Investigation and analysis of Informetrics curriculum education in China

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Abstract

Purpose – The purpose of this paper is to generalize the teaching characteristics of some typical colleges in China which offer Informetrics courses, and to propose useful suggestions for the course construction of Informetrics through empirical investigation.

Design/methodology/approach – The statuses of Informetrics curriculum education of the top ten universities in Library and Information Science and Archives Management in Chinese mainland as well as Fu Jen Catholic University in Taiwan have been investigated and analyzed through a network survey and a telephone survey. Wuhan University and Fu Jen Catholic University are considered as the typical examples.

Findings – The educational development of Informetrics in China has gone through three stages: the initial stage, the developing stage and the improving stage. Based on the empirical investigation and analysis, some meaningful conclusions are drawn concerning the education system, teaching objectives, teaching contents and teaching methods of Informetrics courses.

Originality/value – This paper provides curricular information about Informetrics courses in China.

Keywords China, Case study, Education, Investigation, Informetrics, Course construction

Paper type Research paper

Introduction

Informetrics is the inheritance and development of Bibliometrics and Scientometrics which can be traced back to the analysis of literature and bibliographic citations in the early twentieth century. It is generally believed to be the earliest quantitative study of information. Alan Pritchard (1969), a well-known British scholar, proposed Bibliometrics in 1969, marking the birth of Bibliometrics (Zhao and Xu, 2010). Then Otto Nacke (1979), a German scholar, proposed Informetrics in 1979. The term "Informetrics" is derived from the German term "Informetrie". International Federation for Documentation (FID) established the Informetrics Committee in 1980. The conference of Informetrics teaching planning was held in former Czechoslovakia in 1982. In 1984, Brookes (1984) discussed some basic theoretical issues about Informetrics in his published papers and clarified to vigorously develop Informetrics. In July 1985, FID published the informal magazine *Informetrics News Letter* in India. In 1987, the first session of the International Conference, International Symposium for Theoretical Issues of Bibliometrics and Information Retrieval, was held in Belgium. After that, the conference has been held every other year, and the name of the conference has always contained "Informetrics". In 1995, the name of the conference was officially designated as International Society for Scientometrics and Informetrics, abbreviated as ISSI. In addition, COLLNET (the Global Interdisciplinary Research Network for the Study of all Aspects of Collaboration in

Library Hi Tech
Vol. 34 No. 3, 2016
pp. 539-548

0737-8831
DOI 10.1108/LHT-08-2015-0080

Science and in Technology), established by H. Kretschmer and colleagues, and International Conference on Science and Technology Indicators continuously energize the study of Informetrics, and vigorously promote its innovation and development. Scholars' exploration and research in Informetrics are always advancing as time goes by. With the continuous improvement of information technology and the increase in the amount of electronic network information, Almind and Ingwersen (1997) first proposed the idea of Webometrics in 1997 and suggested applying the method of Informetrics to the quantitative study of online information. Since then, scholars have begun to explore and study on Webometrics.

Reviewing the development of Informetrics, we notice that foreign scholars have played a key role in the development of Informetrics and the level of research abroad is far ahead of China. It is essential to explore how domestic universities train their personnel in the field of Informetrics. Therefore, an empirical survey has been conducted to investigate those colleges which offer Informetrics courses. By analyzing the curriculum system of various colleges and universities, their characteristics are understood to provide references for improving the curriculum system of Informetrics. Thus it can gradually narrow the gap between foreign countries and China.

Data and methods

Colleges and universities undergraduate specialized catalog (Ministry of Education of the People's Republic of China, 2015a), formulated and revised by the Chinese Ministry of Education, is an undergraduate course directory of colleges and universities. And "Lists of disciplines and majors of master and doctoral degrees as well as post graduate education" (Ministry of Education of the People's Republic of China, 2015b), is the basis for Academic Degrees Committee of the State Council to audit the dividing range of disciplines and specialties. After reviewing these two documents, no information about Informetrics, Bibliometrics, Scientometrics or Webometrics was found. Accordingly, Informetrics has not yet been developed into an official discipline in China. There are more than 60 colleges and universities offering Library Science and Information Science in China. By retrieving the admissions professional directory, it was found that only a small number of colleges offer courses related to Informetrics, such as Informetrics and Scientific Evaluation. Through the survey of school websites, the course information of some schools can be found on the Academic Affairs Office section of schools' websites, but information at a majority of schools can only be obtained through the Student Information Management System. In order to ensure the data were available and typical, the top ten universities which are advancing in Library and Information Science and Archives Management and were listed in Academic Degrees and Graduate Education Development Centre in 2012 (Academic Degrees and Graduate Education Development Center, 2015), were selected as investigation subjects. Those universities include Wuhan University (2015), Nanjing University Teaching Affair Office (2015), Renmin University of China (2015), Peking University (2015), Central China Normal University (2015), Zhongshan University (2015), Nankai University (2015), Jilin University (2015), East China Normal University (2015) and Shanghai University (2015).

Meanwhile, many colleges and universities in Taiwan also offer Information Science and Library Science, such as Fu Jen Catholic University, Normal University, National Taiwan University, National Chengchi University, National Chung Hsing University, Shih Hsin University, Hsuan Chuang University, etc. Through a web-based survey, we found that there is a high degree of information disclosure for course construction in Taiwan, since it is relatively easy to obtain curriculum-related information.

Fu Jen Catholic University (2015) was selected as a representative to introduce curriculum situation of Informetrics in Taiwan.

The course construction projects vary in different universities with different talent cultivation plans in China. By investigating universities' official websites, we found that some information could be obtained on the Academic Affairs Office section of schools' websites and some were only accessible by logging into the college student management system. As for the selected universities above, first their college homepages were logged onto one-by-one to investigate the curriculum of the school and get the required data. Then the incomplete data obtained above was added and improved through telephone inquiries and e-mail consultations with relevant teachers and Academic Affairs Office of the school. Among those 11 schools, the required information of Renmin University of China and Nankai University could not be acquired from the internet. Through an e-mail inquiry with Renmin University of China we learned it provides an Information Analysis course instead of an Informetrics course. Through a telephone inquiry with Nankai University, we found out that it only has an Econometrics course. The acquired data can be seen in Table I.

Results and discussion

According to Table I the universities have formed a relatively complete teaching system. Through the investigation and analysis of universities in China, it is concluded that the development of Informetrics curriculum education in China has gone through the following three stages: the initial stage, the developing stage and the improving stage.

The initial stage

In 1983, the Ministry of Education held a national symposium on Information Science Education in Wuhan University. Bibliometrics was first included in the undergraduate course teaching plan of Science and Technology Information. In the following year, Wuhan University offered the Bibliometrics course to undergraduates majoring in Science and Technology Information, Library Science and Archives Science as well as junior college students majoring in Science and Technology Information and Information Management. From 1986, Wuhan University began to offer the Informetrics course to graduate students. Wuhan University also established the relevant professional orientation, training a large number of high-level researchers in the field of metrics study (Qiu *et al.*, 2007). From 1988, Institute of Scientific and Technical Information of China began to use several indicators and methods of Scientometrics to analyze scientific papers.

The developing stage

The introduction of Bibliometrics course in the early stage contributed to the training of personnel. It provided a number of highly qualified professionals to institutions of higher education. According to the survey of Bibliometrics courses in 1995, 20 universities, including Peking University, Jilin University of Technology, Nanjing University, Nankai University, Shanghai University and Xiangtan University, etc., officially offered Bibliometrics courses to undergraduates and tertiary students majoring in Information Science and Library Science (Qiu, 1995). In 1993, Wuhan University began to offer Scientometrics and Informetrics to the master students. At the same time, Peking University and Nankai University also offered postgraduate

School	Department	Teaching object	Course	Teaching materials
Wuhan University	School of Information Management	Undergraduate/ postgraduate	Bibliometrics/ Informetrics	Bibliometrics/ Informetrics
Nanjing University	Department of Information Management	Postgraduate	How to filter network information – in the perspective of Informetrics	Webometrics theory, tools and applications/ link analysis in the perspective of information science
Renmin University of China	–	–	–	–
Peking University	Department of Information Management	Postgraduate	Informetrics	No
Central China Normal University	School of Information Management	Undergraduate	Informetrics/ Webometrics	Informetrics/ Webometrics
Zhongshan University	School of Information Management	Undergraduate	Informetrics	Informetrics
Nankai University	–	–	–	–
Jilin University	School of Public Health	Postgraduate	Informetrics/ scientific measurement and evaluation	Informetrics and its medical application
East China Normal University	Department of Informatics	Postgraduate	Informetrics	Foreign classic literature
Shanghai University	Department of Library and Information and Archive	Undergraduate	Information Statistics	Distribution theory of network degree
Fu Jen Catholic University	Department of Library and Information Science	Postgraduate	Informetrics	Informetrics and document features

Table I.
The related curriculum situation of 11 colleges

courses about Bibliometrics. In 1998, Wuhan University offered Informetrics to students who major in Information Management and Information System. Up to 1998, Wuhan University fully offered Bibliometrics courses to junior college students, undergraduates and postgraduate students, which formed a complete teaching system. It has been proved that Bibliometrics education has begun to take shape, and there has already appeared a number of qualified teachers in China.

The improving stage

Since 2000, many colleges and universities in China have set up Information Management and Information System majors. With the networking and digitalization of information resources, the research subject and scope of Bibliometrics are bound to be extended to the field of Informetrics. Many institutions have introduced Informetrics into the undergraduate teaching program, and some institutions have also established corresponding graduate programs. At the same time, the quality of teaching has been

greatly improved. In 2007, Professor Qiu Junping compiled and published the work *Informetrics* on the basis of *Bibliometrics*. As one of the course materials included in "the Ministry of Education for the 21st Century", *Informetrics* fills the gap and meets the needs of university teaching in the new environment. In the same year, Informetrics courses were awarded as the excellent courses of Wuhan University. In 2008, Informetrics courses were awarded as the excellent courses of Hubei Province as well as the national excellent courses. It should be noted that the excellent course, divided into school level, provincial level and national level, is noted as an exemplary course with first-class teachers, first-class teaching contents, first-class teaching methods, first-class teaching material and first-class teaching management. The excellent course is an important part of teaching quality and teaching reform project in China. In 2009, Professor Wang Wei of Jilin University, compiled and published *Informetrics and Its Medical Applications*. Since then, Informetrics has been extended to the field of medical information. In recent years, Nanjing University, Peking University and others have invited internationally renowned scholars in the field of Informetrics for exchange visits. Those scholars instructed teachers and students on the research frontiers in this field. For instance, Wuhan University has invited a number of prestigious foreign scholars in recent years, including Ronald Rousseau (in 2004, 2010, 2012 and 2015, respectively), Leo Egghe (in 2011) and Wolfgang Glanzel (in 2013), etc.

Reviewing the three developing stages of the Informetrics curriculum education in China, we realize that the Informetrics course was developed from the Bibliometrics course, and it gradually began to conform to the latest trends in the development of domestic and international disciplines. During the 30 years of development, research of Informetrics has made great achievements, including a deepening of the level of study, an improvement of research methods, an evolvement of knowledge systems and an increase in the teaching force.

Typical case study

Judging from the information acquired, Wuhan University is very unique in terms of Informetrics teaching and has an enormous influence in the field of Informetrics in China. Fu Jen Catholic University reflects the status of college Informetrics education in Taiwan. Therefore, they are chosen as the typical representatives to analyze, summarize and to reach conclusions.

Wuhan University

Wuhan University was the first university in China to offer the Informetrics course to undergraduates. It has been more than 30 years since Wuhan University offered its first Bibliometrics course in 1983. The total number of students and teachers who have taken this course is up to 6,000. Currently, the lecturers of Informetrics in Zhongshan University, Lanzhou University, Nanjing University and some other universities are alumni who graduated from the doctoral program in Wuhan University. It is clear that Wuhan University, with its advanced level and authoritative position in China, serves as a role model to other universities and has a radiating effect on other universities.

Wuhan University offers related courses to both undergraduate and postgraduates. And the courses offered to undergraduates and postgraduates differ in teaching contents and other aspects.

The Informetrics course is open to undergraduates. Taking into account the different disciplinary backgrounds, Wuhan University offers Bibliometrics to students who major

in Library Science and offers Informetrics to students who major in Information Management and Information System. These two courses are arranged for 54 class hours, accounting for three credits. The general learning objectives are to enable students to grasp the preliminary theoretical system, and to master a variety of quantitative analysis tools and analytical methods. Students can analyze and research relevant laws about information from a quantitative point of view, and then fulfill scientific management of information. As a result, students will lay a solid foundation for further academic study.

The content system of this course mainly consists of theories, methods and applications. The syllabus of Informetrics for undergraduates is listed in Table II.

The teaching mode is flexible enough to fully mobilize students' interests and enthusiasm. Some topics within the research fields will be proposed and students are assigned to write papers on those topics by using theories and methods learnt in the class. Furthermore, detailed reviewing comment will be given to the outstanding papers. Accordingly, it will improve the students' enthusiasm to participate in research.

Classroom work, course papers and final exam are the main evaluated items for the final grade. The evaluation method is traditional and practical, which improves students' ability effectively and enables students to integrate theory with practice.

The Informetrics course is open to postgraduates. Back in the 1990s, the School of Information Management began to enroll master students in the metrological direction. In 2000, it began to offer quantitative study of information resources to master students, and to offer Informetrics and Scientific Evaluation to doctoral students. After that, the School of Information Management opened a number of related courses, including Webometrics (Qiu, 2007).

Based on theories, the main teaching goal is to cultivate students' ability to apply their knowledge, with a combination of research methods and practices. Case studies help deepen students' understanding and knowledge of the basic theory and strengthen students' ability to use methods and tools. At the same time, the process of case studies can test students' ability to solve problems.

Curriculum contents include development and research of Informetrics, hotspots and frontier, main methods, tools and software as well as cases in the field of Informetrics. There are three teaching methods. First, the latest academic achievements

Table II.
The syllabus of Informetrics for undergraduates

Name	The main content	Class hours
Theoretical knowledge	Introduction	3
	Growth dynamics of scientific literature information	3
	Aging rule of scientific literature information	3
	Bradford's Law	3
	Zipf's Law	3
	Lotka's Law	3
	Theoretical foundation of Informetrics	3
	New development of Informetrics-Webometrics	6
Methods	Statistical analysis of the literature information	3
	Citation analysis	6
	Computer-aided analysis of information	3
Practical application	Applications of Informetrics in library and information management and research	3
	Applications of Informetrics in technology management and forecasting	6
	Experimental, analytical methods practice	6

will be applied to teaching. Second, domestic and foreign experts will be invited to lecture on topical issues. Third, academic seminars are carried out to exchange ideas. Assessment methods are mainly reflected in class participation (accounting for 20 percent of final grade), PPT discussions (accounting for 30 percent of final grade) and the course paper (accounting for 50 percent of final grade). With interactive and heuristic teaching to mobilize students' enthusiasm, it facilitates the ability of independent research which is necessary for students.

Fu Jen Catholic University

The Department of Library and Information in Fu Jen Catholic University offers the Informetrics course to graduate students. Teaching materials used are shown in Table III.

Curriculum contents include historical development of Informetrics, Lotka's Law, H index, Bradford's Law, Zipf's Law, citation analysis, use of Web of Science, application software, link analysis, Webometrics, patent analysis, and Informetrics' applications in various fields which include science and technology, knowledge model and technology roadmap, science policy, resource allocation, innovation and forecasting, etc. Apparently, the practical application of Informetrics is more emphasized. In addition, tutors provide students with some references and reading materials, and require them to take reading notes and display what they have learned. This will not only improve the ability of self-learning, but also enable students to have a deeper understanding of this course. More importantly, it helps students practise expressing their knowledge.

Assessment methods can be divided into three parts. First, for a given bibliography, each person has to take reading notes and give a presentation in the classroom (accounting for 30 percent of final grade). Second, teachers give scores according to students' classroom performance and participation (accounting for 20 percent of final grade). Third, students choose their areas of interest and write a course paper with the methods they have learned (accounting for 50 percent of final grade).

Based on the above empirical investigation and analysis, we can draw the following conclusions about the Informetrics course.

The course focusses on students' ability to innovate, and actively explores the personnel training methods that suit economic and social development. Specific measures can be summarized as the following three points. First, students are trained to have a solid theoretical foundation. The basic concepts, development and classic laws of Informetrics are introduced systematically in the teaching process. All colleges and universities require students to master basic theoretical knowledge

No.	Title	Author	Published year	Publishers
1	*Informetrics and Document Features*	Mingyue, C.	2003	Taipei: National Institute for Compilation and Translation
2	*Citation Indexing: It's Theory and Application in Science, Technology and Humanities*	Garfield, E. and Merton, R.K.	1979	New York, NY: Wiley
3	Bibliometrics as a research field: a course on theory and application of Bibliometrics indicators	Glanzel, W.	2003	–

Table III. Teaching materials of the Informetrics course used in Fu Jen Catholic University

and mathematical statistics. Second, the capacity of students to comprehensively apply multidisciplinary knowledge and innovation is strengthened. As an intersectional science, Informetrics is relevant to Philology, Science of Science, Computer Science and other disciplines. Therefore, the schools focus on training interdisciplinary talents. Third, the students' ability to integrate theory with practice is improved. In the learning process, students are not only required to master the basic theories, methods and techniques of Informetrics, but also required to combine what they have learned with the actual requirements.

The teaching contents are rich, and will be adjusted according to different teaching objects. The undergraduate course focusses on the theoretical basis, and it is designed to allow students to initially grasp classical laws in the field of Informetrics. The graduate course focusses on the practical application, including application in the library management, information analysis and forecasting, information retrieval, evaluation and other social science disciplines. The methodology part of the course emphasizes on the learning of methods (such as statistical analysis, mathematical model method and citation analysis), tools (such as SCI, SSCI, ESI, CSCI, CSSCI and CSTPC), techniques (such as social network analysis, knowledge mapping and visualization) and software (such as Ucinet, Citespace and Pajek). The purpose is to better address the fundamental contradiction at information service work, and to more effectively provide services to science and technology and economic and social development.

A variety of teaching methods are used to stimulate students' interests in learning, and to improve teaching effectiveness, such as putting forward the problem through a typical case; verifying the theory through experiments and simulating the actual environment of Informetrics through cognitive experiments; encouraging students to truly master the basic theory and methodology, and to acquire knowledge from the specific practices and applications; fostering students to learn to apply the knowledge that has been learned to analyze and solve practical problems.

A relatively complete system has been basically formed for Informetrics curriculum education after the initial stage, the developing stage and the improving stage. This discipline possesses outstanding teaching staff. Teachers' education level becomes higher, and their age structure is more reasonable. Teaching levels are complete, covering junior college, undergraduate, master's and doctoral levels. The abundant and diverse teaching modes are formed, based on formal education and supplemented by advanced studies, foreign visiting scholars and expert lectures, etc.

Conclusion

In this study, the top ten universities in Library and Information and Archives Management in Chinese mainland and Fu Jen Catholic University in Taiwan were selected to respond to a survey to analyze the current situation of Informetrics curriculum. A network survey, a telephone survey and other methods were applied to collect the corresponding data. Second, three stages of domestic Informetrics curriculum education were summarized and explained. Then, taking Wuhan University and Fu Jen Catholic University in Taiwan as examples, the teaching objectives, course contents and assessment methods of the Informetrics were elaborated on in details. Finally, based on the above empirical investigation and analysis, four conclusions were drawn concerning the teaching objectives, teaching contents, teaching methods and education system of Informetrics.

Although the Informetrics course has made considerable progress in all aspects, the focus should still be on strengthening the international construction from now on. Colleges and universities offering this course have gradually set up bilingual programs and international curriculum to meet the needs of international academic research and exchanges. Through the exchange of teaching staff and collaborative research, teachers in China have become increasingly more internationally oriented. What's more, colleges and universities offering Informetrics-related courses ought to further enrich the teaching mode and provide online courses to make it richer and more flexible. Online teaching is conducive to openness, sharing and versatility of educational resources, and thus it meets the needs of the development in modern education informatization.

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