

A Bibliometric Analysis on Higher Education Curricula Model

Xiao-Song REN

School of Management Science & Engineering
Shanxi University of Finance & Economics
Taiyuan, China
renxiaosong1986@163.com

Yu-Jia LIU

School of Management Science & Engineering
Shanxi University of Finance & Economics
Taiyuan, China
lyogajia@163.com

Abstract—The aim of this study is to explore the higher education curriculum model and new ways of talent cultivation. This paper uses the bibliometric method to analyze 1019 existing works of literature in the research field of higher education curriculum model, which are selected from the core collection of Web of science database during 2013 to 2018. We sort out and quantitatively analyze the relevant literature of higher education curriculum model. Base on the scientific and intuitive chart data, we analyze the publication time, high-related fields, top journals, high-level research institutions and most cited authors. Moreover, several visual knowledge maps for collaborative network analysis and literature co-citation analysis are made by using CiteSpace software, one of a visualization tool for mapping knowledge domain. Finally, through above quantitative analysis, the results show as follows: (1) the research hotspot focus on the keywords "university education" and "curriculum". (2) the key words "strategy" and "satisfaction" are likely to be new research frontiers in this field.

Keywords—higher education; course mode; bibliometric; citation network

I. INTRODUCTION

At present, the higher education curricula model is usually aiming at strengthening discipline knowledge and theoretical understanding, lacking practice [1]. However, learning through the workplace is an effective training strategy for the higher education [2]. Studying in school and learning in a workplace are two major components of professional education, and students must develop professional competence by building meaningful relationships between knowledge and skills [3]. Therefore, the combination of theoretical knowledge learning and practice in school has become the focus of education revolution. In addition, government, industry, students, and employers are paying more attention to students who receive advanced education in practice [4]. It is necessary for colleges and universities to consider the relationship between education and work practice [5]. Some scholars have carried out a systematic literature review on the 3-p model of workplace learning [6], and some scholars have proposed different goals for school study and professional education [7]. Establishing balance and consistency is one of the main challenges of curriculum development. Higher Education has strong connection with practice, and the comprehensive ability of talents has become the new core competitiveness.

II. METHOD AND DATA

A. The bibliometric method

Bibliometric, integrating mathematics, statistics and philology, is a systematic method to quantitatively analyze all knowledge carriers and focus on quantitative analysis. Literature measurement is an effective method to analyze academic journals [8], which can also analyze the research status and development trend of education curriculum model in colleges and universities [9]. Analyzing the core literature, evaluating publications, and investigating the utilization rate of pieces of literature by means of bibliometric analysis can provide direction for future research.

H-index is a mixed quantitative indicator, proposed by Jorge Hirsch in 2005, a physicist at the University of California, San Diego, which could be used to evaluate the academic output of the researchers and the level of the academic output. H-index means that h numbers of one's total articles are cited at least h times, which is closely related to bibliometric. Hirsch believes that the h index can accurately reflect a person's academic achievements, and the higher a person's h index is, the greater the influence of his thesis [10].

In order to analyze the dynamic evolution trend of higher education curriculum model, we analyze the data statistically through Excel and CiteSpace software. This paper studies the hot spots and the frontier by analyzing the general situation and the trend of the relevant literature on education curriculum model from 2013 to 2018. Through a visual map of knowledge about keyword co-occurrence, author cooperation, and institutional cooperation network, we can obtain the analysis of cited articles to explore the research status and development context of the existing literature.

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B. Data collection

Due to the authoritative and wide application of web of science core collection in the academic field, this paper uses it as the key database for this research, using "Higher Education Curricula Model" as a theme for the basic retrieval. It mainly analyzes the data of 2013-2018, considering that the literature research in the last five years can better reflect the current research status and research focus. Up to 29 April in 2018, 1019 publications are collected, including articles (94.603%), review papers (3.827%), and other publications. In terms of publication language, English is the most frequently used (96.176 %), followed by Spanish (1.667 %), each of the other languages accounts for less than 1%.

III. RESULT

A. The performance of different years

As shown in Fig. 1, No notes the number of publications in every year, and TC stands for the number of cited frequency in every year. The study found that the research of higher education curriculum model shows an increasing trend overall from 2013 to 2018 except 2014. In 2017, the publications reach the top with the number of 215, but the annual output gap is small. In addition, the annual citation frequency is also increasing gradually. In 2013, the cited frequency is 81. In addition, the citation frequency reached 308 in 2014. In 2017, the citation frequency reaches the peak of 1701. Obviously, in recent years, the total citation frequency of the articles in this field has increased greatly, and more and more researchers pay attention to this topic. In 2018, the number of published articles and cited frequency reached slack because of the incomplete data, which are collected before April 2018. However, according to the trend, the number of published documents and the cited frequency may create a new peak in 2018.

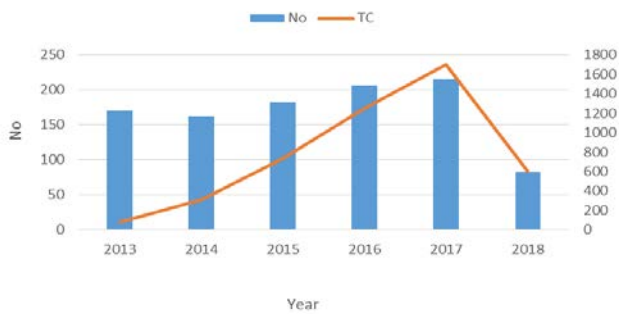


Fig. 1. The number of publications in every year.

Note: the total number of publications, TC: total cited times per year

B. The performance of different journals

Table 1 shows the top 10 productive journals with 177 published articles accounts for 17.37% of the total articles from 2013 to 2018. Academic Medicine and BMC Medical Education had the same publications and took the first place with 24 articles (2.36%) at the same time, little higher than Journal of Chemical Education, the third journal with 23 articles (2.26%). It is found that the gap between the high-yielding journals in the field of higher education curriculum model is not obvious, and the distribution of periodicals is dispersed. As shown in Fig.2, the difference in every journal is

not significant with a similar annual output, and the trend of change is wavy. Only BMC Medical Education published 11 articles in such a field in 2017. According to the incomplete data of 2018, the Journal of Cleaner Production has been paying more attention to this field recently, and five articles have been published by April 2018.

TABLE I. THE PERFORMANCE OF DIFFERENT JOURNALS

JOURNAL NAME	TP	%
ACADEMIC MEDICINE	24	2.353
BMC MEDICAL EDUCATION	24	2.353
JOURNAL OF CHEMICAL EDUCATION	23	2.255
JOURNAL OF CLEANER PRODUCTION	20	1.961
NURSE EDUCATION TODAY	18	1.765
INTERNATIONAL JOURNAL OF SUSTAINABILITY IN HIGHER EDUCATION	15	1.471
JOURNAL OF SURGICAL EDUCATION	15	1.471
ANATOMICAL SCIENCES EDUCATION	13	1.275
EURASIA JOURNAL OF MATHEMATICS SCIENCE AND TECHNOLOGY EDUCATION	13	1.275
STUDIES IN HIGHER EDUCATION	12	1.176

TP: total publications

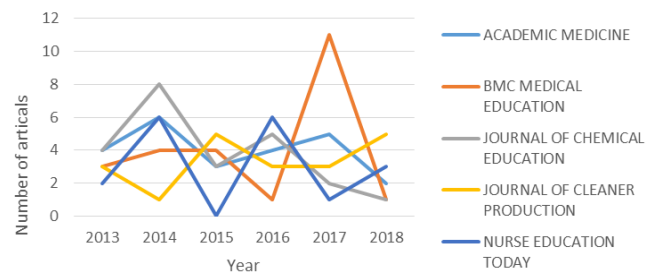


Fig. 2. The performance of different journals

C. The analysis of research orientation

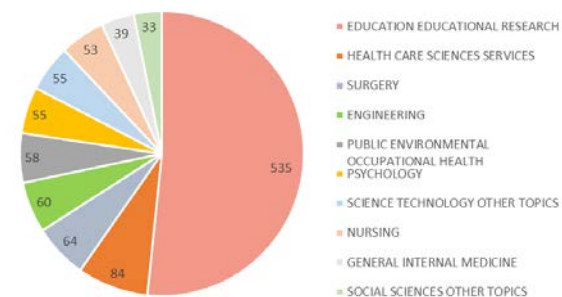


Fig. 3. The analysis of research orientation.

Fig.3 shows the top 10 research orientations of higher education curriculum model from 2013-2018. It shows that the research in this field is mainly about education educational research recently, and the related literature are 535 (52.5%), much higher than health care sciences services, the second orientation with 84 articles (8.24%). The number of studies on surgery, engineering, public environmental occupational health, psychology, science technology and other nursing topics is

similar. The number of studies in general internal medicine and others social sciences topics is relatively small, accounting for 3.83% and 3.24% respectively.

D. The analysis of the hot spot based on keywords

The statistical analysis of keywords is an effective way to determine the scientific direction and explore the development of science and technology (Garfield, 1990). Through the analysis of Citespace software, of the 1019 articles, 170 keywords are used, of which 61.8% appear less than 10 times, 30.6% appear more than or equal to 10 times but less than 50 times. Table 2 lists 13 keywords which appeared more than 50 times in the research field of higher education curricula model, ranked by usage frequency. According to the research, "education" is a keyword with the highest frequency (298), but the node center is only 0.06. And other high-frequency keywords include curriculum, model, student, higher education, etc. The node centralities of higher education and curriculum are 0.13 and 0.1 respectively, which are the key nodes in such a field sorted by the node centrality.

TABLE II. THE ANALYSIS OF THE KEYWORDS

Freq.	Cited References	Centrality	Year
298	education	0.06	2013
222	curriculum	0.1	2013
161	model	0.07	2013
152	student	0.04	2013
124	higher education	0.13	2013
90	medical education	0.05	2013
76	performance	0.02	2013
73	knowledge	0.06	2013
68	skill	0.02	2013
62	simulation	0.04	2013
58	program	0.02	2013
54	school	0.04	2013
52	science	0.04	2013

TP: total publications

Table 3 shows the analysis results of the research frontiers, ranked by Burst Term. The results show that the number of keywords bursting in 2013, 2014 and 2016 is 7, 3 and 2 respectively. According to the two emerging keywords in 2016, the latest research frontier term is strategy and satisfaction, with the burst rate 3.25 and 0.06 respectively. It may be the focus of future research in this field.

TABLE III. THE ANALYSIS OF THE RESEARCH FRONTIERS

Burst	Key Words	TP	Centrality	Year
3.31	primary care	9	0	2013
3.25	strategy	11	0	2016
2.94	high school/introductory chemistry	8	0.01	2013
2.71	resident	23	0.03	2013
2.57	curriculum design	7	0	2013
2.44	satisfaction	13	0.06	2016
2.41	faculty	14	0.06	2014

Cont. to TABLE III

2.2	teaching	6	0	2013
2.2	diversity	6	0.03	2013
2.2	dental education	6	0	2013
2.16	mathematics	17	0.03	2014
2.01	physical education	11	0.02	2014

TP: total publications

E. Publication features of different countries

1) The performance of different countries

Table 4 lists the top 10 most productive countries in the field of higher education curriculum model from 2013 to 2018. The USA is the most productive country in such a field with 474 publications from 2013 to 2018, accounting for 46.5% of total publications, which has the h-index up to 21. However, Australia, the second productive country, has a large gap with the United States, having 85 publications and the h-index of 13. Other productive countries such as England, Canada and Spain, all have h-index above ten. China is ranked sixth in the number of posts with 48 publications, and the h-index is 7. Germany, Taiwan and the Netherlands have fewer publications. It shows that China has been ranked in the middle with appropriate publications, but the h-index is low, indicating that China's influence in such a field is relatively small. Compared with China, Germany has a higher h-index than China, which means its quality and influence are relatively high, although the publications is less than China.

TABLE IV. THE PERFORMANCE OF PRODUCTIVE COUNTRIES

Country/region	TP	TP (%)	H-index
USA	474	46.516	21
AUSTRALIA	85	8.342	13
ENGLAND	76	7.458	13
CANADA	58	5.692	11
SPAIN	49	4.809	7
PEOPLES R CHINA	48	4.711	7
GERMANY	46	4.514	9
TAIWAN	34	3.337	7
NETHERLANDS	32	3.14	7
ISRAEL	19	1.865	6

TP: total publications, TP (%): the ratio of one country's publications to the total number of publications.

2) Academic cooperation

Fig.4 shows the academic collaboration among different countries through the analysis of Citespace software. Node size means the number of productions in each country through international collaboration. The bigger the node, the stronger in international cooperation the country is. As shown in Fig. 4, the USA is the most active country. In addition, Australia and England are also active. According to the clustering analysis, in the top 10 productive countries, Australia, England, Peoples R China and Netherlands cooperate closely, and Germany has a cooperative relationship with Israel. Although the United States does not cooperate with other countries in table 4, it has cooperation with Turkey, Scotland, India, etc.



Fig. 4. The cooperation between different countries

F. Cooperation analysis of institutes

At present, according to the Web of Science, there are 167 institutions studying on higher education curricula model. Of the 167 institutes, 118 institutes cooperated with other institutions, accounting for 70.66%. Table 5 describes the ten most productive institutes in the research of higher education curricula model during 2013-2018. Univ California San Francisco is not only the most productive research institution but also the key node in clustering, with a centrality of 0.13 and more cooperation with other institutions. Stanford Univ is following, with a volume of 14 and a centrality of 0.11. Among these 10 institutes, Univ, San Francisco, and NYU have cooperative relations. At the same time, there is a cooperative relationship between Stanford Univ, Harvard Univ and Univ Penn, and a mutual cooperation between Northwestern Univ and Univ Michigan. Fig.5 shows the cooperative relationship between the major different organizations. Active academic communications between research institutions around the world promote the optimal allocation of scientific resources and accelerate the development of international research theory, promoting the innovation and perfection of education curriculum model research in colleges and universities.

TABLE V. THE ANALYSIS OF THE INSTITUTES

TP	Centrality	Institute Name	Year	Cluster
18	0.13	Univ Calif San Francisco	2013	0
14	0.11	Stanford Univ	2014	1
14	0.06	Univ Washington	2013	3
13	0.05	Northwestern Univ	2013	2
12	0.03	Mayo Clin	2013	4
11	0.09	Harvard Univ	2014	1
11	0.09	Univ Penn	2014	1
10	0.02	Univ Michigan	2013	2
8	0.11	NYU	2014	0
7	0.07	Univ Queensland	2014	6

TP: total publications

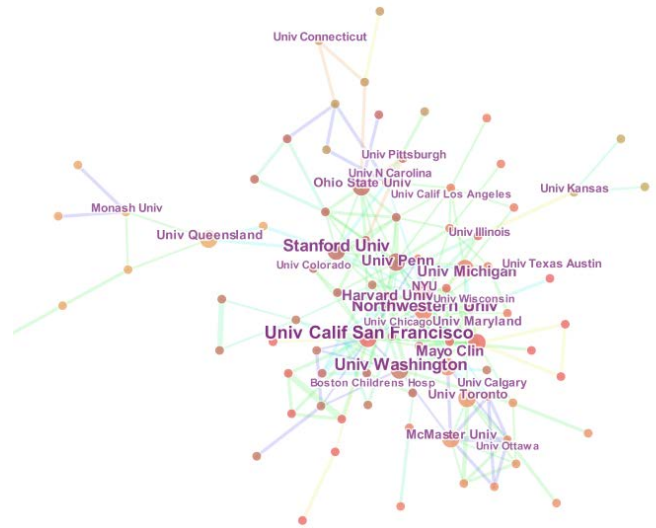


Fig. 5. Collaboration relationships between different institutions

G. The analysis of cited articles

Citation analysis is a research method for information measurement, which reveals the quantitative characteristics and inner laws through analyzing the references and cited phenomena of scientific journals, papers, and authors. Table 6 shows the top ten cited literature, including the author's name, the year of publication, literature source and other specific information. The analysis found that 521 articles are cited twice or more, but only 3 works of literature are cited more than 10 times. Sugand K (2010), Drake RL (2009) and Cook DA (2011) are cited 15, 14 and 10 times respectively, which have high reference value in the study of education curriculum model in colleges and universities. In addition, Schwarz CV(2009), Frenk J(2010), Lozano R(2010), Lozano R(2013) were all cited 9 times, which also have some reference value. Most of the other papers are cited 2 times.

TABLE VI. THE ANALYSIS OF THE MOST HIGHLY CITED ARTICLES

CC	References	Cluster
15	Sugand K, 2010, ANAT SCI EDUC, V3, P83	0
14	Drake RL, 2009, ANAT SCI EDUC, V2, P253	0
10	Cook DA, 2011, JAMA-J AM MED ASSOC, V306, P978	4
9	Schwarz CV, 2009, J RES SCI TEACH, V46, P632	1
9	Frenk J, 2010, LANCET, V376, P1923	3
9	Lozano R, 2010, J CLEAN PROD, V18, P637	2
9	Lozano R, 2013, J CLEAN PROD, V48, P10	6
8	National Research Council, 2012, FRAM K 12 SCI ED PRA, V, P	1
8	Kern DE, 2009, CURRICULUM DEV MED E, V, P	16
8	Ngss LS, 2013, NEXT GENERATION SCIE, V, P	1

CC: citation counts

As shown in Fig.6, we can know from the clustering analysis that the cluster label #0 is medical education. A total of 151 papers are cited, and the earliest citation was published in 2006. Cluster label #1 is high school, which has 93 cited literature.

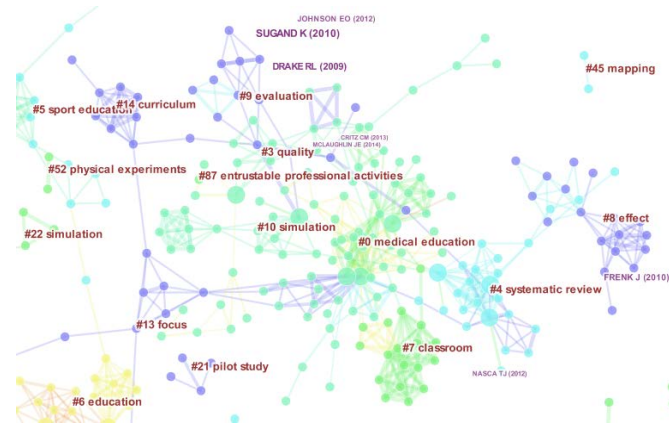


Fig. 6. The analysis of cited articles

IV. CONCLUSION

Education is the foundation of social development, and the way to adapt to social needs can not only improve the quality of talents but also be crucial to the development of the country. The research on higher education curriculum model plays an important role in changing the traditional model of teaching and exploring better methods to cultivate talent. 1019 publications associated with higher education curricula model from 2013 to 2018 based on the SCI and SSCI databases are retrieved by using bibliometric methods, and 94.603% of which were articles. The study reveals that the literature on higher education curricula model has grown gradually over the past 5 years. The findings and results are summarized from the following three aspects:

A. Research trends

On the whole, the research of higher education curriculum shows an increasing trend according to the annual number of posts. In recent years, the citation frequency of articles in this field has gradually increased, and more and more scholars have begun to pay attention to the research in this field. Most of the research mainly focused on education educational research in 2013-2018, with 535 references (52.5%), more than other orientations. And from 2013 to 2018, the research hotspot is centered on the keywords "university education" and "curriculum". The key words "strategy" and "satisfaction" in 2016 are likely to be new research orientations in this field. □

B. National research

At the global research scale of higher education curricula model in recent years, USA is the leading country with the most publications, international cooperation, and highest academic influence. At the same time, the most productive institution (Univ Calif San Francisco) is also from the USA. The gap between other countries and the United States is large, and the difference is reflected in the number of posts and the h-

index. In addition, China is ranked in the middle according to the number of publications, but the influence is small. In contrast, although Germany has a smaller volume than China, its h-index is higher, and the article is influential.

C. Citation analysis

From the perspective of citation analysis, cited references are not so much, but the reference value is large. Sugand K(2010), Drake RL(2009) and Cook DA(2011) are cited more frequently, laying a foundation for the research of higher education curriculum mode. High cited literature focus on the medical education and high school and other fields, so these are the core of this field.

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