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Visualizing the scientific productions of the field of medical education based on bibliometrics indexes in the WOS database

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ABSTRACT

The aim of the current research is to investigate the scientific productions of the field of medical education and other related fields and their historical background with bibliometrics indexes. This research is practical in terms of its purpose. In terms of methodology is survey-analytical with a scientific approach. We used VOS-Viewer and CRExplorer software to draw the maps. The findings indicate that the trend of received citations of articles in the field of medical education based on the year, by CRA Explorer software from 1975 to 2023. The number of citations has been more than 50,000. America, Canada and England are three important and superior countries in the field of medical education. Comparing the mentioned indicators can be a road map for researchers and those interested in this field, that by adopting quick search strategies, it is possible to access provide articles according to their information needs. Illustrating the subject areas of fields such as medical education can be a road map for the main policy makers of this field. This study contributes to the existing literature by presenting a large-scale bibliometric and visualization-based analysis of medical education research indexed in the Web of Science database.

Keywords: medical education, Visualizing, scientific production, bibliometric, citations, journals

Introduction

One of the criteria for determining the scientific status of countries, universities and different subject areas is the scientific documents published by researchers [1]. Every year, many scientific documents are published by researchers and faculty members of universities and scientific institutions, among them, bibliometric is the most common method for analyzing scientific publications. Ackerman defines bibliography as the quantitative analysis of scientific texts based on the amount of publication and citation data [2]. In other words, by using bibliometric analysis, it is possible to identify researchers, institutions, countries, and different subject areas and determine and depict their connections [3]. Romanell and et.al state that bibliometric analysis is a tool to determine the status of research conducted in a journal, a specific subject area, an institution or a country, and its purpose is to identify possible trends and gaps in knowledge, and finally, its results play an important role in management and decision-making in Science and technology play [4]. Although about 500 years have passed since the emergence of bibliometrics, this method is still used in the evaluation of research activities. In the past, researchers mostly used simple bibliometric techniques to analyze scientific documents in journals, different subject areas, countries and universities. In recent years, the combination of bibliometric and visualization is used to provide better analysis. It seems that simple and traditional analyzes of bibliography alone are not enough and researchers should use a combination of bibliometric and Visualization to evaluate scientific publications. Today, in addition to citation databases, many softwares have been designed and provided to researchers in this field to facilitate analysis. The emergence of Visualization can be seen as a new approach in bibliometric studies.

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Milojevic believes that this branch of bibliometric can be called visualization of texts or information visualization [5]. Synnestvedt and Chen, express in the structure of science, some relationships and phenomena can be understood abstractly by the mind, if these relationships are not physically tangible to the eye, visualization tries to discover the invisible relationships and phenomena in the structure of science and express them with language [6]. Draw multi-dimensional graphics in the form of scientific maps. In visualization, the degree of importance is generally displayed using the symbol size (enlargement and reduction of the symbol) or color (bright colors for important categories and light colors for categories with lower importance). In another approach, visualization usually uses a citation threshold (for example, 50 authors who have the highest citations) to determine which categories and how many authors, etc., appear in the output maps [7].

The field of medical education is one of the applied fields of medical sciences. Medical education in academic terms refers to a field that examines the basics of learning and teaching in medicine. The main areas of medical education include general medical education and residency courses. Medical education relies on learning theories to provide solutions and approaches in the process of medical education [8]. Considering the above-mentioned contents and taking into account the fact that it is necessary for the purposeful management of science and knowledge, progress in the scientific fields and being presented at the global level is to gain recognition and a reasoned assessment of the current state of a scientific field. In the present study, we tried to examine the scientific productions of medical education based on scientific indicators. In this way, by using scientometric indicators and application software, it is possible to have a proper and correct view of the demarcation of disciplines and interdisciplinary disciplines and more precise definitions and concepts of research in a specific scientific field and presented a realistic picture of that area. Several researches have been carried out with a scientific approach, which refers to a number of related cases.

In research, Faruk, Rahman, & Hasan, investigated the scientific productions of the subject area of digital marketing in the Scopus citation database. The results showed an average of 2.18 authors per article. The top countries in producing articles in this field were the United States, India, and the United Kingdom, respectively. Also, the main thematic areas considered by the authors according to the keywords used included the following: strategic planning with digital marketing, mobile marketing with apps development and, dealing with demographic profiles of customers [8].

A research by Saleem, et al., investigated keywords and sub-thematic fields in the field of green marketing. The results showed that in the last decade, the most keywords used in compiling researches in the field of green marketing included the following: sustainability, sustainable development, environment marketing and sustainable marketing [9].

In another study, Donthu, et al., investigated the scientific productions of two fields of psychology and marketing. The results showed that between 1984 and 2020, research in this common field has increased 71.9 times. It also shows the growth of citations to these articles by 150.8 times and the number of authors and researchers from the beginning to the end of the investigated time period more than 82 times. On the other hand, 8 common areas of research were also discovered among the articles in the field of psychology and marketing, which are: aesthetics and consumer impressions; celebrity endorsement; conspicuous consumption and hedonic adaptation; climate change; choice likelihood; consumer engagement; consumer psychology; marketing communication; sensory marketing; sharing economy; and social media marketing [10].

Aguado-Cortés, Castaño, mapped the knowledge of Covid-19 from Medline, WOS and Scopus. In drawing the co-occurrence map, terms such as war, biotechnology, fear and economy were observed in the central nodes. Also, the main thematic clusters of this field were human, China, corona virus infection, child and epidemiology, important and larger nodes [11].

Noor, et al., analyzed the category (purchasing) in a bibliometric research. The United States and England were the most influential countries in the production process of this subject area. 3 important thematic clusters were the seller and the produced content, the customer and the information capital. Among the journals, Journal of Consumer Culture had the highest rank in the field [12].

Sabah & et al., in a bibliometric study, analyzed the category of purchase. The United States and the United Kingdom were the most influential countries in the field of scientific production in this field. 3 Important clusters with VOSViewer software showed topics (vendor and content produced, customer and information capital).

Among the journals, the journal of Consumer Culture has the highest rank in the field.13 Yao, et al., conducted a research on the topic of historical roots and original research on the value of health by spectroscopic method. Out of 31 works, 17 significant mutations have been identified. The first reference about health rights dates back to 1801.

America with 61.3%, England with 22.6% and the Netherlands with 0.9% were among the best in this area. Also, the works of Chadwick, Engels and Durkheim in the fields of public health, sociology and political economy were among the main works in this field [14].

Abugabbara, et al., used the spectroscopic method in a research on solar energy meteorology with the co-citation approach of the number of cited references.

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Topics such as measurement, experimental and statistical modeling, direct and scattered radiation in horizontal planes and inclined plane per unit of time, solar geometry issues, radiation transfer calculations through the atmosphere, and resolved spectral refinement of sunlight can be seen in the results [15].

In a research, Merigó, Gil-Lafuente and Yager investigated researches in the field of fuzzy logic. The results showed that the United States, England and Australia are among the top three countries in the field of scientific production in this field. Also, among developing countries and countries with small economies such as China, Iran, and Taiwan, there are many improvements in this field compared to comparable countries [16].

Layus P, Kah investigated the bibliography of scientific productions in the field of Welding in a research. The results of their research presented 5 main clusters of welding keywords, which were determined by the time series analysis method based on the year of publication [17]. Landström, Harirchi and Aström investigated the theories and knowledge base in the field of entrepreneurship in a research. The results showed that this field of science has started to grow since the 1980s. In this research, the top authors in this field and the specialized fields of each of them (due to the interdisciplinary nature of the field of entrepreneurship) were considered. Also, the obtained results showed the most relation between entrepreneurship and business and management [18].

Among other researches in which the spectroscopic method has been used to examine the scientific productions of a specific field, we can mention the researches: Uddin, Ashraf, et al [19]. In the field of computer science, Aric20, in the field of linguistics, Li Y, et al [21]. In the field of environmental damage, Liang, Wang22 in the field of Urban Education.

Based on the above introduction, the following goals can be assumed for the current research:

1- Determining the amount of scientific production in the field of medical education. 2- Determination of citation changes in scientific productions in the field of medical education. 3- Determining co-authored maps of countries, universities and scientific institutions and authors in the field of medical education. 4- Determining the best articles (with high citations) and their citation map. 5- Determining the top journals in the field of medical education in terms of scientific indicators. 6- Determining the co-occurrence map of specialized vocabulary in the field of medical education

Method

This applied study used a bibliometric and visualization-based approach to analyze scientific output in the field of medical education. All data were retrieved from the Web of Science (WOS) core collection, which was selected for its multidisciplinary coverage and compatibility with major scientometric tools.

Search strategy

To ensure comprehensive retrieval of relevant literature, a structured search strategy was developed in accordance with standard scientometric search guidelines. The Medical Subject Headings (MeSH) thesaurus was used to identify precise and standard conceptual terms related to medical education. Since WOS does not list MeSH descriptors, these terms were used only as semantic guides and their corresponding free text equivalents were included in the search term.

A search was conducted across all WOS citation indexes, including SCI-EXPANDED, SSCI, A&HCI, ESCI, CPCI-S, and CPCI-SSH, without applying language restrictions. The search covered the time period 1975 to 2023. The final search was conducted on July 15, 2023, and all retrieved records reflect the state of the database on that date. The search was conducted using the Subject (TS) field, which includes the title, abstract, and author keywords. The final WOS search string was:

TS = ("Medical Education" or "Graduate Medical Education" or "Medical Teaching" or "Clinical Education" or "Continuing Medical Education" or "Residency Education" or "Internship Education")

A total of 47,331 records were retrieved and exported for further analysis in tab-delimited, plain text formats.

Data Cleaning and Preprocessing

Before performing bibliometric analyses, a rigorous multi-step data cleaning process was performed to ensure the accuracy, consistency, and suitability of the dataset for network visualization: 1. Duplicate record removal: Duplicate entries resulting from overlap between WOS indices were identified and removed. 2. Author name disambiguation: Changes in author names were standardized using WOS identifiers along with manual cross-checking to improve reliability in co-authorship mapping [3]. Organizational name unification: Affiliations that appeared in different formats were normalized to a single standard form. 4. Keyword standardization: Spelling variants, synonyms, and conflicting forms of keywords were merged into unified terms to optimize keyword collocation analysis. 5. Incomplete metadata correction:

Records that lacked author, publication year, or document type information were reviewed and corrected where possible.To analyze the retrieved documents based on bibliometric indicators, we used two specialized software in this field, including: VOS-Viewer 1.6.20 (Nees Jan van Eck and Ludo Waltman at the Center for Science and Technology Studies, Leiden University) to draw scientific maps, based on authors, countries, universities and influential scientific institutions, the occurrence of words; as well as CRExplorer 2.0 (Andreas Thor, HTWK Leipzig University of Applied Sciences) software to plot citation mutations over time under review.

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Also To examine temporal publication trends, a linear regression analysis was conducted with publication year as the independent variable and the annual number of publications as the dependent variable. The analysis was performed using ordinary least squares (OLS) regression. Statistical significance was set at $p < 0.05$.

Results

Based on the mentioned objectives, the findings of the research are presented below:

1- Determining the amount of scientific production in the field of medical education.

Table 1 shows the frequency distribution of the production process of scientific articles in the field of medicine and other fields related to medical education during the years 1975 to 2020. A total of 47331 articles have been published in the field of medical education and other related subject areas during 45 years. From 1975 to 2014, the publication of articles has been almost on an upward trend, but after 2014, it faced a significant jump and found a completely upward trend. The year 2021 was the year with 5920 articles in this field. Also, in the 5 years ending in 2023, the production of articles has reached 25,814, which constitutes 42% of the total scientific productions in the field of medical education.

Table 1. The process of producing scientific articles in the field of medical education

Rank	Year	No. Article	Percent
1	2023	4325	7.2
2	2022	4153	8.8
3	2021	4002	9.59
4	2020	3280	8.07
5	2019	3022	6.01
6	2018	2796	5.75
7	2017	2668	5.01
8	2016	2314	4.1
9	2015	2453	4.77
10	2014	2168	3.02
11	2013	1992	3.01
12	2012	2005	3.09
13	2011	1420	2.61
14	2010	1122	2.53
15	2009	1003	2.26
16	2008	1126	2.09
17	2007	726	1.81
18	2006	589	1.6
19	2005	703	1.41
20	2004	421	1.34
21	2003	326	1.19
22	2002	329	1.08
23	2001	219	1.08
24	2000	263	1.09
25	1999	238	1.03
26	1998	295	1.02
27	1997	188	0.91
28	1996	507	0.82
29	1995	308	0.76
30	1994	306	0.67
31	1993	241	0.57
32	1992	198	0.49
33	1991	166	0.52
34	1990	155	0.25
35	1989	186	0.3
36	1988	157	0.25
37	1987	126	0.22
38	1986	98	0.21
39	1985	99	0.27
40	1984	129	0.26
41	1983	72	0.2
42	1982	88	0.22
43	1981	69	0.26
44	1980	75	0.29
45	1979	49	0.3
46	1978	42	0.9
47	1977	38	0.33
48	1976	49	0.27
49	1975	27	0.17
Total		47331	100

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Linear regression analysis demonstrated a significant upward trend in scientific production in medical education over time. The annual number of publications increased by an average of 73.6 articles per year (β = 73.64, $p < 0.001$). The model explained 72.3% of the variance in publication output ($R^2 = 0.723$), indicating sustained and statistically significant growth of the field from 1975 to 2023 (table 2).

Table 2. Linear regression analysis of annual publication trends (1975–2023)

Variable	Coefficient (β)	Std. Error	t-value	p-value
Intercept	-146200	13300	-11.01	<0.001
Year	73.64	6.64	11.08	<0.001

Table 3. Model Summary of Linear regression analysis

Statistic	Value
Number of observations (n)	49
R-squared	0.723
Adjusted R-squared	0.717
F-statistic	122.8
Model p-value	<0.001

Also, based on the collected data, education scientific disciplines subfields with 27.42%, general internal medicine with 23.90%, and health care sciences services with 23.87% have the most scientific productions in the field of medical education. Have given. Table 4 shows the number and percentage of scientific productions in the top 10 sub-subject areas in medical education.

Table 4. Ranking of 10 subject areas related to medical education based on the number of articles

Rank	Sub topic	No. Article	percent
1	Education scientific disciplines	12981	27.42
2	Medicine general internal	11316	23.9
3	Health care sciences services	11301	23.87
4	Education educational research	4011	8.47
5	Surgery	3214	6.79
6	Public environmental occupational health	2899	6.12
7	Pediatrics	1493	3.15
8	Primary health care	1206	2.54
9	Psychiatry	1194	2.52
10	Health policy services	1160	2.45

2- Determination of citation changes in scientific productions in the field of medical education.

Chart 1 shows the trend of received citations of medical education articles by year by CRExplorer software from 1975 to 2020. The blue lines show the number of citations and the red lines show the median deviation of the number of references in 5 years. In general, the graph has an upward trend, which is an upward trend from 1975 to 1986 with a gentle slope, and shows the number of 5 historical jumps in the years 1986, 1998, 2000, 2004, and 2010. Also, the biggest jump was in 2010, with a citation count of just over 50,000.

3- Determining co-authored maps of countries, universities and scientific institutions and authors in the field of medical education.

3-1. Co-authorship of countries: based on the collected data, the United States has 43.38 percent of the production of articles in this field with 20,535 articles, followed by Canada and England with 9.09 percent and 8.04 percent. In the second and third place are the countries that produce articles in the field of medical education. Table 5 shows the top ten countries in producing articles in the field of medical education.

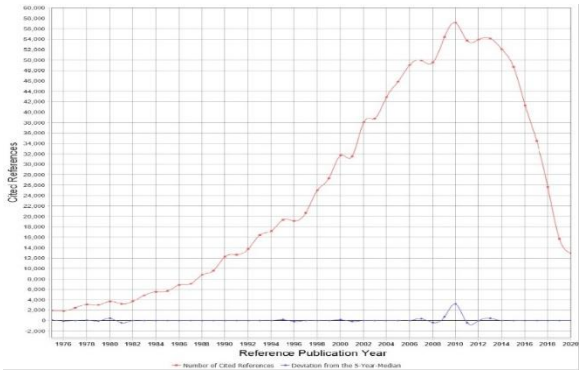


Figure 1. Historical trend of received citations of articles in the field of medical education

Table 5. Co-authored map of countries producing articles in the subject area of medical education

percent	Citation	No. Article	Country	Rank
43.38	376003	20535	United state	1
9.09	104336	4306	Canada	2
8.04	68135	3810	United kingdom	3
4.78	38493	2266	Australia	4
4.30	20355	2037	Germany	5
3.28	40873	1556	Netherland	6
2.06	11614	977	India	7
1.52	8205	722	China	8
1.42	17132	673	Scotland	9
.9	8325	430	Sweden	10

In Figure 2, a co-authored map of 56 countries out of 91 countries in the field of medical education is presented in VOS-Viewer software. The size of the circles indicates the number of articles of each country and the thickness of the lines between the circles indicates the amount of co-authorship between the countries. Also, orange, green, blue, yellow and purple colors show the group of countries that have the most cooperation with each other. As can be seen, countries like America, Canada, in addition to having the highest number of articles and international cooperation in their respective cluster, also have a significant relationship (thickness of lines) with other clusters.

3-2. Co-authorship at the level of universities and scientific organizations: Table 4 shows the research centers and universities producing articles in the field of medical education. As it can be seen, Mayo Clinic has the highest rank with 1308 articles, and the University of Toronto and the University of California San Francisco are ranked second and third, respectively.

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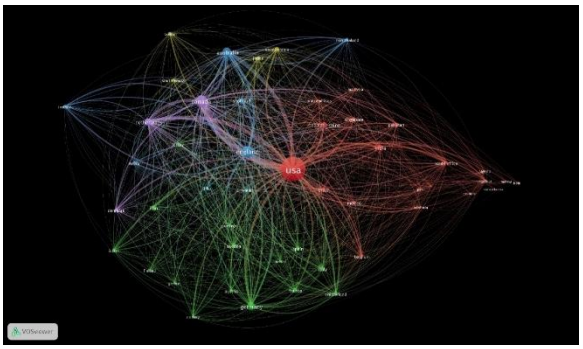


Figure 2: Map of co-authorship of countries in the production of articles and international cooperation in the field of medical education

Table 6. Co-authored map of universities and institutions producing articles in the subject area of medical education

No. Article	Affiliation	Rank
1308	Mayo Clinic College of Medicine and Science	1
1061	University of Toronto	2
719	University of California, San Francisco (UCSF)	3
631	Harvard University	4
525	University of Michigan	5
499	Maastricht University	6
488	Johns Hopkins University	7
482	University of Washington	8
432	University of Pennsylvania	9
404	McMaster University	10

Also, in terms of clustering and cooperation behavior, the co-authored map of 100 top universities and institutions is shown in Figure 3. A total of 4 clusters, each separated by a different color. In the map, each color represents a cluster. The red cluster is the most important cluster that includes 30 partner institutions and universities.

Based on this, the universities of Michigan University, Washington University, Mayo Clin, and California University of San Francisco are among the main universities of this cluster. In the yellow cluster with eight nodes, Boston University, Harvard University and Maastricht University can be mentioned.

There are 16 nodes in the blue cluster, and University of Toronto and University of British Columbia are among the most important universities and institutions in this cluster. At the end, there is a green cluster with twenty nodes, where Tehran University of Medical Sciences, University of Sydney, and University of Monash are located in this cluster. According to the figure below, the red cluster and the universities within it have the most international cooperation with other clusters.

3-3. Prolific authors: Table 7 lists the most prolific and prolific authors. Based on this, Cook, D.A and Ten Cate, O. are ranked first and second with the number of articles 85 and 83, respectively.

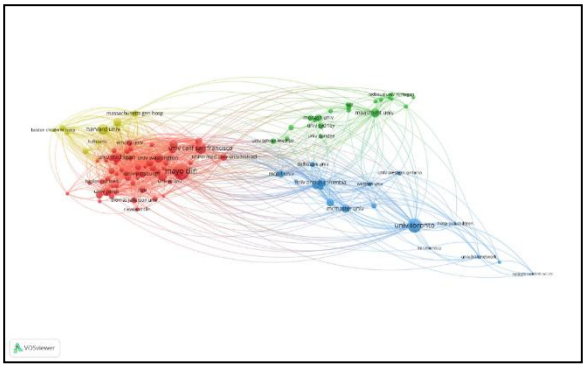


Figure 3. Co-authored map of 100 top universities and institutions in the field of medical education

Table 7. Ten prolific authors in the production of articles in the field of medical education

citation	No. Article	Author	Rank
6025	85	Cook, David a	1
3031	83	Ten Cate, Olle	2
266	80	Walsh, Kieran	3
1427	76	Durning, Steve J.	4
2121	65	Van der vleuten, Cees P.M.	5
1282	58	Sandars, John	6
1834	55	Dornan, Tim	7
2411	54	Regehr, Glenn	8
1321	52	Lingard, Lorelei	9
803	45	Dubrowski, Adam	10

The top 100 authors were selected to estimate and display the co-authorship index. As can be seen, clusters with seven separate colors are formed. Authors who are in the same cluster have the most co-authorship. These authors are either among the first authors or have had the highest cooperation with other authors.

Thus, Cook, D.A. in the purple cluster, Ten Cate, O. in the yellow cluster, Walsh, K. in the red cluster, Durning, S.j. In the blue cluster, Van der Vleuten, cees p.m. In the green cluster, Holmboe, E. s. In the turquoise cluster, McGaghie, William p.m. In the orange cluster, the main people are in these clusters.

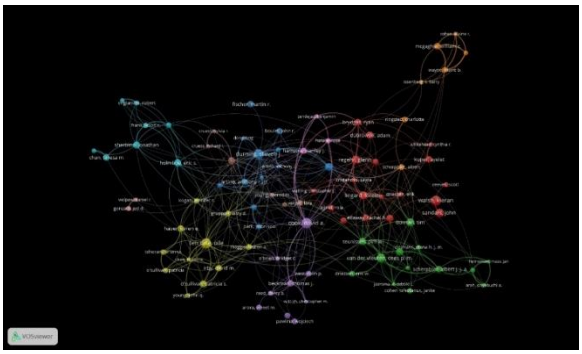


Figure 4. The co-authored map of the top 100 authors in the field of medical education

3-4. Co-authorship of authors with high citations: Table 8 shows the authors with high citations.

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First 10 authors, in the field of medical education, that high citations can be one of the indicators of the high quality of the authors' articles. Accordingly, Cook, da is in the first place, Harden, rm is in the second place and Ten Cate, O is in the third place.

Table 8. Authors with high citations in the production of articles in the field of medical education

Citations	No.Article	H-index	Author	Rank
3133	290	60	Cook, D.A	1
2164	279	51	Harden, R.M	2
1597	239	46	Ten cate, O	3
1591	121	43	Mcgaghie, W.C	4
1566	135	30	Hojat, M	5
1500	391	36	Davis, D.A	6
1431	225	48	Eva, K.W	7
1343	81	26	Frank,J.R	8
1302	317	65	Epstein, R.M	9
1249	169	48	Ericsson, K.A	10

Also, in figure 5, the author's co-authored map with the above reference is presented. As can be seen, the green cluster has authors with the highest citations in the field of medical education.

The main node in this cluster is Cook, D.A. The blue cluster, the main node of which is the author named Harden, R.M, ranks second in the medical field with high citations. The purple cluster, whose main node is an organizational author, is related to World health, organization. The yellow cluster with the main node Ten Cate, O, and the red cluster with the main node Epstein, R.M are placed in the next positions in terms of the amount of co-authorship.

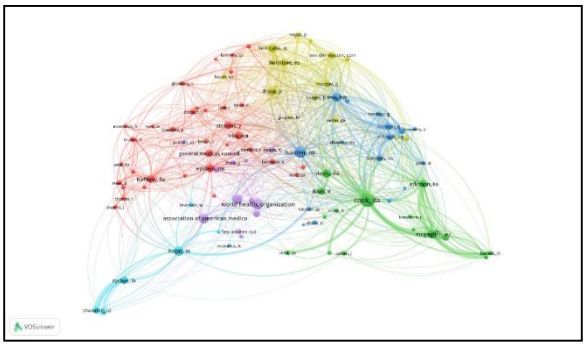


Figure 5. Coauthored map of authors with high citations in the field of medical education

4. Determining the top articles (with high citations) and their citation map: The 10 articles with the most citations are listed in Table 9 along with the name of the journal, the name of the author, and the year of document production. Also, the citation map of 100 highly cited articles is drawn in Figure 7. As can be seen, the names of the authors are different compared to the co-authorship map of the authors with the above reference.

5. Determining the best journals in the field of medical education: Table 10 shows the top twenty journals in publishing medical education articles. Academic medicine magazine from America is ranked first with 2673 articles, Medical teacher, Medical education journal are also ranked second and third, both of which are from England. In Figure 7, the co-authorship map of the top 100 journals in the field of medical education is presented in terms of bibliometric indicators.

Table 9. Highly cited articles by authors in the field of medical education

Rank	Title	Author	Journal	Cite Score Quartile	Cite Score	Year	Citation
1	Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study	Barnett, K	Lancet	Q1	91.50	2012	2712
3	Effective physician-patient communication and health outcomes - a review	Stewart, MA	Canadian medical association journal	Q1	4.50	1995	2257
4	Untangling the concepts of disability, frailty, and comorbidity: Implications for improved targeting and care	Fried, LP.	Journals of gerontology series a-biological sciences and medical sciences	Q1	9.10	2004	2140
5	Lost in knowledge translation: Time for a map?	Graham, ID	Journal of continuing education in the health professions	Q2	2.20	2006	2039
6	Health professionals for a new century: transforming education to strengthen health systems in an interdependent world	Frenk, Julio	Lancet	Q1	91.50	2010	1920
7	Changing physician performance - A systematic review of the effect of continuing medical-education strategies	Davis, DA.	JAMA-journal of the american medical association	Q1	24.80	1995	1870
8	Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review	Issenberg , SB.	Medical teacher	Q1	4.50	2005	1853
9	Impact of formal continuing medical education - Do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes?	Davis, D.	JAMA-journal of the american medical association	Q1	24.80	1999	160
10	Use of carotid ultrasound to identify subclinical vascular disease and evaluate cardiovascular disease risk: A consensus statement from the American society of echocardiography carotid intima-media thickness task force endorsed by the society for vascular medicine	Heravi, M.M.	Tetrahedron	Q1	4.50	2008	149
10	Effective use of simulations for the teaching and acquisition of veterinary professional and clinical skills	Scalese, RJ	Journal of Veterinary Medical Education	Q3	2.30	2005	2696

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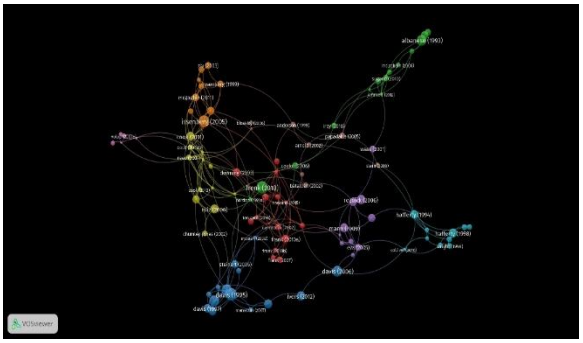


Figure 6. Citation map of highly cited articles in the field of medical education

6. Determining the co-occurrence map of specialized vocabulary in the field of medical education: Vocabulary co-occurrence based on the frequency of occurrence in the field of medical education is shown in Figure 9 (vocabulary co-occurrence map). The dimensions of each square indicate the frequency of that word in the word co-occurrence network. In the picture, the number of words that are repeated at least 50 and more than 50 times in the articles were entered into the map.

As can be seen, the co-occurrence map has 5 main clusters. The word medical education has the most occurrences (9288) among the articles in the field of medical education in the green cluster, and after that, the words education, curriculum, and graduate medical education are in the second, third, and fourth ranks, respectively.

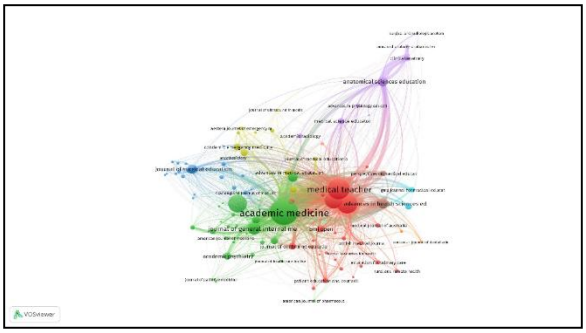


Figure 7. Co-authorship map of the top journals in the field of medical education

The red cluster has co-occurrence of words Primary care, medical education & training, general practice, public health. Blue cluster includes Graduate medical education, quality improvement, and patient safely. In the yellow cluster, the words curriculum, communication, medical, medical education are co-occurring. In the purple cluster, the words medical students and simulation are among the main words in the articles.

Table 10. Top twenty journals in publishing medical education articles

Rank	Journals	No. Article	Citation	Country	CiteScore	Quartile
1	Academic medicine	2673	74804	United states	5.40	Q1
2	Medical teacher	1828	42844	United kingdom	4.50	Q1
3	Medical education	1596	48352	United kingdom	5.30	Q1
4	Mayo clinic proceeding	1406	40501	United kingdom	10.90	Q1
5	BMC medical education	1298	1279	United kingdom	2.90	Q1
6	Journal of general internal	758	7093	United states	4.60	Q2
7	Anatomical sciences education	529	11219	United states	7.20	Q1
8	Advances in health sciences education	508	11341	Netherlands	4.90	Q1
9	Journal of surgical education	504	4420	United states	3.50	Q1
10	Teaching and learning in medicine	478	5047	United states	3.00	Q1
11	The American Journal of Medicine	354	24581	United states	5.20	Q1
12	Bmj open	344	2185	United kingdom	3.70	Q1
13	Academic psychiatry	320	3088	Switzerland	3.10	Q1
14	Journal of Continuing Education in the Health Professions	324	6908	United States	2.20	Q2
15	Medical education online	317	2490	United kingdom	3.80	Q1
16	Family medicine	314	3591	United States	2.00	Q2
17	Academic emergency medicine	308	6296	United States	5.00	Q1
18	Cureus	306	750		-	
19	Advances in Medical Education and Practice	280	1273	United kingdom	2.80	Q1
20	Journal of veterinary medical education	271	1982	Canada	1.90	Q2

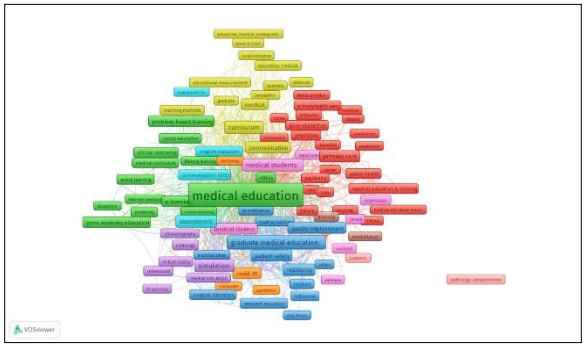


Figure 8. Co-occurrence map of specialized words in the field of medical education

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Discussion

We conducted the current research with the aim of drawing a scientific map of scientific productions in the field of medical education between 1975 and 2023 with a spectroscopic approach. We also collected the required data from the WOS reference database. We searched for articles in this field with maximum comprehensiveness and at the same time the keyword "medical education" in the field of title, abstract and keywords of the articles. Considering that the search term is two words and the medical topic is broad, we used the "" sign for more communication. The time frame of the research was also chosen in such a way as to provide maximum comprehensiveness and the possibility of finding minimum citations. In this research, taking into account that most of the scientometric indicators at the level of author, article, magazine, geographical area, universities and scientific institutes and keywords were examined as a historical trend, therefore VOS-Viewer and CRExplorer software were used. These softwares can draw relationships (bibliometric relationships) that are normally invisible to users as 3D and illustrated structures.

The regression analysis confirms that the observed increase in scientific production is not merely descriptive but represents a statistically significant and sustained growth trend. This finding reflects the increasing institutionalization and global expansion of medical education research over recent decades. The results of the present study are largely consistent with prior bibliometric investigations in other scientific and interdisciplinary domains, while also revealing several distinctive characteristics specific to the field of medical education. Similar to the findings reported by Faruk et al.8 in digital marketing and Saleem et al.9 in green marketing research, the volume of scientific production in medical education demonstrates a clear and sustained upward trend over time. However, compared with these fields, the growth observed in medical education is not only steeper in recent years but also more concentrated in the last decade, with over 40% of publications produced in the final five years of the study period. This indicates a relatively delayed but accelerated maturation of the field compared with domains such as marketing or environmental studies, which experienced earlier expansion phases.

Also According to the findings of the research, the trend of scientific production in the field of medical education has been on a continuous upward trend during the period under review, and this trend was almost the same and without jump from 1975 to 2014, and from 2014 to 2020, it was reported as jumpy and exponential. If we see the production of the most articles in the last 5 years (Figure 1). According to the data provided from the WOS database, the fields related to this field are facing the most diversity, if we deal with fields such as Education, scientific disciplines, general internal medicine, surgery, etc., which shows this issue. It is possible that the field of medical education is an interdisciplinary field and in fact it connects different fields of medicine in terms of education. In other words, considering that the topic of education is a topic in the field of humanities and social sciences, it can be said that the field of medical education acts as a bridge and improves the level of education in medical fields. This doubles the importance of this field and subsequently the importance of its scientometric investigation. Nevertheless, while Donthu et.al.10 attributed growth mainly to interdisciplinary integration, the present findings suggest that structural reforms in medical training systems, such as competency-based education and accreditation-driven research, may have played a more decisive role in medical education.

Regarding co-authorship data, it can be stated that the visualization of co-authorship data at the country level shows that 43.38% of all articles produced in this field were produced by the United States or in cooperation with this country, which is a significant number of contributions. E is mentioned. After the United States, there are Canada and England, which, of course, are at a significant distance from the United States (Table 5). Also, co-authorship data at the level of universities and scientific institutions also shows that universities and scientific centers in United States have the most participation in the production of scientific articles in this field (Table 6 and Figure 3). This shows its importance more when we are faced with several clusters of scientific productions in Figure 3. Different colors indicate the sub-topics of the articles, however, in each cluster, we find the largest share of universities and scientific institutions in the United States, which shows the diversity of the scientific productions of this country. In other words, the top universities, in addition to producing the most articles, have the most variety of topics and cooperation with other universities. Therefore, this kind of identification of universities and scientific institutes are considered as the main centers of producing scientific articles on various subjects in the field of medical education for other researchers in this field. In terms of identifying prolific authors in this field, we can mention Cook, D.A. with 85 articles and Ten Cate, O. with 83 articles (Table 7). Also, by examining the authors with the above reference that can be seen in Table 8, we come across almost similar names that are part of the main nodes in the co-authorship map (Figure 4). It seems that the identification of these authors will make the search for more and higher quality articles easier for the users of this field. Regarding the highly cited articles based on Table 9, there is a point to consider, and that is that the authors of these articles are different from the names of the most active and highly cited authors. In other words, if the researchers of this field are only looking for quality articles (in terms of the amount of citations and use by other researchers).

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Then prolific authors with high citations cannot be the way forward. This can change the behavior of searchers in this field in dealing with different categories and information needs. So a key divergence from several prior bibliometric studies concerns the relationship between author productivity and citation impact. While studies such as those by Layus and Kah17 or Uddin et al.19 implicitly assume a strong alignment between prolific authors and highly cited works, the present findings reveal a noticeable mismatch in medical education research. Several of the most highly cited articles were authored by individuals who are not among the most prolific contributors.

This pattern suggests that, in medical education, citation impact may be driven more by the policy relevance and conceptual influence of individual studies than by sustained publication output, challenging productivity-based evaluations commonly used in research assessment. On the other hand, regarding the top journals in the field of medical education, according to table 8, it can be seen that, for example, the journals Academic medicine, Medical teacher, Medical education, etc. are at the top of the list of journals in this field with the publication of the largest number of articles, but with Carefully regarding the list of journals that publish articles with high citations (Table 9), we come across different names (Lancet, Canadian Medical Association Journal, etc.), which seems to be a point worth considering.

On the other hand, if we look at the quality quartiles of this group of journals, we will reach a common point, and that is that the majority of these two groups of journals are in the first and second quality quartiles. Regarding drawing the co-occurrence map of the words used in the articles of this field, according to Figure 8, we come across the keywords medical education, curriculum, graduate, public health, primary care, etc., which have the highest frequency in the articles.

It is worth considering that the above and similar keywords are in different color clusters that have a high frequency (at least 50 repetitions in each article), which means that in the sub-subject areas of medical education, the key keywords of these cases are which can be used by researchers as document language (authors) to better search for articles with maximum relevance. Finally, the keyword co-occurrence analysis supports observations made in prior bibliometric studies regarding thematic clustering but also indicates greater conceptual fragmentation. Unlike fields such as green marketing8, 9 or welding17 research, where a limited number of stable thematic clusters dominate, medical education exhibits multiple coexisting clusters with overlapping yet distinct focal points.

This finding suggests that the field is not converging toward a single dominant paradigm but is instead evolving as a heterogeneous and multi-centered research domain.

According to the results and discussion of the above-mentioned lines, it can be said that the scientific productions of the field of medical education, like other fields that were discussed in the background of the subject, had a jump in the number and citations received in recent years.

Regarding the other investigated indicators such as co-authorship at the level of universities, authors, articles, etc., it can be stated that comparing the mentioned indicators can be a road map for researchers and those interested in this field, that by adopting quick search strategies, it is possible to access provide articles according to their information needs. On the other hand, illustrating the subject areas of fields such as medical education can be a road map for the main policy makers of this field, which provides them with a picture of the past and present and suggestions for the future.

Considering that the subject area of medical education is an interdisciplinary field, the research process, especially in the stages of information gathering, creates limitations and difficulties that can be mentioned as follows: 1- Considering the interdisciplinary and The vastness of the subject field of medical education, the process of searching and retrieving completely related scientific products based on keyword search in databases (in this research, WOS) increases false drop or retrieval of unwanted information. Although, by using search strategies, the amount of unwanted information recovery is controlled to a large extent. This increases the duration of the research in the stage of data collection and editing for analysis. 2- The subject area of medical education, due to its wide scope and the recovery of a large number of scientific products, causes problems in information processing in scientific software. This causes some limitations in entering data into the software.

Conflict of interest:

there is no conflict of interest.

References

1. Archambault E, Cote G, Michaud B. Potential for scientific collaboration between Canada and Nordic countries 1998-2003 Denmark–Finland–Iceland–Norway-Sweden. Retrieved September. 2008; 24:2019.
2. Ackerman C, Erasmus LJ. The Southern African Journal of Accountability and Auditing Research: A bibliometric review (1998-2017). Southern African Journal of Accountability and Auditing Research. 2018 Nov 1; 20(1):1-2
3. Özköse H, Gencer CT. Bibliometric analysis and mapping of management information systems field. Gazi University Journal of Science. 2017 Jan 1; 30(4):356-71.
4. Romanelli JP, Fujimoto JT, Ferreira MD, Milanez DH. Assessing ecological restoration as a research topic using bibliometric indicators. Ecological engineering. 2018 Sep 1; 120:311-20.

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5. Milojevic S. Big science, nano science? Mapping the evolution and socio-cognitive structure of nanoscience/nanotechnology using mixed methods. University of California, Los Angeles; 2009.
6. Synnestvedt MB, Chen C, Holmes JH. CiteSpace II: visualization and knowledge discovery in bibliographic databases. InAMIA annual symposium proceedings 2005 (Vol. 2005, p. 724). American Medical Informatics Association.
7. Mokhtari H, Soltani-Nejad N, Mirezati SZ, Saberi MK. A bibliometric and altmetric analysis of Anatolia: 1997–2018. Anatolia. 2020 Jul 2; 31(3):406-22.
8. Faruk M, Rahman M, Hasan S. How digital marketing evolved over time: A bibliometric analysis on scopus database. Heliyon. 2021 Dec 1; 7(12).
9. Saleem F, Khattak A, Ur Rehman S, Ashiq M. Bibliometric analysis of green marketing research from 1977 to 2020. Publications. 2021 Jan 8; 9(1):1.
10. Donthu N, Kumar S, Pattnaik D, Lim WM. A bibliometric retrospection of marketing from the lens of psychology: Insights from Psychology & Marketing. Psychology & Marketing. 2021 May; 38(5):834-65.
11. Aguado C, Castaño VM. Translational knowledge map of COVID-19. arXiv preprint arXiv:2003.10434. 2020.
12. Noor S, Guo Y, Shah SH, Nawaz MS, Butt AS. Bibliometric analysis of social media as a platform for knowledge management. International Journal of Knowledge Management (IJKM). 2020 Jul 1; 16(3):33-51.
13. Sabah F, Hassan SU, Muazzam A, Iqbal S, Soroya SH, Sarwar R. Scientific collaboration networks in Pakistan and their impact on institutional research performance: A case study based on Scopus publications. Library Hi Tech. 2019 Mar 7; 37(1):19-29.
14. Yao Q, Li X, Luo F, Yang L, Liu C, Sun J. The historical roots and seminal research on health equity: a referenced publication year spectroscopy (RPYS) analysis. International journal for equity in health. 2019 Dec; 18:1-5.
15. Abugabbara M, Javed S, Bagge H, Johansson D. Bibliographic analysis of the recent advancements in modeling and co-simulating the fifth-generation district heating and cooling systems. Energy and Buildings. 2020 Oct 1; 224:110260.
16. Merigó JM, Gil-Lafuente AM, Yager RR. An overview of fuzzy research with bibliometric indicators. Applied Soft Computing. 2015 Feb 1; 27:420-33
17. Layus P, Kah P. Bibliometric study of welding scientific publications by big data analysis. International Journal of Mechanical Engineering and Applications. 2015 Sep; 3(5):94-102.
18. Landström H, Åström F, Harirchi G. Innovation and entrepreneurship studies: One or two fields of research? International Entrepreneurship and Management Journal. 2015 Sep; 11:493-509.
19. Uddin A, Singh VK, Pinto D, Olmos I. Scientometric mapping of computer science research in Mexico. Scientometrics. 2015 Oct; 105:97-114
20. Arik E. A bibliometric analysis of linguistics in web of science. J. Sci. Res. 2015 Jan 1; 4(1):20-8.
21. Li Y, Liu C, Zhang J, Li F. A bibliometric analysis and visualization of environmental damage research from 2000 to 2018. InIOP Conference Series: Earth and Environmental Science 2018 Jul 1 (Vol. 170, No. 3, p. 032079). IOP Publishing.
22. Liang Y, Wang L. A bibliometric analysis of the papers on urban education. EURASIA Journal of Mathematics, Science and Technology Education. 2018 May 5; 14(7):2857-66.

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