Pak. j. life soc. Sci. (2024), 22(2): 6612-6620 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences

www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.2.00499

RESEARCH ARTICLE

Technology and Educational Quality in College Students: A Bibliometric Review of Scopus

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ARTICLE INFO

Received: Jul 18, 2024

Accepted: Sep 29, 2024

Keywords

Technology

Quality

Education

University Student

Bibliometric

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ABSTRACT

The present study aimed to perform a bibliometric evaluation in Scopus on technology and educational quality in university students from 2004 to 2024. Scientific productivity was quantified by examining data from multiple indicators using bibliometrics as a method. In this study, 733 Scopus documents were evaluated for inclusion according to their keywords (college students, technology and educational quality) and their relevance to the subject matter. A significant increase in scientific production is observed between 2020 to 2023 (n=356; 48.6%), furthermore, China topped the list with 38.5% of the total publications worldwide, Applied Mathematics and Nonlinear Sciences was the most important source, with 26 publications. Almost all of these publications (92%) were scientific articles, and 26% were in the field of computer science. It is concluded that there is an abundance of resources related to technology and educational quality in undergraduates, which include a wide range of authors, sources and resources, providing a better understanding of the global reach, importance and visibility of scientific efforts. This bibliometric study lays the foundation for future research by providing evidence-based support through a comprehensive review of the existing literature.

INTRODUCTION

Currently, the phenomenon of education can be experienced at various levels and in diverse social practices. In response to crises caused by evolving societal needs, this intricate and complex process undergoes periodic changes (Auris et al., 2022). Coupled with this, in their role as providers of high-quality vocational training, universities have a responsibility to adapt to the changing needs of society, i.e., a university professional who is qualified to work in his or her field and who can adapt his or her work tasks to meet the changing technological, quality, and functional standards of companies (Castillo, 2020).

In that order of ideas, a new society has emerged as a result of the technological revolution, which has led to widespread changes and innovations in information technologies, these impact many areas of society, politics, economy, labor market, competitiveness, educational practices, learning frameworks and the way people interact with each other in real time around the world (Prendes & Cerdán, 2021; Gómez, 2021).

On the other hand, in the current era in which technology is fully integrated in higher education, the real challenge is to find the right combination of learning methodologies that enhance the teaching function, integrating pedagogical strategies with gamification, and making effective use of the digital tools available online to meet the demands of modern education (Paz et al., 2022; Romero-Carazas et al., 2024). Thus, a pedagogically sound rethinking of the role of teaching and learning media is necessary for higher education institutions to systematically incorporate technology into their

students' educational experiences (Martinez et al., 2021). This will inspire teachers to consider how to adapt to the changing landscape and provide their students with the necessary improvement in the quality of their education (Moscoso-Paucarchuco et al., 2021).

In that sense, studies on technology and educational quality in university students have increased in the last decade (Valencia-Grijalva & Vargas-Pinedo, 2022). Therefore, it is crucial to evaluate to what extent technology is permeating higher education processes, where there is a strong dependence on technology for communication and collaboration (Mollo-Torrico et al., 2023). In addition, various pedagogical approaches must be implemented to foster student autonomy in their training, as this will greatly impact the quality, efficiency and overall success of the process (Kevans, 2020). In any case, the field of bibliometrics analyzes written and other scholarly works to help researchers determine the relative importance of publications and track the evolution of human knowledge (Caló, 2022; Leyva et al., 2022).

Therefore, having a reliable capacity to collect research data is crucial for databases to function as tools to determine scientific background (Sanz, 2022). Therefore, bibliometric indicators are used, which are measures that quantify the amount of literature around a specific topic or a set of related topics (García-Villar & García-Santos, 2021; Llerena & Arévalo, 2021).

Similarly, a bibliometric framework is necessary for the collection of information on technology and educational quality in university students. The factors that will be taken into account during the review process are year of publication of the material, country of origin, subject matter, type of file, affiliation to an institution, source and authors. Therefore, the objective of the research is to perform a bibliometric evaluation in Scopus on technology and educational quality in university students from 2004 to 2024.

METHODOLOGY

The current dataset on technology and educational quality in college students was evaluated using bibliometric analyses. Consequently, bibliometrics played a crucial role in facilitating data collection for the study (Salinas and Garcia, 2022). Thus, the search was also influenced by the originality of the topic; where Scopus is a well-known global database that collects and evaluates academic publications of impact.

For the study, 847 academic papers were filtered using Boolean search terms such as: college AND students, technology and educational AND quality. Once the data were collected and cleaned, 733 papers were selected for analysis. In addition, the following criteria were applied to papers that were excluded from the dataset: (1) studies conducted before 2004 or after 2024; (2) publications that were duplicates of each other; and (3) studies unrelated to the present research.

On the other hand, 733 papers were subjected to an evaluation process in which various criteria were used to determine their overall impact on technology and the quality of undergraduate education. For which, the following indicators were taken into account: publication date, authors, journals, country of origin, file type, academic discipline and bibliometric affiliations (Florez-Fernández & Aguilera-Eguía, 2020). While VOSviewer V_1.6.19 was used to create the keyword co-occurrence map, Excel was used for data processing and analysis (descriptive statistics and count data).

RESULTS

Research papers published in sources or journals between 2004 and 2024 were the main focus of this bibliometric analysis. For this review, 733 scholarly publications on technology and educational quality in university students were chosen. Accordingly, the most current global publications that are part of the Scopus database are shown in Figure 1. Based on the data, 356 academic papers were published between 2020 and 2023, an all-time high of 48.6% in annual publication rate.

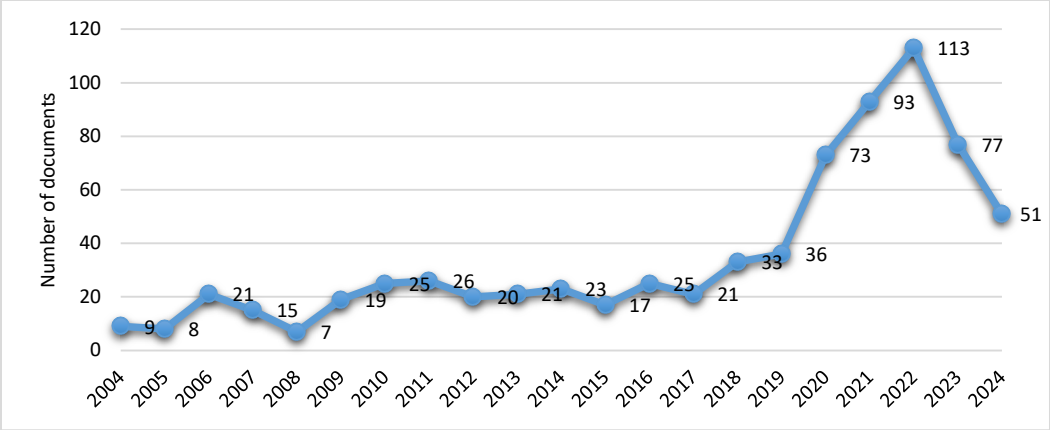


Figure 1: Documents published by year

Source: Scopus data (2024)

As Table 2 illustrates, a total of 67 countries were considered for the study. In terms of scientific productivity, China led the world with 38.5%, followed by the United States with 22.7% and India with 6%. In addition, of the three most widely used languages in academic writing, English was published in 91.7% of the papers, followed by Spanish in 6.5% and Portuguese in 1.8%.

Table 1: Publication of documents by country

N°	Country	Number of documents	%	N°	Country	Number of documents	%
1	China	314	38.5 %	17	Taiwan	7	0.9%
2	United States	185	22.7 %	18	Thailand	6	0.7%
3	India	49	6.0%	19	Spain	5	0.6%
4	United Kingdom	17	2.1%	20	Brazil	4	0.5%
5	Saudi Arabia	16	2.0%	21	Iraq	4	0.5%
6	Philippines	15	1.8%	22	Ireland	4	0.5%
7	Russian Federation	15	1.8%	23	Italy	4	0.5%
8	Indonesia	12	1.5%	24	Nigeria	4	0.5%
9	Japan	12	1.5%	25	Pakistan	4	0.5%
10	Australia	11	1.3%	26	Chile	3	0.4%
11	United Arab Emirates	10	1.2%	27	Hong Kong	3	0.4%
12	Malaysia	9	1.1%	28	Kazakhstan	3	0.4%
13	Oman	8	1.0%	29	Mexico	3	0.4%
14	South Korea	8	1.0%	30	Norway	3	0.4%
15	Canada	7	0.9%	31	Indefinite	63	7.7%
16	Jordan	7	0.9%	**Total**		**67**	

Source: Scopus data (2024)

A total of 101 academic sources were consulted for this review. Table 2 provides a summary of the data collected for this study. It also shows the total number of papers published in different journals and sources, including Applied Mathematics and Nonlinear Sciences (26). On the other hand, the ACM International Conference Proceeding Series published 22 papers. In addition, each of these sources has contributed significantly to the growth of the academic field with which it is associated.

Table 2: Publication of documents by source or Journal

Source or Magazine	Number of documents	Source or Magazine	Number of documents	Source or Magazine	Number of documents
Applied Mathematics and Nonlinear Sciences	26	Iop Conference Series Materials Science and Engineering	5	Journal of American College Health	3
ACM International Conference Proceeding Series	22	Lecture Notes on Data Engineering and Communications Technologies	5	Journal of Intelligent and Fuzzy Systems	3
Journal Of Physics Conference Series	18	Soft Computing	5	Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics	3
Mobile Information Systems	15	Boletín Técnico Technical Bulletin	4	Lecture Notes in Networks and Systems	3
Wireless Communications and Mobile Computing	12	Communications in Computer and Information Science	4	Lecture Notes of the Institute for Computer Sciences Social Informatics and Telecommunications Engineering Lnicst	3
Advances In Intelligent Systems and Computing	10	Computational Intelligence and Neuroscience	4	Plos One	3
International Journal of Emerging Technologies in Learning	10	IEEE Access	4	Proceedings of SPIE the International Society for Optical Engineering	3
Scientific Programming	8	Journal of Environmental and Public Health	4	Proceedings of The International Cdio Conference	3
Advanced Materials Research	7	American Journal of Pharmaceutical Education	3	Advances in Multimedia	2
Agro Food Industry Hi Tech	7	BMC Medical Education	3	Aip Conference Proceedings	2
Sustainability Switzerland	7	Educational Technology Research and Development	3	British Journal of Educational Technology	2
Frontiers in Psychology	6	International Journal of Engineering Education	3	Indefinido	94
Lecture Notes in Electrical Engineering	6	International Journal of Web Based Learning and Teaching Technologies	3	**Total revistas**	101

Source: Scopus data (2024)

In addition, 733 academic papers were written by authors from more than 133 different universities. Figure 2 shows the universities with the highest volume of academic papers produced during the research period. This group consists of the following universities: Purdue University (7), Texas A&M University (7), University of Florida (5), and Southwest University (5).

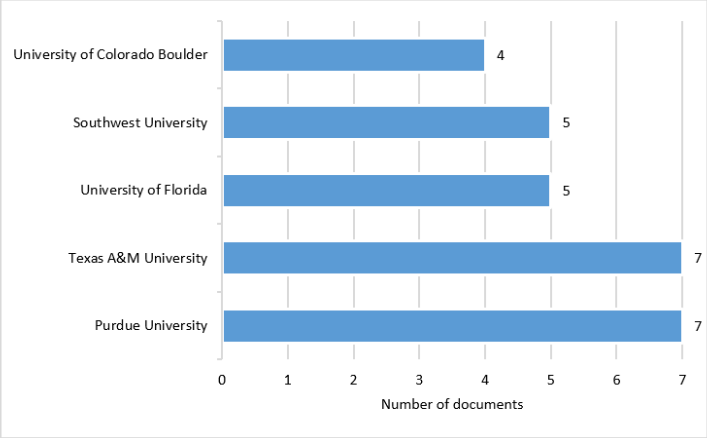


Figure 2: Documents published by institutions

Source: Scopus data (2024)

A total of 142 authors participated in the selected academic publications. According to the data presented in Table 3, authors Alfaisal, R., Almaiah, M.A., and Awad, A.B. obtained the highest number of citations, 98 in total. While, Chadha, R. (88) and Aldraiweesh, A. (87) followed them in the list of outstanding candidates.

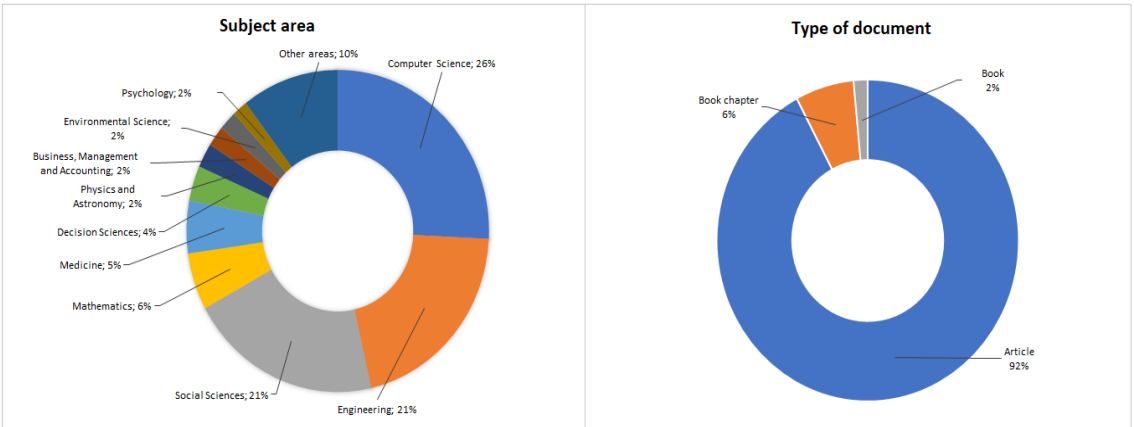
Table 3: Published papers by author

By author	Quantity	Total citations	By author	Quantity	Total citations
Sergeyev, A.	3	4	Almaiah, M.A.	2	98
Aburatani, H.	2	2	Alturki, U.	2	87
Al-Nassar, B.A.Y.	2	5	Anwar, S.	2	0
Alaraje, N.	2	3	Awad, A.B.	2	98
Aldous, D.E.	2	4	Bailey, T.	2	12
Aldraiweesh, A.	2	87	Bottia, M.C.	2	20
Alfaisal, R.	2	98	Cai, H.	2	0
Ali, K.S.	2	5	Chadha, R.	2	88

Source: Scopus data (2024)

Research on technology and educational quality in university students between 2004 and 2024 is summarized in Figure 3. Much of the most up-to-date data on this topic comes from computer science (26%), engineering (21%) and social sciences (21%). By type of document, it can also be seen that scientific articles represent 92% of the production, book chapters 6% and books 2%.

Figure 3: Publication of documents by thematic area and type



Source: Scopus data (2024)

Figure 4 shows the titles, abstracts and keyword lists of the analyzed publications. To facilitate the visualization of clusters of related words, Visual Object Sense (VOSviewer) uses color coding to show the degree of relatedness between keywords.

- Green cluster. "students" (n=55 occurrences), clusters the following words: university students, quality control, big data, teachers, colleges and universities, computerization, sports, physical education, teaching modes, teaching resources, multimedia technologies, classroom teaching, network technologies, comprehensive qualities, higher vocational education, higher education, information management.
- Blue cluster. "technology" (n=37 occurrences), groups the following words: e-learning, information technologies, surveys, educational informatics, engineering research, computer-assisted instruction, personnel training, professional aspects, societies and institutions, educational institutions.
- Yellow cluster. "teaching" (n=29 occurrences), groups the following words: education, learning systems, deep learning, teaching methods.
- Red cluster. "education" (n=20 occurrences), groups the following words: higher education, educational technology, decision making, technology, student satisfaction, college student, psychology, student, procedures, medical student, adult, educational measurement, university, internet, learning, teacher, educational model, professional knowledge, computer-assisted instruction, program evaluation.

Using this categorization system, most of the keywords in the study are relevant to the topic under investigation.

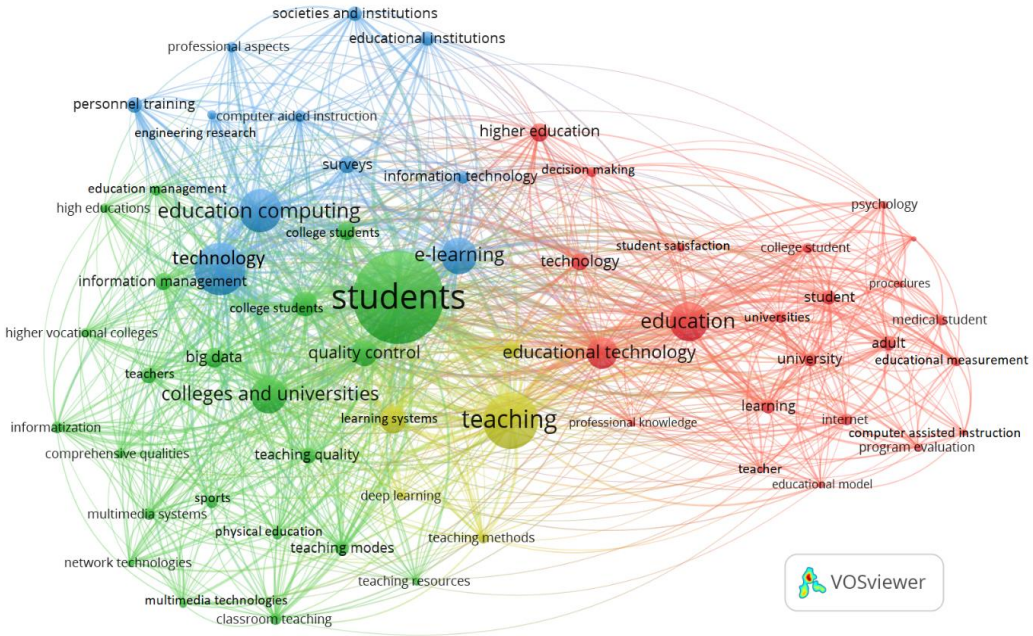


Figure 4: Map of keyword co-occurrence

Source: Results in VOSviewer (2024)

DISCUSSION

This bibliometric review covers the years 2004-2024 and is global in scope. The data show that the largest number of scholarly publications related to technology and educational quality in college students, occurred between 2020 and 2023. According to Huapaya et al. (2023), the fundamental beliefs underpinning high-quality university education emphasize the need to educate people to be contributing members of society in all its facets, capable of taking initiative and providing novel solutions to problems. Likewise, Poveda-Pineda & Cifuentes-Medina (2020) agrees that as institutions of higher education that inherently respond to the communities that surround them, universities also take into account the demands of social policies that emphasize the importance of technological literacy for individual and social progress.

For his part, Navarro (2020) states that the incorporation of technology in higher education has brought about a change in the evolution of pedagogy, with far-reaching effects on pedagogical approaches, communication models, accessibility to information, and the structure and substance of course materials. Coupled with this, Zambrano & Zambrano-Quiroz (2019) agree that the result of the use of technology, asynchronous meetings and other features have entered into mediation, resulting in a perceived improvement in educational quality.

In general, Vargas et al. (2022) point out that, in the globalized world, social agents must be more productive than ever, which in turn requires changes in the structure, content and delivery of educational programs, in order to better connect learning with real-world job requirements, produce enough skilled workers to meet production demands, foster technological advancement and compete on a global scale. Consequently, methodological changes and the challenges posed by different means of communication and access to information have contributed to increase the importance of technology in learning processes in higher education (Granados et al., 2020).

CONCLUSION

Studies examining educational technology and quality in undergraduate students have increased in recent years. After evaluating all the documents indexed by Scopus from 2020 to 2023, the bibliometric analysis revealed an increase of 48.6% (n=356). Among the countries considered, China stands out, with a production rate that stood at 38.5%, where 91.7% of the publications were written in English. Equally important was the release of 26 academic publications in the journal Applied Mathematics and Nonlinear Sciences, and the most cited authors were Alfaisal, R., Almaiah, M.A., and Awad, A.B., with 98 citations respectively.

As for the type of publication, 92% were scientific articles, including 26% in the area of computer science and 21% in engineering. Likewise, the keyword "students" was identified 55 times in the VOSviewer keyword analysis. It is also important to take into account the terms "technology", "teaching" and "education", as they are all relevant to the selected research.

The 733 scientific papers highlight the importance of technology and educational quality in university students, as this paves the way for the development of digital competencies, the promotion of adaptability, the spread of digital literacy and lifelong learning, as well as the availability of educational resources from all over the world. Finally, it is concluded that there is an abundance of resources related to technology and educational quality in university students, which include a wide range of authors, sources and resources. Thus, the impact, relevance and visibility of scientific work on a global scale can be better understood from this perspective. Through a comprehensive evaluation of the existing literature, this bibliometric study provides evidence-based support, thus establishing a foundation for future research.

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