COVID-19 y espacios creativos de aprendizaje universitarios. Tendencias en investigación

COVID-19 and creative university learning spaces. Research trends

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RESUMEN.
La COVID-19 ha irrumpido en la vida de los seres humanos causando efectos devastadores en la salud y en la vida de gran parte de la población mundial, afectando a las esferas sociales, económicas y educativas del planeta. La comunidad científica se encuentra ante uno de sus mayores retos para resolver un problema sanitario de alcance global como es la pandemia del COVID-19. Esta situación ha generado un volumen de publicaciones sin precedentes. El impacto del COVID-19 en la enseñanza ha supuesto que los momentos de contacto social hayan desaparecido a cambio de reuniones, clases, exámenes o encuentros virtuales. En este escenario, las aulas universitarias al volver a abrirse no serán las mismas, tampoco sus campus ni espacios del ámbito educativo, deberán aportan creatividad en el a la hora de organizarse y usarse. El objetivo del estudio fue identificar las publicaciones científicas relacionadas con los efectos del COVID-19 en las aulas universitarias durante el período 2019 hasta la actualidad. Para esto, se realizó un análisis bibliométrico de la literatura científica. Se identificaron 676 documentos sobre esta temática. Los resultados del análisis revelaron que la productividad científica se ha incrementado desde enero de 2020 con más de 650 artículos sobre la enfermedad, verificando el profundo interés por el COVID-19 en todas las disciplinas. Las principales tendencias de investigación incluyen el impacto de la vuelta a las aulas con los efectos en los procesos cognitivos, motivaciones y del rendimiento académico de los estudiantes.

PALABRAS CLAVE.
COVID-19, espacios de aprendizaje, creativo, investigación, educación superior, enseñanza.

ABSTRACT.
COVID-19 has disrupted the lives of humans causing devastating health effects and life of a large part of the world population, affecting the social, economic and educational spheres of

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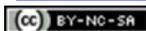
the planet. The scientific community is facing one of its greatest challenges to solve a global health problem such as the COVID-19 pandemic. This situation has generated an unprecedented volume of publications. The impact of COVID-19 on teaching has meant that moments of social contact have disappeared in exchange for meetings, classes, exams or virtual meetings. In this scenario, the university classrooms when reopened will not be the same, nor will their campuses or spaces in the educational field, should contribute creativity in organizing and using them. The objective of the study was to identify scientific publications related to the effects of COVID-19 in university classrooms during the period 2019 to the present. For this, a bibliometric analysis of the scientific literature was performed. Thus, 676 documents were identified on this subject. The results of the analysis revealed that scientific productivity has increased since January 2020 with more than 650 articles on the disease, verifying the deep interest in COVID-19 in all disciplines. The main research trends include the impact of returning to the classroom with the effects on the cognitive processes, motivations and academic performance of students.

KEY WORDS.
COVID-19, learning spaces, creative, research, higher education, teaching.

1. Introduction.
COVID-19 is having devastating effects on the health and lives of much of the world's population. The current pandemic has caused enormous human losses, added to the disastrous effects that are already beginning to be seen in the economy of almost all countries (Di Franco et al., 2020). To protect their populations and mitigate contagions, which multiply exponentially, governments have recommended, and in some cases forced, their citizens to take shelter in their homes. This has meant the closure of shops and the suspension of industrial activities, with the consequent loss of jobs. In a globalized world like the current one, the rupture of the production, distribution and consumption chains is causing untold economic losses. The rapid advance of the pandemic has put the health systems of many countries, even the most developed ones, in serious difficulties. In some cases, the emergency has been so great that the capacity to care for those infected has collapsed. This serious situation has been spreading in education and pandemic all over the planet like a great wave since the beginning of the year: beginning in Asia and spreading to Europe, Africa and America (Bonilla-Guachamín, 2020).

Among the first measures to contain its progress was the closure of schools at all levels of the educational system. According to UNESCO reports, as of March 30, 2020, 166 countries had closed their schools and universities. Globally, 87% of the student population was affected by these measures; that is, about 1,520 million students. Furthermore, around the world, around 63 million teachers stopped working in classrooms (IESALC-UNESCO, 2020). Faced with the abrupt and unexpected suspension of their academic activities, the world's educational systems have turned to digital media to continue their school activities. This led to a forced trial of new ways of teaching, learning, and evaluating (Avello, 2020; Rodríguez et al., 2020).

This emergency has also revealed the deficiencies and inequalities both in the availability of these digital resources and in the preparation of teachers and students to move towards the modalities of distance education (Vázquez-Cano & López-Meneses, 2014).

In a recent report, De Vincenzi (2020) describes the international panorama of the reactions of some universities and higher education institutions (HEI) to the transition to online education. Although a number of university institutions have closed and attempted to adopt online learning, very few are well prepared to make this change quickly and abruptly. Many confusions and improvisations have occurred, and administrators, teachers, and students struggle to implement online learning broadly and effectively. The transition to this modality requires effective learning management systems, videoconference facilities and academic staff with experience in distance education (García-García, 2020).

On the other hand, Rodríguez, Díaz, & Pandiella (2020) affirm that HEIs around the world have suspended international travel and exchange programs, as well as many research activities. Also discussed are the decisions to be made to assess learning, whether to postpone or cancel final exams, and how to select new students for the following school year. But not all universities have agreed to transition to online education. In several faculties it has been decided to postpone classes and reorganize the academic calendar, under the argument that only face-to-face courses can guarantee quality.

The dimension of equity, stresses Rodríguez (2020), has been one of the most outstanding in this global health emergency. Gaps are not just reduced to the digital divide in poor countries (Hueso, 2020). HEIs will also have trouble rapidly developing quality distance education programs.

In this context, learning spaces necessarily require redesign to return to being habitable, healthy and safe spaces (González-Zamar & Abad-Segura, 2020b). Classrooms as social spaces should offer flexibility and versatility to reorganize groups when necessary. One of the keys is to leave behind the rigid and inflexible classrooms of the master class and move forward in open, open, and flexible spaces.

In this way, the current crisis will serve as a wake-up call to reevaluate the vulnerabilities of the private sector of higher education and the challenges of living in a globalized and interdependent world. In addition, the crisis has demonstrated the importance of contingency planning and risk management, as well as the benefits of supporting innovative forms of education and the need to make learning assessment and admissions processes more flexible. The current health emergency has also allowed us to recognize that achieving equity in higher education for vulnerable groups in society continues to be one of the greatest challenges (Echeita, 2020; Valenzuela, 2020).

Consequently, the objective of this study is to identify the scientific publications related to teaching and the classroom at the time of COVID-19 in Higher Education, during the brief period that has brought about the outbreak of this disease, that is, from its beginnings until June 2020. Likewise, the collaboration networks between authors, countries and institutions, and the relationships between the main keywords are analysed.

The bibliographic visualization methods used allowed analysing and representing the characteristics of the selected publications. The result yielded a total of 676 selected

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publications during the period from 2019 to mid-2020, following the research criteria. Thus, recognizing scientific productions is of interest by allowing us to explore the effects that the pandemic has had on education and on university physical spaces.

To investigate the evolution of scientific production, bibliometric analysis was used. In this way, it is possible to determine by means of the obtained indicators the growth of publications in this scientific area and understand the research trends. The database used was Scopus. The field of higher education was selected, examining the publications that included terms related to the COVID-19 disease and the university classroom. Likewise, the formation of the clusters that originated according to the bibliographic link was considered, attending to the most productive countries, institutions and authors, in addition to the keywords.

Finally, it should be noted that among the lines of research that are currently being developed in relation to the subject of study, these refer, among others, to correlating through empirical research, the return to educational spaces with variables such as well-being and the happiness of the students. Other actions correspond to implementing proposals for more functional, efficient, and sustainable designs for the entire university campus.

2. Theoretical framework.

The changes experienced in the educational and social field have been reflected in the growing interest in knowing the variables that intervene in the academic act. COVID-19 and the state of confinement will increase the need to know what the return to physical spaces will be like and the measures to consider for its correct handling free of viruses.

Researches such as those of Barret et al. (2017) and Daniels et al. (2017) have addressed the relationship between the attributes of physical space, the methodology used and the influence that both have on the teaching and learning process and the students.

Regarding the significance of learning spaces, the previous literature shows clear and reliable evidence of the link between student satisfaction with their environment and the academic results obtained. In this way, if students experience personal well-being and attachment to the place where they spend much of their daily life, this translates into a positive impact on their attention, motivation and learning (Hopland & Nyhus, 2015).

Maxwell (2016) emphasizes that the design, quality and adequacy of learning spaces favour students to maintain positive emotions, feel integrated and valued. On the other hand, the incidence that design has on learning spaces, considering that the space intervenes in the social connection of the students, thus promoting collaboration, reflection, exchange, and interaction. On the contrary, if the design is insufficient, it can favour the development of childhood disorders, such as tacit dumbness and lack of social interaction. Acaso & Megías (2013) propose to rethink space, which implies considering time to create a new model where physical space is related to educational pedagogies.

In this context, learning spaces necessarily require redesign to return to being habitable, healthy, and safe spaces (González-Zamar & Abad-Segura, 2020b). Classrooms as social spaces should offer flexibility and versatility to reorganize groups when necessary. One of the keys is to leave behind the rigid and inflexible classrooms of the master class and advance in open, open spaces, that is, multi-spaces.

In this sense, both flexibility and functionality are qualities sought by design professionals in any school project. Tse et al. (2015) demonstrated the need to conceive educational spaces as cultural tools. Prioritizing the design, construction and use made of them together with the appropriate performance of the pedagogical discourse, can really make the environment become the third teacher (Malaguzzi, 2000). Currently, university spaces require a greater transformation than other levels of teaching and learning, and even more so after COVID-19. Thus, the need to include new pedagogical formats and make way for the design of spaces that house ICTs and satisfy students in aesthetic terms of functionality, flexibility and versatility (Yang, Becerik-Gerber & Mino, 2013) is inescapable.

Another challenge facing education and its university campuses is knowing how to take advantage of the material technology that we have together with the social technologies that develop on them: networks, collaborative groups, cooperation between people regardless of physical space; to organize a more useful, effective and efficient learning context (Abad-Segura et al., 2020).

The co-teaching and multidisciplinarity of wide and flexible classrooms promote the resolution of challenges in a collaborative way, which helps to develop soft skills such as autonomy in learning, empathy or critical thinking with information sources, very useful skills to face moments of insecurities, uncertainties and constant changes.

Education analysts (Hargreaves, 2018) agree that this closure of educational and university centers should not be how to recover what has been delayed or how they will catch up. Rather, it should affect those other deep learning for life that, in conjunction with families and the community, the school has neglected.

The crisis of COVID-19 can be, then, an opportunity for these other learnings that the inherited school culture has made impossible. When they return to the physical classrooms, in addition to diagnosing the state, and inequality, of the essential learning, these other deep learning must be valued, and the social capital of families must be promoted, while rebuilding the lost community through this long period of social isolation. It will be time to increase learning networks with the community environment, with other schools and educational agents (Gutiérrez-Moreno, 2020; Rojas, Huamán & Salazar, 2020).

In this sense, education plays a key role in the development of a society, so that teaching and learning must continually adapt to the characteristics of the individuals that make it up and to the reality that arises.

We will come out of this situation, but in a different world, also for universities. Instead of doing more of the same, we must re-imagine what is the role of education in these uncertain times (Arce-Peralta, 2020). Get lessons on what is happening, how we have arrived at the situation we are in, and what to do next.

Figure 1 show the key terms of the search carried out in Scopus in this research topic.

Figure 1. Word cloud with key terms from COVID-19, learning, and classroom publications. Source: Own elaboration.

The pessimism of intelligence and optimism of will proposes to bravely face the magnitude of COVID-19 to arm ourselves with the courage and discipline necessary to overcome this crisis. There is no waiting or wanting to return to what we used to call normal everyday life. We can, and we must, achieve something much better, especially in the field of education (Ramírez, 2020).

Given that the health emergency is not over, it is not yet time to take stock of the damage or of the strategies that will have to be developed to recover what has been lost, mainly in terms of the advances or setbacks in the teaching and learning processes both from students as well as teachers.

3. Methodology.

A bibliometric analysis was performed to present a general approach to documentary research related to the effects of COVID-19 in university learning spaces. For this, the results obtained from the bibliometric analysis are presented. Bibliometrics is a part of Scientometrics and the application of mathematical and statistical methods to analyse scientific literature, as well as the authors who produce it (Pritchard, 1969). The objective of this methodology is to identify, organize and analyse the main components within a specific research field. The bibliometric indicators obtained are tools that allow measuring scientific productions and analysing the impact caused by scientific work in the community (Abad-Segura, & González-Zamar, 2019b). They also make it possible to present the evolution of interest in the subject matter under study by reflecting the most relevant authors, countries, journals, and keywords in recent years (Durieux & Gevenois, 2010).

Its application is based on the leading role that publications play in the dissemination of new knowledge. In this sense, statistical data is not the limit of the function of the indicators of scientific activity, but its use is as a tool to integrate to achieve solid explanations related to science. Using these techniques, it is possible to create, visualize and explore bibliographic maps. Also, there are links between pairs of articles. Links show the connections or relationships between elements. In this study, bibliographic coupling links and concurrency links are illustrated. Links and articles form a joint bibliographic network.

An analysis of the scientific literature was performed from the Scopus database. This contains extensive coverage reaching almost 25,000 journals published by more than 5000 international publishers, and with coverage of more than two decades ago. The search included the following terms that combine the production of this research field: "covid-19", "2019-nCoV", "covid19", "coronavirus disease 2019", "coronavirus 2019", "SARS-CoV-2" , "Education", "higher education", "classroom" and "learning".

The choice of search fields caters to those with the highest descriptive value within each record and that are most representative, according to the literature review carried out (Abad-Segura, & González-Zamar, 2019a). This includes the title, abstract and keyword fields. On the other hand, it has been considered to enrich the records from own or external thesauri in the Index Terms field. The temporary coverage considered corresponds to the period of onset of the disease as of June 2020.

Thus, the final sample included a total of 676 articles, with a wide variety of variables to analyze for each record, such as: the year of publication, the journal, the subject area, the author and co-authors of the work, the institutional affiliation of the authors, as well as the country of affiliation and the keywords that define the article. It should be noted that no limits were applied in the language of the document. In addition, documents, in addition to those of scientific research, from Trade Publications, Conference Proceedings and Book Series were included.

4. Results and Discussion.

The results of the bibliometric analysis are presented grouped into groups in order to respond to the bibliographic coupling of countries, authors, institutions and keyword matches. Productivity is also included, according to the units of analysis and temporality.

In this first section, it is necessary to mention that only scientific articles are included in the search carried out, due to their proven quality in the peer review processes. Regarding the thematic areas, Figure 2 shows the publications according to the research field. It is observed that there is a majority prevalence for Medicine (409; 40.1%), followed by Social Sciences (130; 6.4%), Computer Sciences (65; 6.4%), Engineering (125; 5.2%), Biochemistry, Genetics and Molecular Biology (48; 4.7%), and finally, within the first five areas is the Nursing area (39; 3.8%).
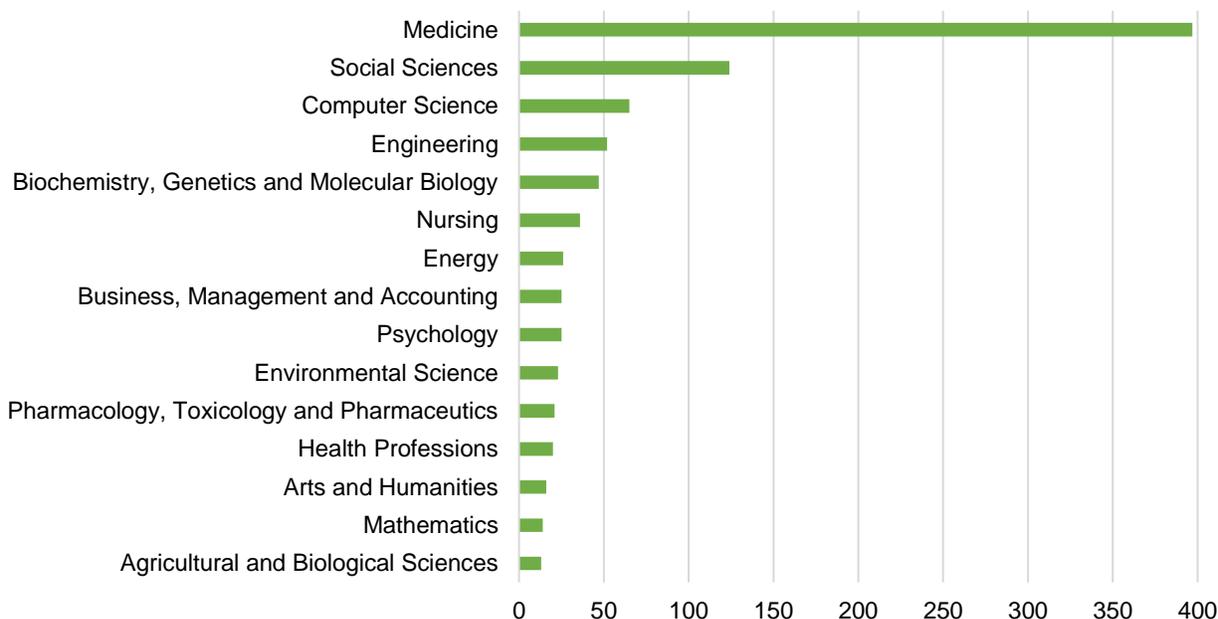
Figure 2. Thematic areas. Source: Scopus

On the other hand, it is relevant to highlight the language of the publications, and although the supremacy of English persists (627; 95.4%), Chinese (20; 3.0%) appears as the second language of the publications. Spanish is the third (8; 1.2%).

Hence, the temporal distribution of scientific production is a relevant fact, since it allows us to observe the flow of publications and the importance or depth that a subject is acquiring in research.

Tthe main results of the evolution of scientific production in this research field of recent and deep interest, that is, from the year 2019 to June 2020. In 2019 there is only one published article on this topic.

Taking into account that the analysis of the research considered in this work considers the period that goes from the year 2019 to the month of June 2020, it is relevant that in these 6 months the scientific production has yielded a total of 656 documents; while in 2019 only one article was published. A growing trend can be seen in the elaboration of articles, which begins to rise in January 2020, coinciding with the upturn in cases of COVID-19 (Cáceres-Piñaloza, 2020). In this sense, it can be seen that production has made rapid progress in relation to issues associated with the search for vaccines and solutions to the pandemic, after the pandemic was declared on March 11, 2020 (World Health Organization, 2020).

Figure 3 shows the collaboration between countries based on the co-authorship of the most productive authors.

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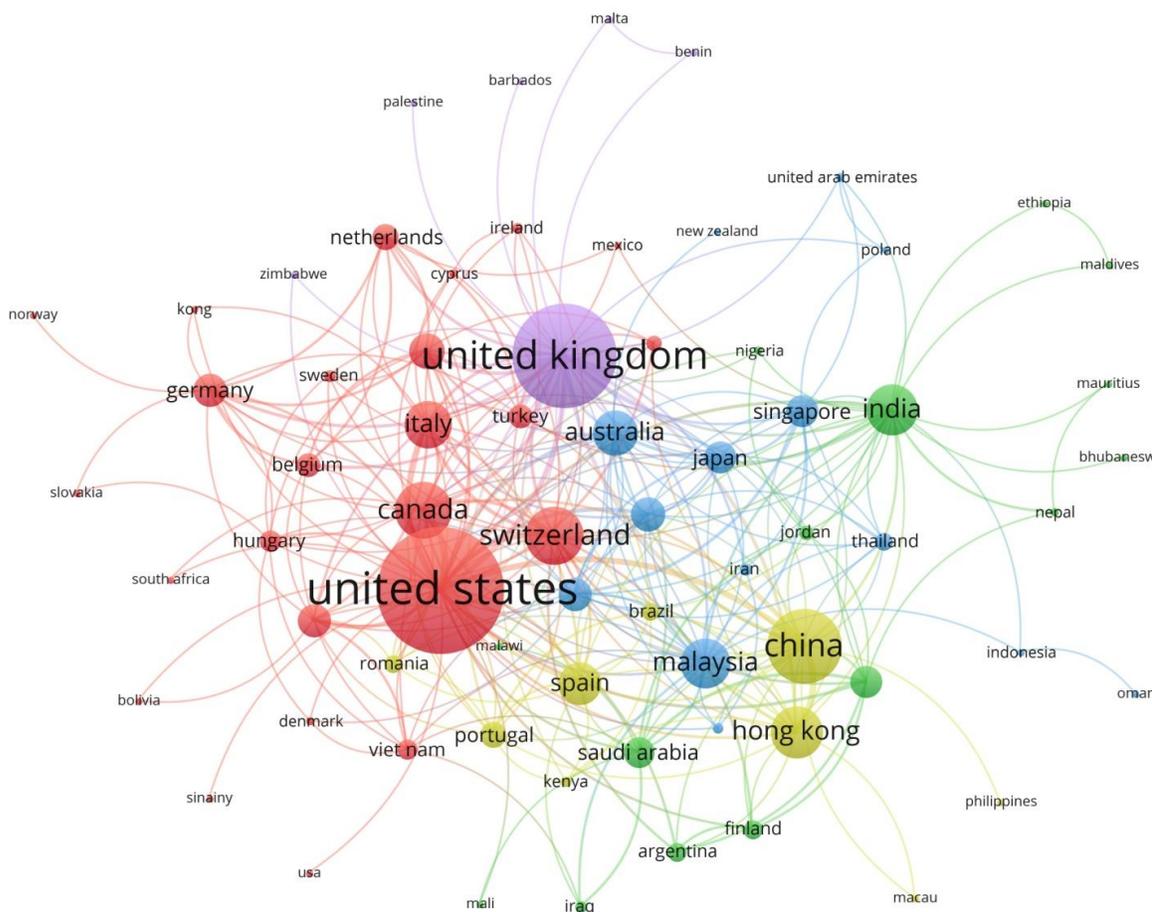
Figure 3. Network between countries based on co-authorship. Source: VOSviewer.

The results revealed the coupling in five groups. Each of the colours represents a group and the countries that make it up, while the size of the circle refers to the number of articles that group produces.

The first group includes 26 countries, the second 15, the third 12, the fourth group consists of 7 countries, and the fifth group consists of 5 countries. Thus, group 1 (red) is led by the United States and works with Canada, Switzerland, Germany, the Netherlands, Turkey, Sweden, Belgium, Hungary, among the most representative. For its part, group 2 (green) is headed by India and cooperates with India, Saudi Arabia, Finland, Argentina, Jordan, among others. Group 3 (blue) is led by Australia, and makes up the group with Japan, Singapore, Malaysia, Thailand and Iran, among others. Group 4 (yellow) is led by China along with Hong Kong, Spain, Portugal, Brazil and Romania. Finally, group 5 (violet) is led by the United Kingdom and includes Palestine, Malta and Barbados.

Figure 4 shows the scientific production by country. The United States, China, India and United Kingdom stand as the most producing countries. France, Saudi Arabian and Iran they are the least producers.
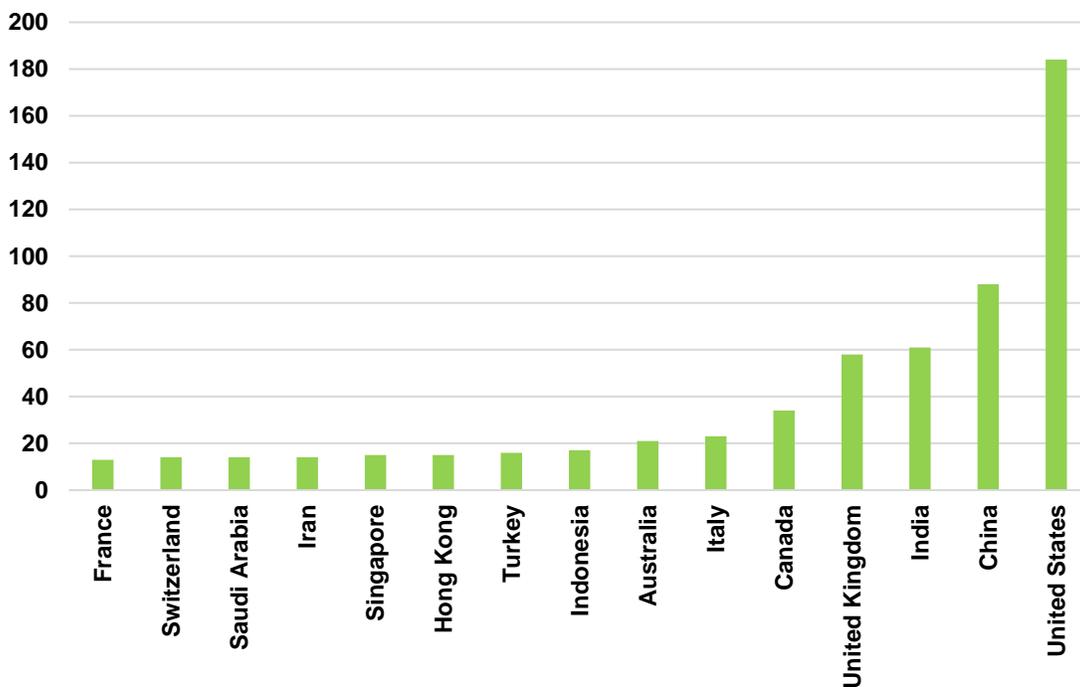
Figure 4. Scientific production by country. Source: Scopus

The results obtained in terms of cooperation based on co-authorship between countries, shows the progress and evolution on this topic, manifested in studies that correlate the problems of health systems around the world and the adoption of guidelines on operational planning to balance the demands of the direct response to COVID-19 with the need to continue providing essential health services and mitigate the risk of system collapse (Pegado et al., 2020).

Therefore, education in the days of COVID-19 faces an enormous challenge of educational equity that can have consequences that alter the lives of vulnerable students (Moreno & Molins, 2020).

Other questions refer to the change that virtual learning requires in terms of flexibility and the recognition that the controlled structure of an educational centre is not replicable online. Unfortunately, the colleges and universities that can offer a complete virtual academic experience, with students who have electronic devices, teachers who know how to design functional online lessons and a culture based on technological learning, are not many. The reality is that most of them are not prepared for this change that allows us to recognize that unequal access to the internet is just one of the many problems facing our education system at the global level (Gutiérrez-Moreno, 2020; Zapatería, 2020) .

With technological innovation, it is possible to create new learning, both pedagogical, communicative and expressive, which enables the development of new training and educational experiences. Likewise, the presence of ICT in university classrooms guarantees

the development of skills highly valued by the labour markets where students will be inserted. In this way, the gap between skills and labour strategies in the medium and short term are covered (Imbernón Muñoz, Silva García & Guzmán, 2011).

Some of these ICT skills for learning refer to the ability to solve information, communication and knowledge problems, as well as legal, social and ethical dilemmas in a digital environment (Abreu, 2020).

Thus, it is verified that digital resources and meaningful learning can develop research and practices to cultivate skills in all students. Young people who are immersed in an educational system in which the knowledge applicable to their future work is valued and promoted, will be able to count on an additional preparation that they will be able to use without a doubt in the changing world of work. What is sought is that learning is active and meaningful, and that technology is transversal to all areas of knowledge and ultimately constitutes a transversal axis of society as a whole (Fernández-Márquez, Vázquez-Cano & López-Meneses, 2016).
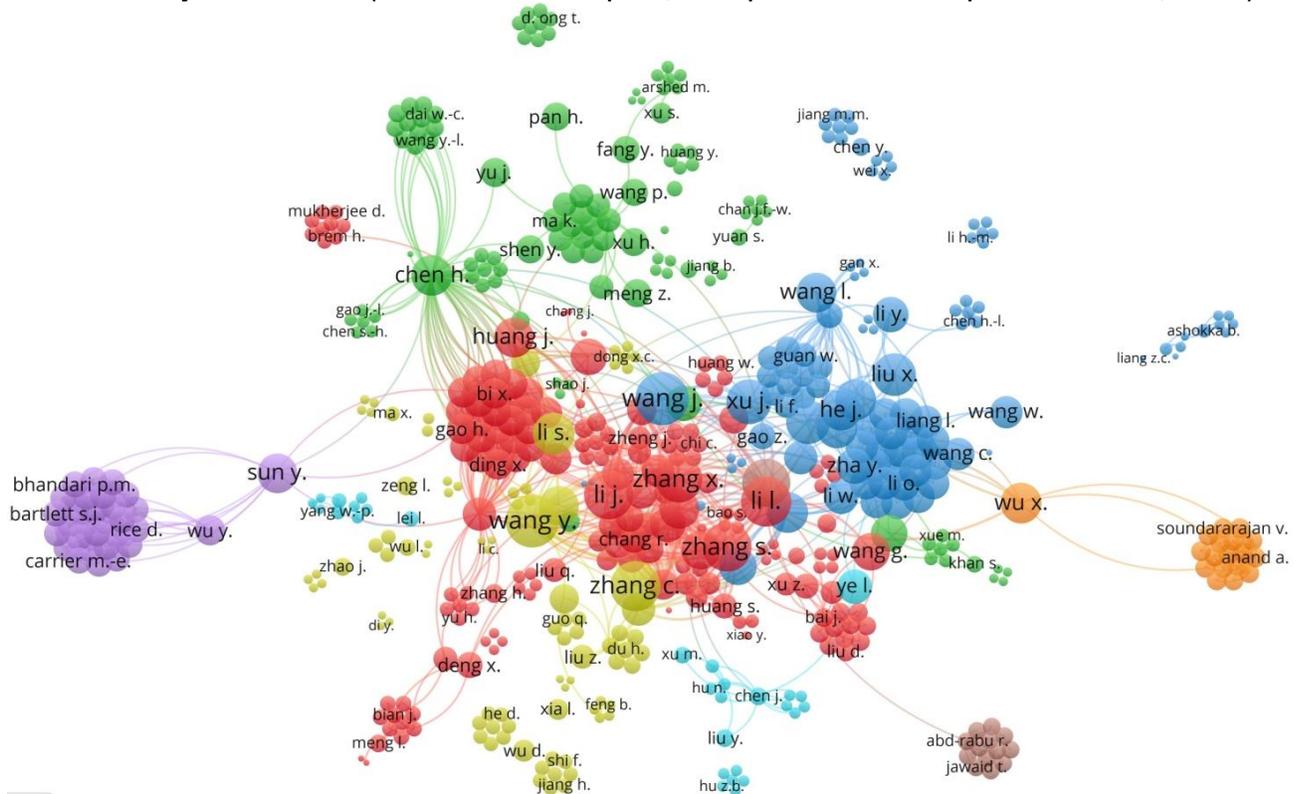

Figure 5. Network between authors based on co-authorship. Source: VOSviewer.

Likewise, these results are related to initiatives that seek to integrate digital competences with students' attitudes towards ICT (Cabero, 2014) as a proposal that harmoniously fits with the social and individual requirements pursued by each of them, and in transversal skills to acquire.

In relation to the collaboration between the main authors who have published on the subject analysed, based on co-authorship, Figure 5 shows that they are grouped into eight groups.

Thus, group 1 (red) is led by Zhang X, along with Zheng, Li, Chang, Huang, Zhang; while group 2 (blue) consists of Wang J., Xu, Liang, Xu, Wang L. and group 3 (green) Chen, Shen, Yu, Fang and Pan. Finally, group 4 (yellow), includes Wang, Zhang, Guo, Du, Liu, and Feng, and group 5 (cyan) Xu, Hu, Chen, and Ye.

As for the main institutions, where the publications and documents analysed have been made (Figure 6), the University of Toronto and the University of California, San Francisco stand out in the first place, with 12 documents each. It is followed by the University of Hong Kong, with 11 documents, and Wuhan University, with 10 documents.

The University of Washington (Seattle) and the University of Sidney have 9 documents each. With 8 documents is the University of Washington (Seattle) and with 7 documents each, The Harvard Medical School, Chinese University of Hong Kong and The National University of Singapore.
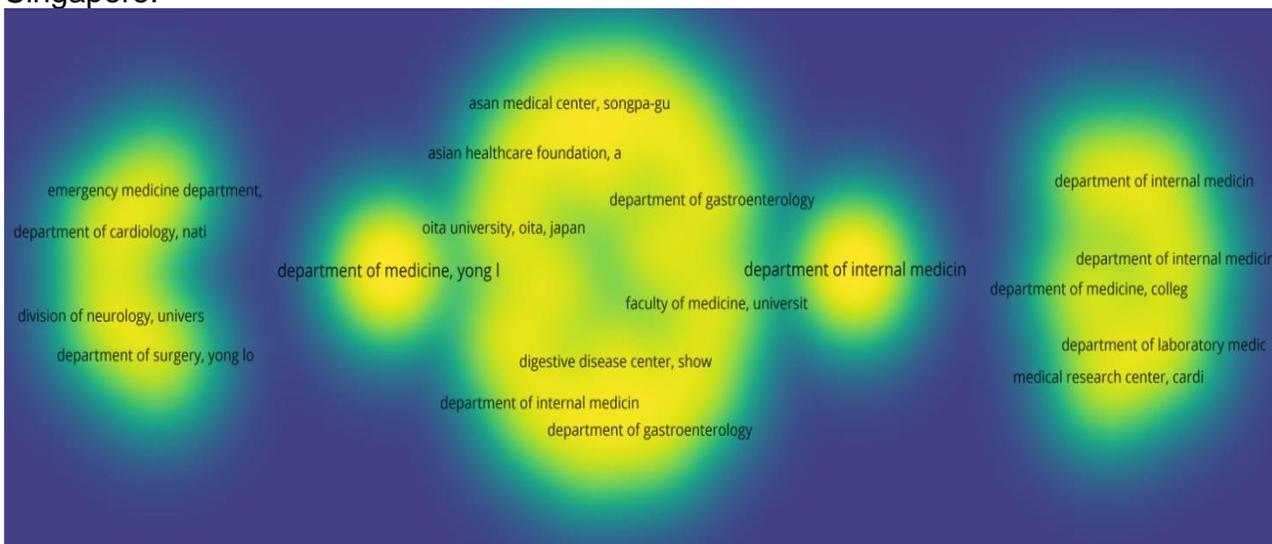
Figure 6. Mapping of institutions based on co-authorship. Source: VOSviewer.

Figure 7 shows the network of keywords during the period analysed, based on co-occurrence, associated in six groups. The most relevant groups are mentioned.

The first group (blue) is made up of the words, COVID-19, human, world health, organization, coronavirus infection, genome, machine learning and pathology, among others. Group 2 (red) is made up of the keywords: pandemic, infection, health care, education, china, clinical competence, learning, young adult, and physician, among others. Group 3 (green) is then made up of Coronavirus Disease 2019, article, humans, pandemics, pneumonia virus, viral, infection and pneumonia. Group 4 (yellow) is led by the words: medical education, intensive care, intubation surgery, critical care, personal protective and equipment. Finally, groups 5 (violet) is made up of words like pathology, thorax, dyspnoea, integration; and group 6 (cyan) by words like radiography, glucose, diabetes, complication, and monitoring.

Figure 7. Keyword network based on co-occurrence. Source: VOSviewer.

In the analysis of the keywords in this research field, it is observed that the terms "COVID-19", "pandemic", "virus", "education" and "pedagogy" are the most representative.
Table 1 expresses the number of articles per university institution.
Research on this topic that relates the emerging and future challenges of COVID-19 with the prevention and implementation of actions that mitigate the collapse of health systems around the world; They are the ones that have produced the greatest volume of scientific production in recent months (Avello, 2020; De Vincenzi, 2020).
Regarding the Social Sciences, specifically the impact on education, the manuscripts go online on the concern to achieve a quality distance and virtual education (Avello, 2020), to close the gap between students and countries (Hueso, 2020) and take the times of the pandemic as an opportunity to think about how to make our educational systems more inclusive (Echeita, 2020).
On the other hand, the attitude towards confinement is of interest, where in general, students have a good predisposition towards ICTs, considering them interesting, essential and essential to enhance collaborative work, showing a high interest in updating their ICT knowledge in order to his professional future (Tranier et al., 2020).

Table 1. Number of articles per university institution.

Research Institution	Articles
University of California, San Francisco	12
The University of Hong Kong	10
University of Toronto	10
Tongji Medical College	9
The University of Sydney	9
Wuhan University	9
University of Washington, Seattle	8
Harvard Medical School	7
King's College London	7
National University of Singapore	7
University College London	7
Huazhong University of Science and Technology	7
NHS Foundation Trust	7
Albert Einstein College of Medicine of Yeshiva University	7
Chinese University of Hong Kong	6

Figure 8 shows the keyword temperature mapping based on matches. Digital competence, as pointed out by López-Meneses et al. (2020), involves the acquisition of knowledge, skills and attitudes based on the elementary use of computer hardware, its operating systems, software as a working tool, off-line and on-line communication, as well as the use of ICTs that have to do with the processes of locating, accessing, obtaining, selecting and using information (García, 2020).

These results are related to the line of research that investigates, values and describes creativity as a necessary skill for students of the 21st century in higher education (González-Zamar & Abad-Segura, 2020a), and the positive effects it causes. in the motivation of the students.

This is consistent with various studies reviewed in the literature (Fink, 2013; Huber 2008), which demonstrate how ICTs help students to develop creativity and, therefore, flexibility, expressiveness and adaptability in situations of life. Thus, there is clear evidence that in learning the design and organization that physical space acquires exerts a motivating effect on those who inhabit it (Baum, 2018), thus favouring reflection and cognitive rigor. Thus, the results show what has been exposed in various investigations that a pandemic changes the lives of those who suffer from it, with the human being having to make a great effort of adaptation and resilience (Cortina & Conill, 2020; Vázquez-Cano et al., 2018).

In other words, these times offer value in terms of innovation, or the ability to develop innovative and effective solutions to the problems stimulated by change. The works that coincide in the importance of generating a digital literacy for university education that benefits

students in general are of interest, since there is currently a growing need for a digital structuring of knowledge" (Choi & Behm- Morawitz, 2018).
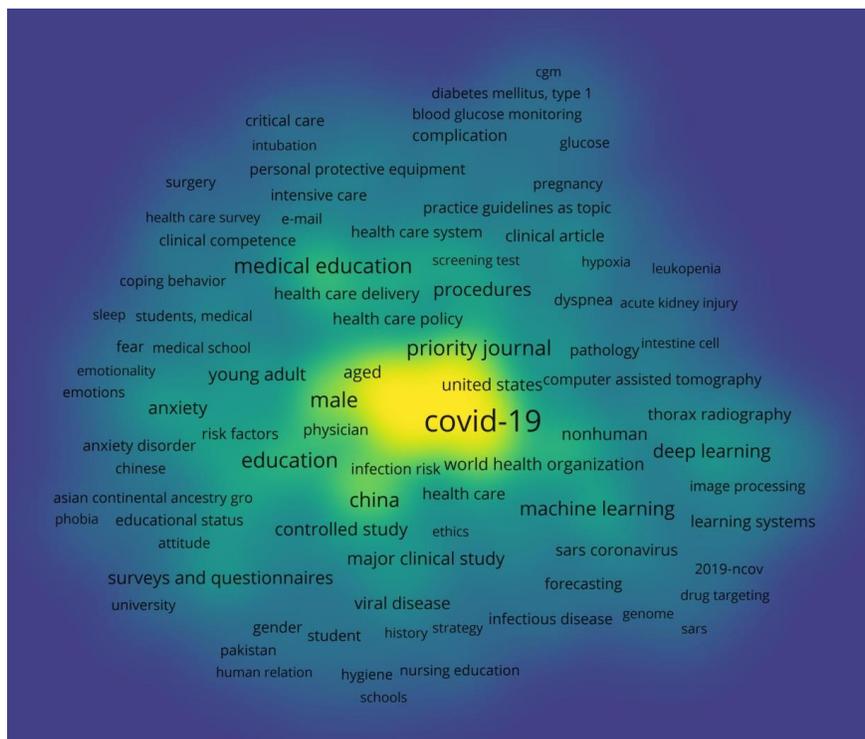

Figure 8. Match-based keyword mapping. Source: VOSviewer

Therefore, it is necessary to train students in basic competences, to participate creatively and critically in the construction not only of the knowledge that, given the technological conditions of the moment, is increasingly built from sensitive and intelligible processes, but of the changing labour market that awaits them.

Finally, it is necessary to emphasize that the presence of ICT in classrooms has meant that students have a series of technological resources that provide them with stimuli and motivate their curiosity to access learning and information in a playful, visual and creative.

5. Conclusions.

The objective of this study was to identify research trends on the effects of COVID-19 in university classrooms, during the brief period that covers the onset of the virus in 2019 until today. A bibliometric analysis of 676 articles obtained from the Scopus database has been developed. The numerous scientific articles generated in this period, has supposed a rate of daily growth of scientific production on this subject. The scientific communication and publication system have been tested in the face of the enormous amount of knowledge generated in such a short period of time.

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As for the countries that have carried out a greater international collaboration in their work, they have been United States, China, United Kingdom, India, Canada, Italy, Australia, Hong Kong and Singapore. Likewise, the main authors who have published on the subject in international collaboration are Zhang X, along with Zheng, Li, Chang, Huang, Zhang. On the other hand, the main keywords that are related to register publications with the same subject line They are: "COVID-19", "pandemic", "learning", "classroom" and "higher education".

Consequently, research on the effects of COVID-19 in university classrooms and ultimately on individuals, should continue to develop in the coming months and years, incorporating new and productive lines of research related to other disciplines. In this sense, researchers can set their sights on a multidisciplinary research work that combines education, psychology, and architecture.

Due to the multidisciplinary nature of the research front of COVID-19 and the multitude of data sources, an urgent quantification and a global characterization, even if it is descriptive, would help science professionals to understand and visualize an informative phenomenon to which we have to face in the coming months, returning to the physical spaces of the classrooms and university campuses.

This study shows that there is a strong link between authors and countries, so more work should be invested in the review of collaboration frameworks to describe, classify and identify new opportunities. It is also interesting, the analysis and pilot tests carried out in various educational centres, since they have allowed verifying successes and errors in the implementation of specific work actions.

Scientific publishers have turned to the provision of works on COVID-19, reaching unprecedented open access percentages in journals. Repositories are also central, although they are not a substitute for scientific journals. The current challenge not only concerns research in the medical field, but also requires a response from professionals in education and other disciplines to an unprecedented explosion of information that places us at the centre of the pandemic.

Future lines of research on this topic will focus, among others, on studying the impact of classroom design and its impact on personal attitudes and the generation of motivating behaviours towards learning that has changed forever and has incorporated tools digital as allies. Likewise, the extent to which physical variables influence students' cognitive and emotional processes will be addressed; in interactive learning and in the improvement and transformation of learning communities, considering, the relationships between student motivation, perception, and learning outcomes.

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