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Informetrics Education in Library and Information Science (LIS) Academic Departments in South Africa

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Abstract

Purpose: The purpose of this paper is to explore literature on informetrics education globally, in order to determine the relevance of informetrics education in South Africa.

Design: This paper is based on the literature review on informetrics education in the field of LIS worldwide. The paper addresses the status of informetrics education; extent and levels at which informetrics education is offered; teaching methods for informetrics education; and, challenges associated with informetrics education.

Findings: The literature reveals that there are 32 countries that offer informetrics education within the field of LIS worldwide. The informetrics education is commonly offered to both undergraduate and post-graduate students. For undergraduates, it is generally offered as an elective course. Commonly, the course content consists of laws and theories, link analysis, resource allocation, methods and applications, innovation and forecasting. The lecture method (face-to-face) of teaching is commonly used. There is a variation of course names from department to department, such as Informetrics, Bibliometrics, Scientometrics, etc. Challenges associated with informetrics education were revealed, including: teaching capacity, student preparedness and ICT support. This paper noted the limitation of informetrics education locally and globally, and recommends more awareness creation, curricula development, short courses and awareness of global trends

Originality/Value: Theoretically, the paper will add to the body of literature within the field of LIS. It will offer a vivid characterization of informetrics and demonstrate the importance of its education. Practically, this paper provides a prolific centre of knowledge sharing among LIS departments concerning informetrics education. Through a good attention given to informetrics education, the research evaluation in various fields will attain utmost quality and objectivity.

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Keywords: Informetrics education, bibliometrics, informetrics, LIS education and training, South Africa

Paper Category: Literature review

1. Introduction

The purpose of this paper is to discuss informetrics education in LIS departments worldwide. It is acknowledged that research is the foundation for development and informetrics provides a strong tool for research evaluation and performance measurement. Scholarly communities that engage in research tend to do so with, among other intentions, a desire to contribute to development. The South African government (through the Department of Higher Education and Training), allocates funding to research that is undertaken to meet national development goals (Department of Higher Education and Training, 2015). Fiala (2013) admits that research-funding bodies increasingly give competitive advantages to researchers with noteworthy contributions to research collections. Given that research and researching are old traditions, it is normal that there would be growth of literature in most academic disciplines, and the growth is increasingly measured by metrics, such as informetrics. According to Zhao *et al.* (2016), informetrics studies were introduced to provide quantitative methods to study scientific literature in all aspects. This is often done to help comprehend the statistical dimensions of information processes and guide prospective research contributions to the relevant and appropriate direction. Informetrics makes it easier to identify research trends and growth of knowledge, predict productivity of researchers, and forecast past, present and future publishing trends (Shukla, 2015). Milojević and Leydesdorff (2013) remind that informetrics is rooted in Library and Information Science (LIS). As Kennan *et al.* (2014) acknowledge, “bibliometrics is a prominent research field in LIS”. Informetrics also plays a key role in research evaluation, performance measurement, tracing relationships among authors and scholarly entities, impact evaluation, and so forth.

As informetrics is in the mainstream of research evaluation and impact measurement, its teaching and learning therefore is a fundamental requirement. Such education, Kennan *et al.* (2014) recognise, provides students with the ability to acquire new skills, flexibility in times of a change, and a commitment to life-long learning. In the context of LIS schools/departments in South Africa, not much is known in terms of informetrics education. Thus, there is no notable analysis of informetrics education (e.g. who does what, to what degree, when, where, etc.), in South Africa. As evidence, Galyavieva and Elizarov (2017) do not include South Africa in the list of countries with universities offering informetrics courses. Several challenges that hinder informetrics growth worldwide, as well as locally, are identified. As a matter of concern, Kennan *et al.* (2014) note that the need for informetrics is extensive and resources, particularly people, are scarce. Wormell

(1998) and Ajiferuke (2011) reveal that many faculty members in LIS schools are not well versed in quantitative methods. Galyavieva (2013) also raises a concern about a lack of competence in the field of informetrics by the majority of scientists, research managers, and scientific policy makers. With reference to the growth of informetrics in Africa, there are challenges associated with unaffordable analytical tools, inadequate data collection resources, and a lack of appropriate skills by researchers (Ajiferuke, 2011; Hood and Wilson, 2003). These challenges have significant impact on the development of informetrics curriculum and the success of informetrics education. Luo (2017) supports this observation, noting that it is important to constantly examine and properly adjust informetrics education to meet the needs of future LIS practitioners.

2. Library and information Science education in South Africa

The Library and Information Science education in South Africa began in 1933 (Raju, 2003; Ocholla and Bothma, 2007). As per the recommendations made by the South African Institute for Librarianship and Information Science (SAILIS) in 1987 (Raju, 2009), the LIS education was offered at tertiary level (university and college level) to meet an international trend. Studies conducted over a decade ago in this regard seem to still be relevant today. For example, Ocholla and Bothma (2007) believe that having LIS education at Higher Education Institutions (HEIs) ensures that the curriculum development and quality control is adequately monitored and evaluated. LIS education operates within the South African Higher Education Qualifications Framework, which was signed into law in October 2007. Even though the LIS departments in SA do relate to some extent, there are notable differences between them. Majanja (2007) admits that there is no uniformity in the LIS education and how it is administered. She further explains that the varying levels of resources, such as lecturers, ICTs, library, etc., could largely influence this uniformity. Notably, there is a wide variation of official names among LIS departments within South African institutions caused largely by transformation in higher education in South Africa at the beginning of this century, that lead to mergers and amalgamation of qualifications.

The LIS education in SA is primarily broad and as noted by Luo (2017), such comprehensive scope of LIS enables its professionals to find employment in various LIS sectors. Ocholla and Bothma (2007), Ocholla and Shongwe (2012) and Luo (2017) admit that the LIS education earlier targeted training of librarians, but recently, its scope has expanded to accommodate multiple professions beyond librarianship. The LIS qualification programmes are commonly rooted in management,

research methodology, knowledge organisation, information seeking and retrieval, knowledge presentation and user-studies, with increased utilisation of ICT infrastructure (Ocholla and Bothma, 2007). The authors further elucidate that the LIS curricula also provides core courses or electives in knowledge management, records management, publishing, multimedia, ICT etc. Increasingly, the faculty where LIS qualification is located determines the focus of the qualification, either traditional or non-traditional focus, such as technology, knowledge management, social informatics, publishing, records management, multimedia. More technology tends to infuse the qualifications though.

The majority of LIS institutions in SA operate contact learning mode other than the distance learning that the University of South Africa (UNISA) offers. Ocholla and Bothma (2007) recognise two learning modes for librarianship in SA, the undergraduate mode and the postgraduate mode. The undergraduate mode dominates the postgraduate, and has three or four years' qualification programmes. However, some institutions like the University of Zululand (UNIZULU), University of South Africa, University of Limpopo (UL) and University of Western Cape (UWC) offer not only undergraduate programmes, but also postgraduate Diploma in Library and Information Science programmes (PGDLIS) (Hlongwane, 2014). We note that some of these qualification programmes are not currently active, suggesting that they may be shut down in future as students increasingly prefer masters qualifications offered with course work (e.g. at University of Cape Town and University of KwaZulu-Natal) than PGDLIS. Each undergraduate programme is made up of a variety of topics/themes from the broad field of LIS, with a number of compulsory and/or elective courses from other disciplines. In the postgraduate mode, students are expected to obtain any general degree to be admitted to a postgraduate diploma in library and information science or two-year masters qualification. Luo (2017) suggests that the diversified approach can be useful and widely adopted, as it is an attempt to continuously expand the parameters of the LIS field by making research methods more relevant within all LIS programmes. While informetrics education is important, there does not seem to be sufficient knowledge of such education in South African LIS Schools.

2.1. The LIS teaching and learning methods

In this paper, the teaching methods refer to the instructional processes and resources used for academic communication between an instructor and students that may be adopted for informetrics

education. The two commonly known modes of teaching/learning are contact or face-to-face and distance teaching/learning modes. The correctly chosen teaching/learning methods impact the quality of education being offered (Rajkoomar, 2015). It is commonly known that ICTs have transformed the pedagogic nature of higher education and training. According to Raju (2013) and Bitso and Raju (2015), this transformation is often associated with the integration of blended learning (combination of both online and face-to-face learning), the adoption of online e-learning through Web2.0/3.0 interactive technology, access to educational resources via the internet, synchronous and asynchronous communication, etc. Therefore, the ICT resources have a noteworthy position in LIS education. Majanja (2009) and, Le Roux and Evans (2011) suggest that academic staff need to take cognisance of and use a new variety of learning styles which are easily facilitated by ICTs.

Given that there are two modes of learning or instruction in higher education, the distance and a contact mode of learning, Ocholla and Bothma (2007) note that in universities, the mode of instruction for LIS education is mainly contact. The contact mode of instruction is that whereby an instructor and students interact in a face-to-face session within an academically conducive environment. The contact mode of instruction is also referred to as in-class delivery (Majanja, 2009) and is considered the most invaluable mode of teaching and learning based on efficiency and economic benefits. However, the distance teaching/learning has gained its space within the LIS education since the introduction of ICTs (Majanja, 2009). According to Majanja, the ICTs offer an advantage of synchronous, asynchronous or even hybrid distance LIS education.

Within the aforementioned two teaching/learning modes, there are methods for teaching which LIS instructors may adopt. Rajkoomar (2015) observes that determining an appropriate teaching method depends on a number of factors, such as: the nature of subject being taught (on the bases of theoretical versus practical, technical versus non-technical, etc.); the prior experiences of students; the instructor's or student's preferences and competences; the students' expectations of the pedagogic method to be employed; and, the student's maturity and study skills. Rajkoomar (2015) further provides the following applicable teaching/learning methods in the LIS education [that can be used for informetrics education]:

2.1.1. Lecture method

The lecture method fits into the in-class mode of teaching/learning. According to Rajkoomar (2015), the lecture method is still the most dominant method of teaching in higher education setting. Lockwood (2013) acknowledges that lecture method provides an economical and efficient way of delivering considerable amount of information to a large number of students at once. However, its disadvantages include that it facilitates one-way communication, positioning students in a passive role rather than an active role (Rajkoomar, 2015).

2.1.2. Group discussion

In a group discussion, students are actively participating on a topic within a classroom environment. Rajkoomar (2015) notes that group discussions are ideal for developing students' interpersonal and group skills. However, the group discussion requires a good facilitator, and in some instances, some students become inactive.

2.1.3. E-learning

E-learning is one of the modern methods which are influenced by the introduction and integration of ICTs in academic practices. The E-learning occurs through web-based technologies. Islam, *et al* (2011) observe that e-learning has proved to accelerate the LIS education process by increasing the accessibility to a wide range of information, supporting efficient knowledge sharing among students and increasing knowledge storing capacity significantly. Rajkoomar (2015) states that the Learning Management Systems (LMSs) are used primarily in e-learning applications. For example, the LIS department at the University of Zululand uses Moodle as an e-Learning Management System (Unizulu e-learning website: <http://elearn.uzulu.ac.za/>).

2.1.4. Distance education

The distance education has grounds within the framework of SA's LIS education. The distance education takes place by means of communication between an instructor and students located in different geographic places. The University of South Africa, UNISA, is an example of academic institutions that offer distance learning. Raju (2009) opines that the ICT-aided distance education has maximised the enrolment rate through its economic merits and effective communication arrangements through synchronous, asynchronous and hybrid distance education.

2.1.5. Blended learning

Dangwal (2017) describes blended learning as an innovative concept that covers the merits of both traditional and ICT supported learning, including both offline and online learning. According to

Dangwal (2017), the blended learning involves face-to-face learning, student interaction with the course content, peer group interaction, virtual classroom, accessing e-library and so on. From this point of view, one may deduce that blended learning is a very inclusive method of learning in higher education. Rajkoomar (2015) reveals that the majority of LIS educators in SA have access to ICTs (such as: data projectors, laptops, whiteboards and blackboards). However, there are still a number of LIS students who are reluctant to use technology for academic activities. Sarmah and Sen (2014) acknowledge the importance of blended learning in the provision of LIS education, in order to support the production of best information professionals in this blended world. The blended learning could be appropriate for informetrics education on the bases that informetrics require the availability of ICTs and face-to-face interaction between a student and an instructor.

2.2. Challenges faced by the LIS field

The field of LIS carries the mandate to produce information professionals that are up-to-date with the information dynamics in this digital world. Like any other field, there are a number of challenges which have been reported to surround the field of library and information science. The decline in student enrolment has been historically noted as one of the challenges. Ocholla and Bothma (2007) observe a decline in the number of students enrolling for library science in most LIS schools in Africa. According to Ocholla and Bothma, this decline is as a result of limited job opportunities in librarianship, which is motivated by a minimal number of libraries in Africa.

The educational success relies on the availability of libraries and schools that are well equipped and funded. The shortage of funding for libraries, which are in collaboration with the LIS academic institutions, poses a challenge to the success of LIS education. Kumbhar (2018) recognises that many libraries do not receive adequate funding for infrastructure, training, resources, collection etc., and as a result, they do not have the capacity to improve and provide IT supported services.

It remains a fact that the LIS field has to keep up with the rapidly evolving technological development in the information sector. Even the employment market requires that the LIS curriculum reflects current trends and technologies which meet the 21st century information environment (Ocholla and Bothma, 2007). Meanwhile, the shortage of adequate ICT infrastructure is also noted as one of the historical challenges affecting the field of LIS (Ocholla and Bothma, 2007). In the South African context, where the country's population is mostly rural based, the access to electronic information resources is still problematic, extending to the shortage of

educational facilities. The LIS field therefore is challenged to invest so much on ICTs in order to keep up with national and international trends.

In this digital world, the field of LIS prepares a growing range of careers from a broader scope of information science. Notably, the scarcity of career opportunities for LIS professionals has compelled the LIS academic bodies to align their curricula with the job requirements of the LIS industries. In this sense, career opportunities give a very unstable direction for the LIS curriculum development.

There are still challenges faced by the LIS field. These recent challenges are mainly along the contest to make LIS education conform to the dynamics of information in the 21st century. As Bitso and Raju (2015) mention, internet access difficulties, variations in students' digital literacy and meeting the learning needs of a diverse cohort of students are still considered existing challenges of LIS. One may also observe that liaising with the LIS community of practice towards developing an LIS curriculum that fulfils the professional requirements is a challenge, particularly in a society where LIS education has no uniformity from institution to institution.

3. Theory

A theory is a helpful tool to interpret reality. For this reason and others, it is necessary to evaluate and discuss the model relevant to informetrics education in LIS departments. The interconnection between the Heutagogical Teaching and Learning Theory (HTLT) and the Curriculum Development Model (CDM) situates a solid foundation for this discussion, and they will be discussed, followed by unpacking the concept of informetrics.

3.1. The Heutagogical Teaching and Learning Theory

The term, heutagogy was coined by Stewart Hase of the Southern Cross University (Parslow, 2010). According to Kenyon and Hase (2001), the heutagogy is the study of self-determined learning. The heutagogical teaching and learning theory was developed as result of failure of traditional self-directed learning theories (pedagogy – for example, in primary and secondary education, and andragogy – for example, in higher education) to meet the educational demands of the 21st century (Kenyon and Hase, 2001; Bitso and Raju, 2015). The HTLT therefore fits into the teaching and learning methods that involve ICTs. It is in this regard the HTLT was used in this

paper to determine the methods (including resources) used in the delivery of informetrics education.

Furthermore, given that learning is increasingly aligned with daily activities (Kenyon and Hase, 2001), the heutagogical teaching and learning theory is largely student-centred. The rationale of the heutagogical teaching and learning theory is underlined by the fact that students are major participants in their own learning. Bitso and Raju (2015) support that the heutagogical teaching and learning theory is well suitable in the digital information environment; since it focuses on self-directed or self-determined learning. Like any other research activity, an informetrics study puts more responsibility on the students than the lecturer. According to Blaschke (2012), more matured students require lesser instructional control and can be more self-directed in their learning. In the situation that informetrics requires research understanding, ICT literacy and less instructional control, this paper sought to determine levels at which the informetrics course is offered. We observe that students who have newly enrolled into universities are incompetent with ICTs and research. The HTLT guides the evaluation on whether the informetrics course is offered at a level that meets the students' ICT and research competency. However, the HTLT does not give entire responsibility to the student, but the instructor has a role to play, such as facilitating the learning process by providing guidance and learning resources (Blaschke, 2012).

In the heutagogical teaching and learning theory, an instructor facilitates a desire to investigate own learning. Likewise, an informetrics instructor has limited contributions to a student's informetrics study, because every student has a unique informetrics focus. In addition, an informetrics student has to go beyond instructor's guidance when conducting informetrics. It is worth noting that the study of Bitso and Raju (2015) has a close link with the current study, based on the fact that they are both contextualised within the field of LIS education in South Africa, with focus on the delivery of education in digital world. The Heutagogical Teaching and Learning Theory (HTLT) was used by Bitso and Raju (2015), as they analysed how LIS education in South Africa has responded to the dynamic information landscape.

3.2. The Curriculum Development Model

This paper further adopted the Curriculum Development Model (CDM) that was developed by Peter Wolf in 2007. The model was developed at the University of Guelph, with the aim of supporting individual educators to improve their often isolated courses through, for example,

access to higher education literature, informed pedagogic practices and course design process. The Wolf's (2007) curriculum development model asserts that a curriculum develops on a continuous basis, the opposite to episodic attempts of curriculum renewal. The three phases of the CDM have a close link to the themes of this paper. These phases are: curriculum visioning, curriculum development and alignment, coordination and development (Wolf, 2007).

3.3. The cooperation between HTLT and CDM

One may note that the HTLT largely focuses on the responsibilities of students and lecturers in the delivery of education in the 21st century. On the other hand, the curriculum development model concentrates on the course design that responds to information needs in the modern society. Clearly, both HTLT and CDM concur that the academic course has to meet the teaching and learning trends in the 21st century. This paper considers the influence that ICT developments may have on informetrics education. A further link can be traced from the illustration of the developmental model of bibliometrics, which depicts that the development of bibliometrics rely much on the evolution of ICTs (Davis *et al.*, 2005). The aim of this paper would be achieved sufficiently from the analysis of levels, resources and methods used for existing informetrics education. It is this link that communicates the themes of this paper, with its theoretical foundation.

4. Informetrics

The concept informetrics is defined variably. Davis, Wilson and Horn (2005) define informetrics as an umbrella term for all metric studies in information science such as bibliometrics, webometrics, cybermetrics, and scientometrics. Björneborn and Ingwersen (2004), defines informetrics as the study of quantitative aspects of the construction and use of information and information resources, while Egghe (1994) describes informetrics as all kinds of statistical or mathematical aspects of information. The term bibliometrics is incautiously used interchangeable with informetrics. Bibliometrics is a branch of informetrics that studies the quantitative aspects of production, dissemination and utilisation of documented or recorded information (McKiernan, 2005). Deducing from these view points, there is consensus that the terms “quantitative” and “information” are pillars for defining informetrics.

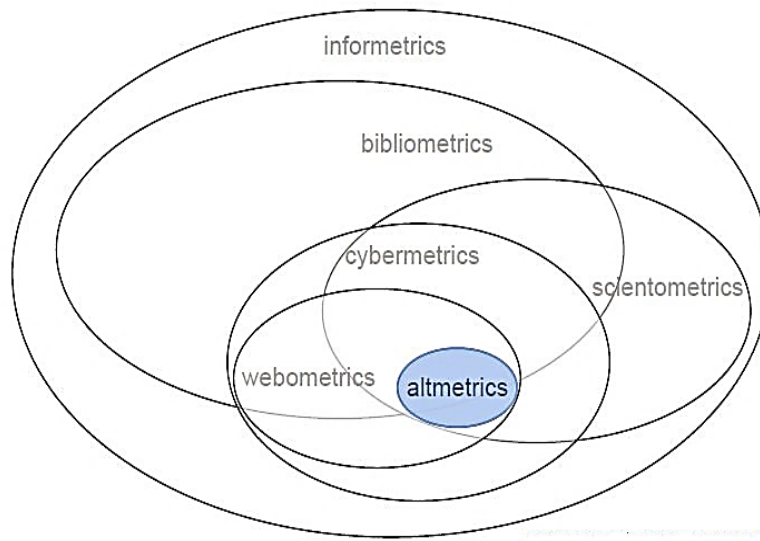


Figure 1: The relationship between the metrics terms (Haustein, 2016)

All metric studies in the field of information science fall within the scope of informetrics. Scientometrics is the study of all aspects of the literature of science and technology (Hood and Wilson, 2001). Cybermetrics is that branch of informetrics which uses mathematical and statistical methods to quantify internet and its components and concepts (Sen, 2004). Webometrics concerns with a variety of studies of quantitative aspect of link structures, page content, search engine performance, and users' of information behaviour on the Web (Björneborn, 2004). Lastly, altmetrics is aimed at capturing the “impact” through social media. For example, counting the number of followers, likes, downloads, tweets, or readers of an article on a reference manager (Haustein, 2016). This study put focus on informetrics education that includes all or any of the mentioned aspects of informetrics.

The subject affiliation of informetrics has been controversial. Bar-Ilan (2008) and Wormell (1998) locate informetrics between information science and computer science, based on its association with information retrieval (IR), using well-established information and communication technologies (ICTs). There is often confusion between IR and informetrics, given that informetrics strongly links to the theoretical and methodological aspects of IR (Mayr and Scharnhorst, 2015). Mayr and Scharnhorst (2015) distinguish IR from informetrics in terms of the audiences they serve, the goals, the scale and nature of collection, and their educational paths. Informetrics is not limited to the field of LIS. Wolfram (2003) reveals that informetrics studies have been undertaken by

scholars from various disciplines including LIS, computer science, sociology, communications and linguistics. For Zhao *et al.* (2016), informetrics is relevant to social science, computer science, philology, and other disciplines. Therefore, informetrics is multidisciplinary.

It is clear that the field of informetrics existed long before the term “informetrics” was introduced. According to Rajan and Sen (1986) and Egghe (2005), the field of informetrics (not the term) started way back in 1896, by a notion scattering of information which was an idea by F. Campbell. However, Campbell did not coin any term until S. C. Bradford introduced the law of scattering, which became popular in 1900 (Bhavnani and Wilson, 2010). Galyavieva (2013) agrees that the empirical foundations of informetrics were laid in the first half of the 20th century by scientists, among who are: A. Lotka, G. Zipf, and S. Bradford. Historically, the informetrics field existed as bibliometrics, which Tague-Sutcliffe (1992) and Papic (2017) define as the study of the quantitative aspect of information processes (creation, dissemination, and use of recorded information). The term informetrics was introduced by Blackert and Siegel in 1979, but it gained popularity in the international informetrics conference in 1987 (Egghe, 2005). The study of science about science, scientific communication and science policy (scientometrics) became popular from the year 1978, with the establishment of the journal named *Scientometrics* by Tibor Braun (Papic, 2017). The scientometrics was therefore a new branch of bibliometrics at that time.

The International Society for Scientometrics and Informetrics (ISSI) played a significant role in the development of informetrics worldwide. It advanced the area from “invisible college” to independent scientific discipline, as the regular international conferences on scientometrics and informetrics were conducted (Galyavieva, 2013). The ISSI was founded in 1993 at the international conference on bibliometrics, informetrics and scientometrics in 1993, after the series of bibliometrics conferences, where the first one was organised by Leo Egghe and Ronald Rousseau in 1987 (International Society for Scientometrics and Informetrics website, 2018). “The society aims to encourage communication and exchange of professional information in the field of scientometrics and informetrics; to improve standards, theory, and practice; to stimulate research, education, and training; and to engage in relevant public conversation and policy discussions”.

The Institute for Scientific Information (ISI) also offered a notable contribution into the development and application of bibliometrics in the first half of the 20th century. Wormell (1998)

notes that in the 1960s, bibliometrics were applied using the Science Citation Index (SCI) and Social Science Citation Index (SSCI). According to Jacobs (2010), Eugen Garfield established the Institute for Scientific Information, envisioned to quantitatively analyse scientific research outputs using the SCI. As stated in Garfield (1980), the citation index does not only serve as a bibliographic search tool, but also as an application to the patent literature and it is useful as a tool for the following: the study and management of science; measuring the usefulness of journals and the relationship between them and the field; analysing the structure of science; and measuring the performance of scientists.

The emergence and development of internet (including its constituents such as Web, online pages, applications and hyperlinks) influenced the continuous introduction of new technologies and methods for use in the communication of scientific information, information retrieval and librarianship (Glänzel, 2014). Such progress has triggered noteworthy transitions across information processes and practices in the 21st century. Likewise, the framework of informetrics has undergone significance improvements from its traditional methods to modern methods. Björneborn and Ingwersen introduced the term “webometrics”, with a purpose that underpins the utilisation of informetrics methods to analyse the Word Wide Web (www) (Papic, 2017). As a result, Ingwersen (2012) introduces two models of scientific communication, mentioning the pre-internet and internet-based model. According to Ingwersen (2012), pre-internet model is concerned with communication of scientific information in the world without internet related technologies. On the other hand, the internet-based model involves internet related technologies for the communication of scientific information.

As the number of disciplines and researchers emerged over time, the scope of informetrics has broadened. Davis *et al.* (2005) agree that informetrics nowadays is used as a generic term for all quantifiable aspects of information science (bibliometrics, scientometrics, cybermetrics, webometrics, altmetrics, etc.) as well as aspects of related fields. The modern informetrics methods are compatible with the information dynamics of the 21st century. Nowadays, informetrics pays attention to university level metrics, journal level metrics, article level metrics, author level metrics etc. with the purpose of developing rankings and evaluating them (Papic, 2017).

4.1. Application of informetrics

The growth of literature in various disciplines and its complexities necessitate the adoption of statistical methods across multiple fields. Basically, informetrics studies are commonly used to inform policies and decisions in economic, political, technological and social spheres affecting information flow and the pattern of use; outside, between and within the institutions and countries (Maluleka and Onyancha, 2016). Informetrics can be adopted to fulfil a wide range of purposes. Asernova (2013) opines that library technologies can be designed on the basis of bibliometrics analysis. The Authors (Davis *et al.*, 2005; Jacobs, 2010; Glänzel, 2014) mention other primary purposes such as:

- Tracing relationships amongst academic journals and authors (including authorship patterns),
- Evaluating studies for training programmes or research funding,
- Studying researchers' publishing behaviour,
- Developing, stacking and weeding policies,
- Evaluating the impact of scholarly contributions,
- Determining the past and present, and forecasting future publishing trends,
- Studying the obsolescence and dispersing scientific literature,
- Locating literature of specific fields, and
- Other purposes.

4.2. Informetrics in SA

South Africa is recognised to have made some notable contributions to the field of informetrics. The informetrics productivity in SA can be traced back to the second half of the 20th century. The first scientometrics studies were undertaken in 1987 to meet the needs of the National Research Foundation (NRF). At that time, NRF was the Foundation for Research Development (FRD) (Pouris, 2012). According to Pouris, the country was ranked the 21st in the world in year 2001 among countries publishing in the journal of scientometrics and SA was the only African country in this standing. Notably, South Africa won the bid to host International Society for Scientometrics and Informetrics (ISSI) conference in 2011 (Ocholla, 2007) in Durban. Again, the Web of Science (WOS) database has indexed up to four per cent (4%) of South African informetrics literature (Web of Science website, 2018). When comparing the continents of the world, African continent

was ranked last in terms of informetrics productivity between the years 1987 and 2007, and South Africa was leading all other African countries between the years 1960 and 2010 (Ajiferuke, 2011). Therefore, SA could be the leading African country in informetrics productivity.

4.3. The informetrics and LIS education

The issues touching informetrics have been controversial for many years within the framework of LIS education (Galyavieva, 2017). Along typical debates, the focus has been on how informetrics and LIS fit together, given that the library and information science education is bound to produce graduates who are able to effectively mediate this dynamic information society (Bitso and Raju, 2015). Such dynamics are often transformed by rapid evolvement of information and communication technologies, influencing the development of more sophisticated measures and protocols for scholarly communication. Informetrics presents the methods for quantifying scholarly communication across a variety of scholarly disciplines (Galyavieva, 2017). Based on this connection, the informetrics and LIS education settle on a fruitful interplay.

Various authors support that informetrics and LIS education are two sides of the same coin. Galyavieva (2017) proves that even though courses on informetrics are interdisciplinary in nature, the major interest in informetrics appears in academic qualifications within the fields of knowledge, such as: medical information science, archival studies and document studies. Raju (2017) recognises the fact that the LIS education has a responsibility to provide research support, which involves bibliometrics, to ascertain research impact of published scholarly outputs, research rating of publications, performance reviews, etc. Davis *et al.* (2005) agree that informetrics brings substantial solutions to major challenges affecting the field of library and information science, particularly in the evaluation of journals and journal collection planning and management. Davis *et al.* (2005) further add that modern informetrics methods offer solutions to issues relating to the creation and management of libraries' digital collection and selection of necessary material to meet user needs. Clearly, the importance of informetrics in library services and other research bodies justifies the importance of informetrics education within the LIS curriculum. Rajkoomar (2015) recommends that, since libraries are now computer oriented, it is important that LIS education introduces more courses dealing with information systems and electronic management. Therefore, every LIS curriculum has to include informetrics education within its research components. The

current paper contributes to existing literature on the strength of informetrics education within LIS departments.

5. An overview of informetrics education

Even though there are still many countries which do not offer informetrics education, it is internationally recognised. Informetrics education is provided at institutions of higher education, commonly in the field of LIS. Galyavieva and Elizarov (2017) discovered up to 32 countries that offer informetrics education within the field of LIS worldwide. However, one may note that some countries (like South Africa) were not mentioned in Galyavieva and Elizarov (2017); whereas we can witness that it is offered (University of Zululand in South Africa). As this paper further discusses the status of informetrics education in LIS departments. It will demonstrate the level of awareness and presence of informetrics education across the country. Various scholars who are aware of informetrics do recognise the importance of its education, which will be discussed below.

5.1. Importance of informetrics education

Informetrics has gained growing importance in science policy and management, and plays a very prominent role in the domain of research evaluation (Jacobs, 2010). It is of great importance that the development of bibliometrics is continuously maintained and evaluated. The development and benefits of informetrics would not be attained without having proper, well established and maintained informetrics education. Informetrics education provides deeper understanding about information user communities and the boundaries of specific fields (Davis *et al.*, 2005). Since science and technology can be regarded as a part of the national innovation system, it has become more important to monitor their development using informetrics methods. Informetrics serves research monitoring and evaluation purpose in an objective way. In this sense, all scholarly communities which engage in research are accommodated to enjoy the benefits of informetrics education. Informetrics caters for almost all scientific fields (Galyavieva, 2013). Sun *et al.* (2016) further acknowledge that bibliometrics help demonstrate the impact of someone's research to support grant decision. In addition, researchers from a variety of backgrounds have to come to acquire and use bibliometrics methods in order to identify where the literature of their field is located (Davis *et al.*, 2005).

The importance of informetrics education extends to both practical and theoretical perspectives within formal and informal communications. As Davis *et al.* (2005) articulate, the examination of formal communication channels among scientific communities provides a prolific insight on what is read and used, and user or reader preferences. The information workers such as librarians would definitely find typical advantages through the adoption of informetrics methods. Davis *et al.* (2005) further note that informetrics provide a picture of where the boundaries of a specific field intersect with other fields or disciplines.

Since there is evidence that some institutional libraries offer informetrics education in a form of workshops and seminars (Kennan *et al.* (2014), the informetrics education within the LIS curriculum simplifies the roles of librarians. According to Sun *et al.* (2016), “To carry out research evaluation properly, it no doubt needs more education and training courses on informetrics”. Davis *et al.* (2005) and Kennan *et al.* (2014) opine that informetrics education has to be offered as research course components to students taking information-related degree programmes.

5.2. The status of informetrics education world-wide

In Japan, the education in informetrics is integrated into LIS education (Sun *et al.*, 2016). Sun *et al.* analysed the LIS courses to picture the provision of informetrics education in Germany. This validates an idea that informetrics is globally offered exclusively at higher institutions of education, because the LIS education is also offered within institutions of higher education (Ocholla and Bothma, 2007). There is evidence that some academic libraries do offer informetrics education in the form of seminars, in-training programs and workshops (Kennan *et al.* 2014). Kennan *et al.* further note that most library staff members’ cross-national who provide bibliometrics training gained it on the job, or through in-house and self-training. In China, informetrics, as a course, is offered to both undergraduate and postgraduate students (Zhao *et al.*, 2016). It is worth noting that informetrics education is limited in most countries of the world: for instance, Japan is ranked number two (Unirank, 2017) of the top forty education systems in the world, but only one institution (Tsukuba University) is found to have full time informetrics course (Sun *et al.*, 2016). Germany is number twelve in the ranking list, but only five (5) institutions offer informetrics course in a total number of one-hundred and six (106) institutions (Sun *et al.*, 2016).

In China, twenty (20) universities were found to officially offer a bibliometrics course to both undergraduates and graduates students majoring in Information Science and Library Science in

1995 (Zhao *et al.*, 2016). In Australia, there was no university offering an informetrics course in 2005 (Davis *et al.*, 2005). Sun *et al.* (2016) opine that these scarcities are associated with the fact that: some universities have an informetrics course only if there are students who are in demand for the course; most courses are taught by adjunct instructors or part-time lecturers; or if universities have professors who majored in informetrics. Davis *et al.* (2005) reveal that an informetrics course was once introduced in one Australian university, but then dropped in subsequent years due to insufficient enrolment to justify its continuity. However, there are seminars organised to equip students with informetrics methods in the University of New South Wales. Notably, informetrics has not developed yet in the African continent. In Africa, Galyavieva (2017) recognises the Democratic Republic of Congo (ranked number 14), the Kingdom of Morocco (ranked number 15), and Uganda (ranked number 30) as the only African countries with informetrics education in a world scale.

5.3. A typical content of informetrics educational programmes

Just like any other educational programmes, an informetrics course has to set course objectives. For example: at the Wuhan University (in China), the general objectives of an informetrics course are to enable students to grasp the preliminary theoretical system, and to master manifold quantitative analysis methods and tools (Zhao *et al.*, 2016). As seen above in the broad scope of informetrics, the course providers might face challenges when organising its framework for an educational purpose. Such challenges could possibly include wider scope of informetrics teaching within limited timeframes. The University of Zululand (in South Africa) offers informetrics education, for a semester, as a compulsory module to Information Science (IS) undergraduate students at level three of the Information Science degree (University of Zululand, 2017). Informetrics is also offered to fourth year students as unit for two to four weeks in the four year Bachelor of Library and Information Science programme/qualification. Informetrics education offered in the mentioned university encompasses the bibliometrics concepts, the historical development of bibliometrics/informetrics, and the bibliometrics/informetrics theories, models and laws, methods, citation and impact factor analysis, case studies/application. The graduate' course content for bibliometrics offered by the University of Tsukuba (in Japan) involves: citation analysis, network analysis, indicators, statistical analysis, and applications (Sun *et al.*, 2016). The informetrics course content offered by the Wuhan University (in China) to undergraduate students

encompasses the informetrics concepts, laws, methods, and practical application (Zhao *et al.*, 2016).

5.4. Challenges affecting informetrics education

The challenges that surround informetrics would eventually affect its education. There are numerous challenges reported to cause a decline in informetrics education worldwide. These challenges are: lack of appropriate skills by researchers (Ajiferuke, 2011; Wormell, 1998), unaffordable analytical tools, and inadequate data collection tools (Ajiferuke, 2011; Wormell, 1998). It is also noted that LIS professionals generally show little interests in the incorporation of quantitative analysis for their services (Wormell, 1998). Some more shortcomings that hamper the development of informetrics as noted by Wormell (1998) include: informetrics subfields drifting apart and a lack of consensus among informetrics specialists. Kennan *et al.* (2014) emphasised that “the need for informetrics is extensive, resources are limited, particularly people” in higher education. The shortage of people who are competent in statistical research methods poses a great challenge to the success of informetrics education.

6. Conclusion

The Heutagogical Teaching and Learning Theory (HTLT) and the Curriculum Development Model (CDM) moulded a solid theoretical foundation of this paper. It is clear that the scope of informetrics is very broad, covering: informetrics concepts (i.e. metrics in LIS), mapping of science (i.e. informetrics laws), dimensions of informetrics, and informetrics indicators. The informetrics studies can be approached from social, documentary and/or epistemic dimension(s). In the global scale, there are up to 32 recognisable countries with informetrics education, offered in the field of LIS. China is leading other countries in informetrics education in the world scale, having up to 26 informetrics courses. The Democratic Republic of Congo and Uganda are the only recognisable African countries with informetrics education. The paucity of informetrics education in Africa and around the globe has been vividly highlighted in literature. However, there is evidence that some countries like South Africa (University of Zululand) do offer informetrics, but they are not picked up by the literature reviewed. The informetrics course is commonly offered at both undergraduate and postgraduate levels. Some informetrics trainings are provided by academic libraries rather than academic departments. The teaching methods in the framework of LIS education are commonly blended method of learning. The lack of uniformity in the contents of

informetrics across all LIS departments was noted. Challenges surrounding informetrics education are associated with teaching capacity, students' preparedness and ICT support. There is inattention surrounding informetrics education worldwide, and the paper recommends more awareness creation, curricula development, short courses and awareness of global trends.

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