Aguilera, F-, Villalba, M. (2022). | Promotion of Intercultural Competencies and Use of ICT: Towards a Digitally Inclusive University | REICE. Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación |
| 4 | Infante-Moro, A., Infante-Moro, J. y Gallardo-Pérez, J. (2021) | The acquisition of ICT skills at the university level: The case of the Faculty of Business Studies and Tourism of the University of Huelva. | Revista de Medios y Educación |
| 5 | Fernández, F. (2020) | The will for an epidemic in the Spanish civil code and use of icts. | Revista de derecho privado. |

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| 6 | Castañeda-Trujillo, J. y Jaime-Osorio, M. (2021) | Pedagogical Strategies Used by English Teacher Educators to Overcome the Challenges Posed by Emergency Remote teaching During the covid-19 Pandemic | Ikala |
| 7 | Katz, S. (2021) | Rapport in the Foreign Language Classroom: From Face-to-Face to Online in Times of Pandemic. | Ikala |
| 8 | Zaiti, A. y Zaidah, S. (2021) | Malaysian English Language Teachers' Agency in Using Digital Technologies During the Pandemic: A Narrative Inquiry. | Ikala |
| 9 | Rangel, A. (2021) | Information and communication technologies in higher education: A documentary analysis | Pixel-Bit, Revista de Medios y Educación. |
| 10 | Cerón, G. (2021) | The family and the play as a distance learning strategy during the pandemic of Covid-19 in México: A proposal from university education in health sciences | Revista de Educación a Distancia. |
| 11 | Llamas-Salguero, F. y Macías Gómez, E. (2018) | Initial training of teachers in basic education for the generation of knowledge with information and communication technologies | Revista Complutense de Educacion |
| 12 | Carrillo-López, P. y Hernández-Gutiérrez, A. (2022) | ICT and functional diversity. Knowledge of teachers in the Canary Islands. | Revista Interuniversitaria de Formación del Profesorado |
| 13 | Díaz-Noguera, M., Hervás-Gómez, C., | Autonomy, Motivation, and Digital Pedagogy Are Key Factors in the | International Journal of |

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| | De la Calle-Cabrera, A. y López-Meneses, E. (2022) | Perceptions of Spanish Higher-Education Students toward Online Learning during the COVID-19 pandemic. | Environmental Research and Public Health |
| 14 | Barros-Lane, L., Smith, D., McCarty, D., Perez, S. y Sirrianni, L. (2021) | Assessing a Trauma-Informed Approach to the COVID-19 Pandemic in Higher Education: A Mixed Methods Study | Journal of Social Work Education. |
| 15 | Guillén-Gámez, F., Linde-Valenzuela, T., Ramos, M. y Mayorga-Fernandez, M. (2022) | Identifying predictors of digital competence of educators and their impact on online guidance. | Research and Practice in Technology Enhanced Learning |

Note: Own elaboration

As seen in Table 2, there is a predominance of research in English and only a few in Spanish. Likewise, focusing on the title, it can be observed that all the articles collected have at least one study variable that matches this research, making it helpful to continue the study.

Table 3

Title of the research and its main results and/or conclusions.

| Nº | Title | Results / Conclusions |
|----|---|--|
| 1 | Enseñanza virtual de lengua inglesa durante el confinamiento domiciliario: percepciones y reacciones del alumnado en una universidad española | The results evidenced the problems involved in this virtual modality, in terms of the acquisition and practice of skills such as oral expression, class participation, articulation of group work and interpersonal relationships. In addition, they highlighted benefits such as greater knowledge and management of technological resources. Finally, they were used to show teachers the digital work and evaluation tools best and worst valued by the students. |

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| 2 | The use of ICT as a palliative of learning difficulties in the social sciences. | The paper addresses an important field of research in the current context and serves as a guideline and students with a wealth of visual information and a wide variety of information figures. |
| 3 | Promotion of Intercultural Competencies and Use of ICT: Towards a Digitally Inclusive University | The importance of working through digital tools as an opportunity to promote the acquisition of intercultural competencies in an inclusive education framework. That is why this should be a priority to be addressed from the institutionalized educational spaces, being the universities and their teachers, protagonists of this process of lifelong learning in response to their responsibility with the training of future education professionals. |
| 4 | The acquisition of ICT skills at the university level: The case of the Faculty of Business Studies and Tourism of the University of Huelva. | The acquisition of ICT skills has a relevant role in the training programs of educational institutions since these skills are among the most demanded when companies look for workers, because they require technological tools in most cases to perform many of their functions. |
| 5 | The will for an epidemic in the Spanish civil code and use of icts. | This research emphasizes the use of information technologies in the area of law. A ‘digital testament’ was used for law where it is evident that the use of ICT is (in recent years) very indispensable in everyday life. |
| 6 | Pedagogical Strategies Used by English Teacher Educators to Overcome the Challenges Posed by Emergency Remote teaching During the | This case study aimed to explore the pedagogical strategies and technological resources used by test in a Foreign Language Teacher Education Program to overcome the challenges posed by the transition from face-to-face to emergency remote teaching in |

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| | covid-19 Pandemic | times of the COVID 19 pandemic. |
| 7 | Rapport in the Foreign Language Classroom: From Face-to-Face to Online in Times of Pandemic. | This study reveals the importance of teacher feedback in the teacher-student relationship, both in the form of corrective feedback and positive comments, as well as the importance of positive comments and personal thematic discourse in the student-student relationship. |
| 8 | Malaysian English Language Teachers' Agency in Using Digital Technologies During the Pandemic: A Narrative Inquiry. | Arguably, the COVID 19 crisis serves as a powerful force pushing the vast majority of teachers to use their cunning in online teaching, a feat that no previous ICT in education policy could achieve. The unprecedented scenario has disrupted existing classroom teaching practices of language teachers, forcing them to migrate to online platforms. |
| 9 | Information and communication technologies in higher education: A documentary analysis | It is known that academic publications on ICTs have been increasing over the years; however, their growth has not been constant or representative since the number of research studies on the subject does not correspond to the development achieved by these tools in recent years. |
| 10 | The family and the play as a distance learning strategy during the pandemic of Covid-19 in México: A proposal from university education in health sciences | Although information and communication technologies have become important meeting place for teachers and students to provide continuity to non-face-to-face learning, it is vitally important to consider the context in which the participating students are learning. That is, an environment of uncertainty about what will happen in terms of school, economics and health, uncertainty in the face of a return to the classroom that seems like it will never happen. All this during |

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| | | confinement, social distancing and psychosocial consequences such as stress, anxiety and depression, as well as lack of access to technology. |
| 11 | Initial training of teachers in basic education for the generation of knowledge with information and communication technologies. | It is relevant to highlight in the conclusions of the study that in the sample of teachers analyzed, a large majority state that they have ICT training, although this initial training has not been carried out at the university, but has been the result of informal learning; this may explain, at least in part, why teachers feel insecure about using technologies in the classroom. Another fact that stands out is that informal training reflects the motivation and desire to learn, which adds to the fact that all teachers demand more training in ICT tools and applications. |
| 12 | ICT and functional diversity. Knowledge of teachers in the Canary Islands. | These results may be of special interest for the educational context in order to identify and improve the quality of the teaching and learning process to achieve quality education for all students, regardless of the educational stage, ownership and type of educational center. It is also suggested that future studies with a representative sample of the Canary Islands and of longitudinal cut include other variables to analyze the possible effects that greater ICT training on the part of the teacher can have on the integral development of the student body. |
| 13 | Autonomy, Motivation, and Digital Pedagogy Are Key Factors in the Perceptions of Spanish Higher-Education Students toward Online | Higher education should not forget the impact of information and communication technologies, which is shared in 3 trends: artificial intelligence, digital platforms and transparent immersive experiences. |

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| | Learning during the COVID-19 pandemic | Therefore, it is necessary to promote them to motivate autonomy in the teaching-learning process. |
| 14 | Assessing a Trauma-Informed Approach to the COVID-19 Pandemic in Higher Education: A Mixed Methods Study | Programs should consider ICT as an option to support students during and after COVID-19. |
| 15 | Identifying predictors of digital competence of educators and their impact on online guidance. | The unexpected emergence of Covid-19 has presented challenges around the world, and the education system has been no exception. Education was paralyzed by the pandemic, forcing them to migrate all educational activity to the online modality. This forced the implementation of strategies to improve the teaching-learning process and especially the guidance processes, using ICT. |

Note: Own elaboration

Table 3 shows the main results and / conclusions reached by the authors concerning the research variables of the present study, where the fact that there is little research on such a current topic as the importance of the use of information technologies in higher education in the context of the COVID 19 pandemic predominates.

DISCUSSION

Concluding the analysis of the systematic review, it is observed that during the years 2017 and 2022, research on information and communication technologies was conducted in various higher institutions around the world, having a population of university teachers and students, both undergraduate and graduate. Furthermore, the information obtained reveals that the research papers published in specialized journals in the area of education, with a predominance of Spanish and English languages, have varied approaches, being the most used, qualitative and mixed approaches, and of less use, systematic reviews.

The analysis of the research reveals that although there has been a variety of research in recent years, there has been no focus on the COVID-19 context, being a relevant topic at present. Also, it can be seen that the research emphasizes the use of ICT directed to students; being also essential to focus on teachers and how they can increase and innovate the teaching-learning experience.

As mentioned by Rangel (2018), although research regarding the use of information and communication technologies has been increasing over the years, this is not consistent with all the information that should be shared, given that this event in history should remain a precedent for future research.

Guillén-Gámez *et al.* (2022) agree that the COVID-19 pandemic has forced both teachers and students to migrate from face-to-face to virtual, resulting in a good option for their continuity and its benefits academically, economically and others.

In conclusion, the article provides evidence of certain results that were not foreseen before the work was carried out. First, scientific journal articles were identified and collected in various databases, and after passing the filters of the PRISMA-2020 guide, it was recognized that the database that provides research articles is the Scopus database. Second, each article was thoroughly analyzed, emphasizing similarities concerning the research variables: Information and communication technologies, higher education, COVID-19 pandemic. Finally, the results of each investigation were presented, where it became evident that it is necessary to continue studying these variables to have a broader picture.

It is also recommended that further research be conducted on the topic addressed in this article and use this systematic review as a basis for future research.

CONFLICT OF INTEREST

For the research article entitled: Information and communication technologies in higher education in times of COVID-19: Systematic review, there is no conflict of interest between the authors.

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