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

By

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Supervisor:

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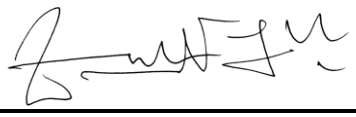
# DECLARATION

I declare that *Informetrics Education in Library and Information Science (LIS) Departments in South Africa* is my own work, and it has not been submitted before for any other degree or assessment at any other university. The sources used or quoted from have been duly acknowledged by means of references.

Nkosingiphile Mbusozayo Zungu



Date: 16 April 2019

Supervisor:

Date: 16th April 2019

Prof. DN. Ocholla

# DEDICATION

I would like to dedicate this work to GOD (The Creator), and my family (oSengwayo)

# ACKNOWLEDGEMENTS

I could not have compiled this work without the support from many people.

My immense gratitude goes to my dedicated supervisor, Prof. DN Ocholla for his valuable time, support and encouragement. I really appreciate all you do.

My appreciations to Dr N. Evans and the entire staff of the Department of Information Studies at University of Zululand; you have given me warmth and a second home.

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To my friends, thanks for your support, nganzakwethu

It would have been impossible for me to compile this work without the presence of the following supportive LIS departments and their respective HODs:

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University of Zululand

My thankfulness extends to all the unmentioned who keep me academically motivated, and smiling. ☺

# ABSTRACT

This research sought to explore informetrics education in Library and Information Science (LIS) departments in South Africa. This study adopted the pragmatic epistemology and pluralistic ontology. The abductive approach was considered appropriate for this study. The employed mixed research methods were survey and content analysis. The survey research methods, through questionnaire, were used to collect data from the LIS heads of departments (HODs) and informetrics lecturers. On the other hand, the content analysis was employed to analyse the content of course outlines. The study's population was all LIS departments in South Africa. Nine LIS departments were targeted and responses were received from eight LIS departments. Five of the eight departments were found to offer informetrics education. These were the LIS departments from the University of Cape Town, University of Kwa-Zulu Natal, University of Limpopo, University of Western Cape, and the University of Zululand. The LIS department at the University of Zululand is the only department that offers informetrics education as autonomous module/course in the full programme. Other LIS departments offer it as a chapter/Unit in a module. Three LIS departments (University of Cape Town, University of Limpopo, and University of Western Cape) offer informetrics as module component at a Masters level. The LIS department at the University of Zululand offers informetrics education to level three and four undergraduate students in two programmes- BLIS and BIS. The University of Limpopo also offers it at an undergraduate level (level two, three and honours). The content analysis revealed that the scope of informetrics is broad in the essence that there is no uniformity in the content of informetrics across all LIS departments. The blended learning method is widely used: cased studies, group discussions, and online teaching and learning methods are commonly used for informetrics education. Numerous challenges that surround informetrics education were pointed out. Most of them are linked to the consideration that informetrics is broad, ICT reliant and dynamic. The solutions to the challenges were suggested. The study concluded that there is very limited informetrics education in South Africa. The study recommended that LIS departments create awareness about informetrics education, develop informetrics curricula, provide short courses on informetrics, and keep up with the trends in LIS education internationally.

**Table of Contents**

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF ABBREVIATIONS

AIF : Author Impact Factor

BIS : Bachelor of Information Science

BLIS : Bachelor of Library and Information Science

CDM : Curriculum Development Model

DHET : Department of Higher Education and Training

HEI : Higher Education Institution

HOD : Head of Department

HTLT : Heutagogical Teaching and Learning Theory

ICT : Information and Communication Technology

IF : Impact Factor

IR : Information Retrieval

IS : Information Science

ISI : Institute for Scientific Information

ISSI : International Society for Scientometrics and Informetrics

JIF : Journal Impact Factor

LIS : Library and Information Science

LMS : Learning Management System

SA : South Africa

SAILIS : South African Institute for Librarianship and Information Science

SCI : Science Citation Index

SSCI : Social Science Citation Index

SWOT : Strengths Weaknesses Opportunities Threats

UCT : University of Cape Town

UKZN : University of KwaZulu Natal

UL : University of Limpopo

UNISA : University of South Africa

UNIZULU : University of Zululand

UP : University of Pretoria

UWC : University of Western Cape

UZREC : University of Zululand Research Ethics Committee

WIF : Web Impact Factor

WoS : Web of Science

WSU : Walter Sisulu University

# CHAPTER 1: INTRODUCTION AND BACKGROUND

## 1.1. Introduction

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: 4). On the other hand, Fiala (2013: 1) also recognises that research-funding bodies increasingly give competitive advantages to researchers with noteworthy contributions to research collections. These contributions are both in terms of quality and quantity. Given that research and researching are old traditions, it is accepted that there has been growth of literature in most academic disciplines. With such growth, a need arises to understand complexities with regard to authorship, publishing, readership, and so on, of various scholarly disciplines. Applying quantitative measures and processes of scientific information to examine research trends is commonly known as informetrics. According to Zhao, Guo and Fu (2016: 540) 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 directions. 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: 8). Milojević and Leydesdorff (2012: 1) claim that informetrics is rooted in Library and Information Science (LIS). As Kennan, Corrall and Afzal (2014: 670) state, "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, its teaching and learning therefore is a fundamental requirement. Such education, Kennan, Corrall and Afzal, (2014: 670) 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. 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: 298) do not include South Africa in the list of countries with informetrics courses at universities around the world. Several challenges that hinder informetrics growth worldwide as well as locally are identified. As a matter of concern, Kennan, Corrall, and Afzal (2014: 673) note that the need for informetrics is extensive and resources, particularly people, are scarce. Wormell (1998: 259) and Ajiferuke (2011: 182) state that many faculty members in LIS schools are not well versed in quantitative methods. Galyavieva (2013: 89) 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: 183; Hood and Wilson, 2003: 593). These challenges have a significant impact on the development of informetrics curriculum and the success of informetrics education. Luo (2017: 49) supports this observation, noting that it is of paramount importance to constantly examine and properly adjust the informetrics education to meet the needs of future LIS practitioners. The purpose of this study, therefore, was to explore informetrics education in LIS departments within South Africa (SA).

### 1.1.1. The background to Informetrics

Various researchers conclude that informetrics is the study of quantitative aspects of information in any form, not just records or bibliographies, and in any social group, not just scientists (Tague-Sutcliffe, 1992: 1; Jacobs, 2010: 6; Rousseau, 2012: 21; Milojević and Leydesdorff, 2013: 2; Bar-Ilan, 2008: 1; Galvan and Galvan, 2017: 12). There are other alternative viewpoints to defining informetrics. For example, Davis, Wilson and Horn (2005: 196) define informetrics as an umbrella term for all metric studies in information science such as bibliometrics, webometrics, cybermetrics, scientometrics, and altmetrics. Bjornebon and Ingwersen (2004: 1217), Jacobs (2010: 6) and Schaer (2013: 274) define informetrics as the study of quantitative aspects of the construction and use of information and information resources. Egghe (1994: 35) describes informetrics as all kinds of statistical or mathematical aspects of information. Furthermore, Stock, and Weber (2006: 385) perceive informetrics to be the quantitative study of collections of moderate sized units of potentially informative text, directed at the scholarly

understanding of information processes at the social level. Deducing from these points of views, there is consensus that the terms "quantitative" and "information" are pillars when conceptualising informetrics.

The subject affiliation of informetrics has been controversial. Bar-Ilan (2008: 34) and Wormell (1998: 257) position informetrics between information science and computer science, based on its association with information retrieval (IR) using well-established information and communication technologies (ICTs). Again, 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: 3). Mayr and Scharnhorst (2015: 4) then demystify the noted confusion between IR and 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. As a matter of fact, Wolfram (2003: 40) reveals that informetrics studies have been undertaken by scholars from various disciplines including LIS, computer science, sociology, communications and linguistics. For Zhao, Guo and Fu (2016: 540), informetrics is relevant to social science, computer science, philology, and other disciplines.

### 1.1.1.1. The origins and development of informetrics

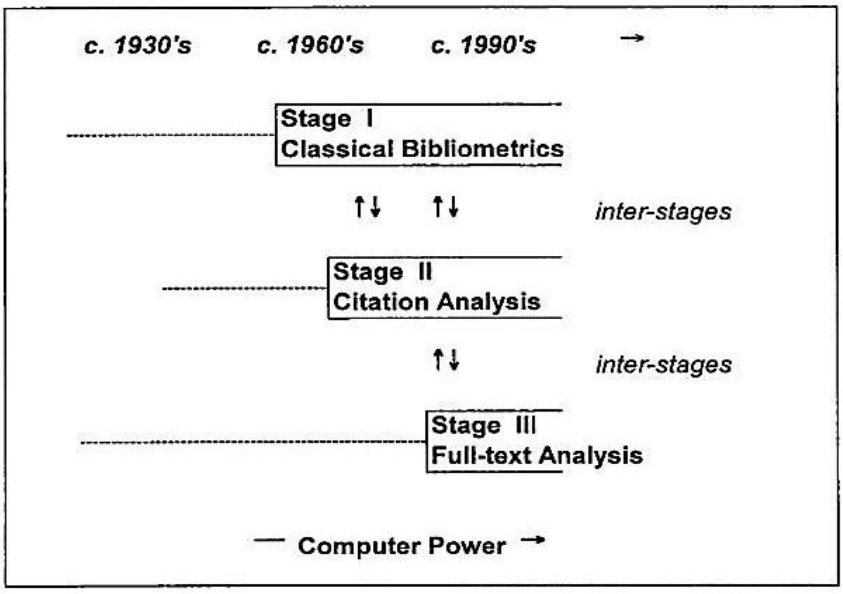


*Figure 1: Summary of Developmental Model of Bibliometrics (Davis, Wilson and Horn, 2005: 206)*

The figure above clearly demonstrates that the development of bibliometrics has been highly dependent on the development in ICTs, which is reliant on the growth in computer power. According to the graph, before the 1930s, citation analysis and full-text analysis were not introduced. In the 1960s, bibliometrics could not serve the full-text analysis. However, citation and classical bibliometrics were applied.

It is clear that the field of informetrics existed long before the term "informetrics" was introduced. According to Rajan and Sen (1986: 1) and Egghe (2005: 1312), 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: 1). Galyavieva (2013: 89) agrees that the empirical foundations of informetrics were laid in the first half of the 20$^{th}$ century by scientists, among who are: A. Lotka, G. Zipf, and S. Bradford. Historically, the informetrics field existed as bibliometrics, which Tague-Sutcliffe (1992: 1) and Papic (2017: 700) 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: 1312). 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: 700). 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: 89). 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: 261) and Jacobs (2010:2) note that in the 1960s, bibliometrics were applied using the Science Citation Index (SCI) and Social Science Citation Index (SSCI). According to Jacobs (2010: 2), Eugen Garfield established the Institute for Scientific Information, envisioned to quantitatively analyse scientific research outputs using the SCI. As stated in Garfield (1980: 172), 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: 230). Such progress has triggered noteworthy transitions across information processes and practices in the 21th century. Likewise, the framework of informetrics has undergone significance improvements from its traditional methods to modern methods. Bjorneborn 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: 700). As a result, Ingwersen (2012: 14) introduces two model of scientific communication, mentioning the pre-internet and internet-based model. According to Ingwersen (2012: 14), 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 has emerged over time, the scope of informetrics has broadened. Davis, Wilson, and Horn (2005: 196) 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: 700).

### 1.1.1.2. 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 use of pattern; outside, between and within the institutions and countries (Maluleka and Onyancha, 2016: 42). Informetrics can be adopted to fulfil a wide range of purposes. Asernova (2013: 681) opines that library technologies can be designed on the basis of bibliometric analysis. The Authors (Davis, Wilson and Horn, 2005: 209; Jacobs, 2010: 4; Glänzel, 2014: 230; Raju, 2017: 12) 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 presence; and forecast future publishing trends,
- Studying the obsolescence and dispersing scientific literature,
- Locating literature of specific fields, and
- Other purposes.

## 1.1.2. The contextual background on LIS education in SA

The Library and Information Science education in South Africa began in 1933 (Raju, 2003: 74). As per the recommendations made by the South African Institute for Librarianship and Information Science (SAILIS) in 1987 (Raju, 2005: 78), the LIS education was offered at tertiary level (university and college level) to meet an international trend. Ocholla and Bothma (2007: 56) believe that having LIS education at Higher Education Institutions (HEIs) ensures that the curriculum development and quality control is adequately monitored and evaluated. According to Majanja (2009: 3), the current 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: 4) states that there is no uniformity in the LIS education and how it is administered.

Majanja (2007: 4) further attest 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. Raju (2003: 75) provides examples of such names as: Department of Library and Information Science, School of Librarianship, Department of Information Science, and Department of Information Studies, etc.

The LIS education in SA is primarily broad.. According to Luo (2017: 49), such comprehensive scope of LIS enables its professionals to find employment in various LIS sectors. Ocholla and Bothma (2007: 56), Ocholla and Shongwe (2012: 2) and Luo (2017: 49) admit that the LIS education earlier targeted training of librarians, but recently, the LIS 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: 56). The authors further elucidate that the LIS curricula also provides core courses or electives in knowledge management, records management, publishing, multimedia, etc.

The majority of LIS institutions in SA operate contact learning mode other than the distance learning that the University of South Africa (UNISA) does. Ocholla and Bothma (2007: 56) 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 University of Zululand (UNIZULU) University of South Africa, University of Limpopo (UL), Walter Sisulu University (WSU), and University of Western Cape (UWC) offer both undergraduate and postgraduate Diploma LIS programmes (Hlongwane, 2014: 9). Each undergraduate programme is made up of a variety of topics 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. Luo (2017: 50) 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 on such education in South African LIS Schools.

## 1.2. Problem statement

Although the demand for informetrics in scholarly communities is notable, its development in the South African academic context is blurred. Galyavieva and Elizarov (2017: 298) exclude South Africa from the list of countries with informetrics courses in their universities. The challenges surrounding informetrics could affect its development in education. It appears that while it is an old research discipline within LIS, it remains unpopular (Wormell, 1998: 257). The need for informetrics is extensive, resources, particularly people, are scarce, (Kennan, Corrall, and Afzal, 2014: 673). Ajiferuke (2011: 183) observes that there is a comparatively low research contribution in the field of informetrics in Africa. South Africa has limited expertise in the field of informetrics (Pouris, 2012: 1). Wormell (1998: 259) observes the lack of consensus within the field of informetrics. According to Wormell, this lack of consensus has resulted in schools educating their students based on their institution's profile. The informetrics tools are relatively unaffordable (Ajiferuke, 2011: 182). Therefore, providing informetrics education is costly. Hood and Wilson (2003: 593), Ajiferuke (2011: 183) and Galyavieva (2013: 8) conclude that many faculty members in the global scale are not versed in quantitative methods in research. In addition, Wormell (1998: 259) notes that LIS professionals generally show little interest in the application of quantitative analysis to their services. The mentioned issues around informetrics could possibly hinder its growth within SA.

The Republic of South Africa is internationally recognised in the streams of informetrics, as the country won the bid for International Society for Scientometrics and Informetrics (ISSI) conference in 2011 (Ocholla, 2007: 186). However, there is no remarkable analysis of its education in SA and the current study sought to fill this gap. There is too limited evidence of studies that give local and international students an overview of how informetrics is taught in SA, and by which institutions. Observably, few LIS departments in South Africa do offer informetrics education at different degrees. For example: informetrics as a full course, as module in a course, as a chapter within a module, etc. These differences make is uneasily to survey the presence of informetrics education in SA prior to the current study.

Nevertheless, informetrics education remains important in all academic communities, especially in the LIS spheres. According to Zhao, Guo and Fu (2016: 540) "It is essential to explore how domestic universities train their personnel in the field of informetrics". The informetrics education would facilitate the identification of researchers that have to be given priority to

receive funding (Fiala, 2013: 1). Libraries worldwide are increasingly realising the importance of informetrics in their services (Davis, Wilson and Horn, 2005: 199), therefore, it is important that South African libraries have staff members, who are educated in informetrics, so that their services can be up to international standard. The current research hoped to help LIS departments realise their competitive strengths and weaknesses concerning informetrics education, so that LIS schools and departments that have not yet integrated informetrics studies into their curricula would realise the importance of informetrics and adopt it. Consequences for not addressing the challenge were therefore noted. Turning a blind eye to the development of informetrics education in the country might comparatively downgrade the intellectual rank of most LIS professionals in future. The institutions might run a risk of shortage of competent informetricians. The main research question is –what is the status of informetrics education in library and information science/studies departments in South Africa?

## 1.3. Aim of the study

The study aimed to explore informetrics education in Library and Information Science departments in South Africa.

## 1.4. Objectives of the study

The study sought to achieve the following objectives:

- To examine the status of informetrics education in LIS departments within South Africa
- To analyse the content of informetrics education in LIS departments in SA
- To determine the teaching method/s of informetrics education in LIS departments in SA
- To determine challenges associated with informetrics education in LIS departments in SA

## 1.5. Research questions

The study sought to respond to these questions:

- What is the status of informetrics education, within LIS departments, in South Africa?
- What is the content of informetrics education in SA's LIS departments?
- What are the methods for teaching informetrics in LIS departments in SA?
- What are the challenges surrounding informetrics education in LIS departments in SA?

## 1.6. Significance of the study

The contributions of the current study are in both theoretical and practical perspectives. Theoretically, the study intended adding into the body of knowledge in the field of LIS, teaching and learning in particular. It was anticipated that the study would offer a vivid characterisation of informetrics and demonstrate the importance of its education. Practically, the study hoped to provide a prolific centre of knowledge sharing among LIS departments concerning informetrics education. As an outcome, the LIS departments with/without informetrics education are expected to realise the weak areas in their curricula and make necessary adjustments. It is hoped that this study will help guide LIS departments without informetrics education towards incorporating it in their curricula. With the aid of this study, local and international students who wish to study informetrics will know where, what and how to study informetrics in SA. It is hoped that findings from this study will enable LIS' Heads of Departments (HODs) and informetrics lecturers to acquire and utilise suggested ideas towards improving informetrics education in SA.

## 1.7. Methodology overview

In terms of the philosophical perspectives, the ontological position of this study was pluralistic. The study used pragmatics epistemology. Regarding the research approach, the abductive research approach was employed to accommodate both qualitative and quantitative methods of enquiry. The study adopted the mixed research methodology to achieve its objectives. Structured questionnaires were administered as the data collection instrument for the quantitative aspect of the research, and content analysis schedule was used as the qualitative method of data collection. Both quantitative and qualitative data were collected and analysed concurrently, therefore triangulation was concurrently applied. The study targeted all LIS academic departments in South Africa. The LIS departments were represented by their respective heads (HODs). Where informetrics education was offered, the relevant questionnaire (please see Appendix A) was forwarded to the informetrics lecturer/instructor. The intensely discussed research methodology is in chapter three of this study.

## 1.8. Ethical considerations

The University of Zululand ensures that all its researchers adhere to the policy and procedures on research ethics. Ethics are the systematic approach to understanding, analysing and distinguishing issues of wrong and right (Rich, 2013:4). They are concerned with human

conduct, more specifically the behaviour of individuals in the society. The University of Zululand has a research ethics committee (UZREC) which is responsible for implementing research ethics policy and procedures, and where necessary clarify and interpret them to staff. According to the University of Zululand (2012: 8), ethics should embody respect of the rights of others who are directly or indirectly affected by the study. This study ensured to uphold maximum integrity and obeyed the ethical obligations across all variables in its practices. Some ethical obligations that this study adhered to, involve ensuring proper acknowledgement of consulted and used information resources, constant neutrality, respecting privacy of participants and honesty. Further, the research ensured that relevant stakeholders are consulted for the permission to conduct research. In addition, the researcher of the study refrained from plagiarism. Furthermore, the researcher's personal perspectives did not manipulate the findings of this study (as seen in chapter four).

## 1.9. Scope and limitations of the study

This study covered the LIS academic departments in South Africa. The researcher was aware that not all LIS departments in South Africa do offer informetrics education. Therefore, the study's objectives were restricted to the LIS departments that offer informetrics education in SA. The study targeted precisely HODs of LIS, informetrics lecturers, and informetrics course outlines. The researcher was again aware that some academic institutions could have informetrics education that is offered outside the academic programmes that are guided by the curriculum (e.g. library training programmes). However, such education was not considered for the purpose of this study. The study excluded all individuals or groups of individuals who do not form part of the target population.

## 1.10. Knowledge Dissemination

The subject of informetrics has not received substantial recognition in the academic world and. only few researchers focus on it. This work serves to bridge the gap created by shortage of research contributions to informetrics. As a way of increasing the body of knowledge in the field of information science, this study had to be made freely accessible to all researchers. It is hoped that this study will be published in peer refereed journals in the information studies and other related scholarly research publications. Preliminary presentation of the research results was made at the UNIZULU HSS conference in October 2018. Another presentation is scheduled at the

UNILISA conference, UNISA, March 2019. The dissertation will be deposited in the UNIZULU Institutional Repository as a requirement by the University policy.

## 1.11. Structure of the study

The first chapter, introduction and background provided a vivid understanding of the research area by discussing both conceptual and contextual framework of this research. The research problem, objectives and questions of the research were addressed in this chapter. The chapter further discussed the overview of the research methodology employed in the study.

Chapter 2 provides the theoretical foundation of this study. An in-depth literature review along the themes associated with the objectives of the study is thoroughly provided. Furthermore, chapter two exposes the development of informetrics in South African LIS departments and the existing gaps.

Chapter 3 reveals the layout of this study's research design, research methodology, research methods, sampling, data collection, and data analysis.

Chapter 4 presents the findings of the research as collected from participants or data sources of the study. The findings are presented as per objectives of the study. This chapter further provided interpretation of findings.

In Chapter 6, the achievement of objectives will be discussed. This will be the closure chapter, the conclusion and recommendations will be based on the findings. In this chapter, the findings will be matched with the literature review and recommendations will be made as to how the subject can be improved upon for future use.

## 1.12. Summary

This chapter addressed the research background and overview of informetrics as an area. The problem statement, aim and objectives of the research were discussed. The chapter further provided the methodological scope and limitations of the current research. The scarcity of

research on informetrics education, worldwide, was pointed out, and the gap which the study sought to fill was established. The next chapter reviews existing literature on informetrics education.

# CHAPTER 2: LITERATURE REVIEW

## 2.1. Introduction

The previous chapter described the introduction and background to the study. It provided an overview of the subject of informetrics, the field of LIS and the position of this study within the intersection of LIS education and informetrics in the South African context. This chapter presents the literature review; it provides an insight on issues related to this study, as discussed by other researchers. The current chapter begins by exploring the theory underlying this study on informetrics education in SA. The literature review plays a very crucial role in research. As agreed by Ridley (2012: 6) and Galvan and Galvan (2017: 12), its importance extends to positioning one's research in its space within a field. The literature review for this research is focuses on the following themes:

- The framework of informetrics as a subject area,
- Importance of informetrics education,
- The status of informetrics education in the global scale,
- The typical content units of informetrics education,
- The teaching and learning methods within the field of LIS,
- Informetrics in South Africa, and
- Challenges surrounding LIS education and informetrics.

## 2.2. Theoretical foundation of the study

The theoretical framework is a foundation from which all knowledge is constructed for a research study (Grant and Osanloo, 2014: 12). Thus, theoretical framework provides background knowledge about one's research area. According to Grant and Osanloo (2014: 12), the theoretical framework in research is important, as it serves as a structure and support for the underpinning rationale of the research. 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 in SA. The interconnection between the Heutagogical Teaching and Learning Theory (HTLT) and the Curriculum Development Model (CDM) situates a solid foundation for this study, and they will be discussed below.

### 2.2.1. The Heutagogical Teaching and Learning Theory

The heutagogical teaching and learning theory (HTLT) was discovered and used by Bitso and Raju (2015) as they analysed how LIS education in South Africa has responded to the dynamic information landscape. The term, heutagogy was coined by Stewart Hase of the Southern Cross University (Parslow, 2010: 121). According to Kenyon and Hase (2001:3), the heutagogy is actually the study of self-determined learning. It is worth noting that their study 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 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: 2; Bitso and Raju, 2015: 21). The HTLT therefore fits into the teaching and learning methods that involve ICTs. As this study sought to determine methods used for informetrics education, these methods should involve ICT resources. From the discussion on informetrics in the introductory chapter, it is obvious that informetrics is largely reliant on ICTs. It is in this regard the HTLT was used in this study 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: 3), 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: 22) 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. This factor motivated the adoption of HTLT to ascertain if the current teaching methods for informetrics education do support independent learning.

According to Blaschke (2012: 60), more mature 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 study sought to determine levels at which the informetrics course is offered. It is the researcher's observation 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: 60).

The participation of an instructor in heutagogy, as an expansion of andragogy (which emanates from pedagogy) can be clearly described using the pyramid in figure two below.

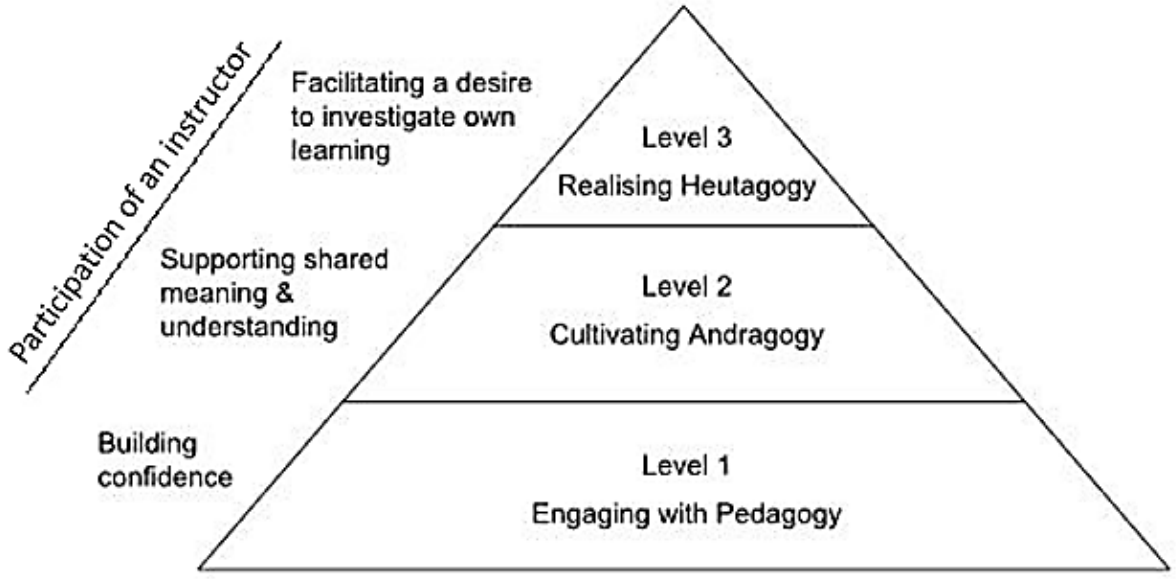


*Figure 2: The heutagogical teaching and learning theory*: Adapted from Canning (2010: 63)

In the heutagogical teaching and learning theory, an instructor facilitates a desire to investigate own learning. Likewise, an informetrics instructor has limited contributions into 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 an informetrics.

### 2.2.2. The Curriculum Development Model

This study further adopted the Curriculum Development Model (CDM) that was developed by Peter Wolf in 2007. The model was developed in 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 aim and objectives of the current study. These phases are: curriculum visioning, curriculum development and alignment, coordination and development. Below is their clarification as stated in Wolf (2007).

#### 2.2.2.1. Curriculum Visioning

As Wolf (2007) elucidates, in this phase, the existing curriculum undergoes assessment. The assessment strategy is developed department heads using the data that are gathered from relevant stakeholders, such as alumni, undergraduate and postgraduate students. The SWOT analysis is used to examine an existing curriculum (Wolf, 2007). Therefore, development of LIS curriculum that accommodates informetrics education could largely rely on the outcomes of the SWOT analysis for the current LIS curriculum.

#### 2.2.2.2. Curriculum development

In this phase, the focus is on how instructors make their choices to foster student development in programme objectives and content units (Wolf, 2007). Wolf enlightens that the curriculum development phase also involves the identification of useful resources and relevant methods for teaching, learning, and assessments. The identification of possible gaps and challenges take place in this phase. This phase can be directly linked to last four objectives of the current study.

#### 2.2.2.3. Alignment, coordination and development

The development and delivery of customised follow-up workshops take place in this phase. According to Wolf (2007) this would include fostering student's information literacy across the programme. Furthermore, this phase includes encouraging students to attend relevant workshops and conferences. Wolf further clarifies that curriculum development agenda is set for a period of two to three years, with regular feedback to the faculty on developments, challenges and successes. The figure three below presents the curriculum development model: process overview.

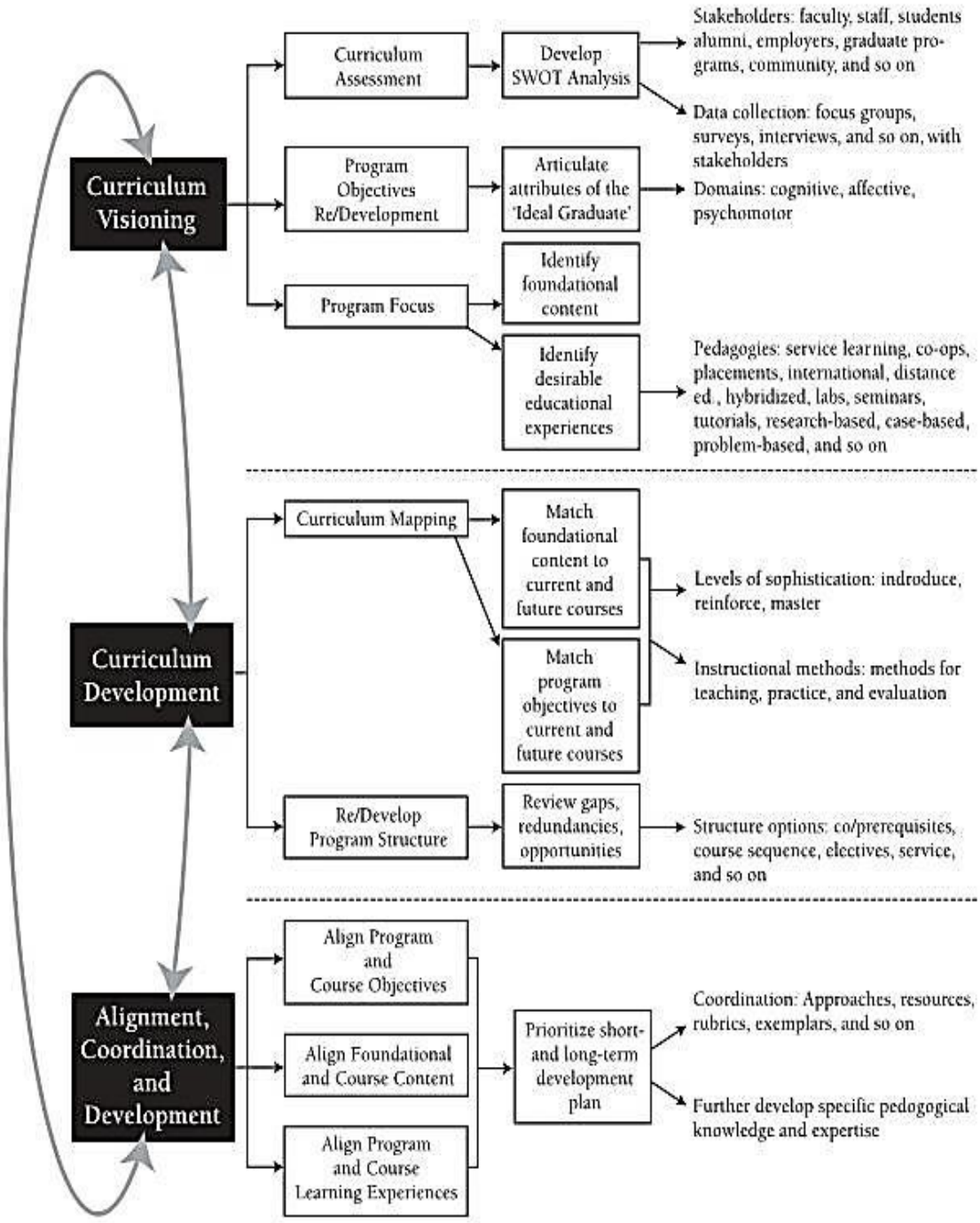


*Figure 3: Curriculum Development: Process Overview (Wolf, 2007)*

### 2.2.3. 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 are in agreement in that the academic course has to meet the teaching and learning trends in the 21st century. This study 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 shown in chapter one, which depicts that the development of bibliometrics rely much on the evolution of ICTs. The aim of this study would be achieved sufficiently from the analysis of levels, resources and methods used for existing informetrics education. It is this link that communicates all objectives of this study, with its theoretical foundation.

## 2.3. The Conceptions of informetrics

The scope of informetrics is broad. The informetrics concepts, mapping of science, dimensions of informetrics and informetrics indicator are discussed below. It is in this regard that this study sought to analyse the content of informetrics education in LIS departments in SA.

### 2.3.1. The informetrics concepts

All metric studies in the field of information science fall within the scope of informetrics. As, Egghe (2005) broadly defines, informetrics is all metrics studies related to information science, and these metric studies include: bibliometrics, scientometrics, cybermetrics, webomtetrics and altmetrics. The figure 4 vividly demonstrates the relationship between these metrics.

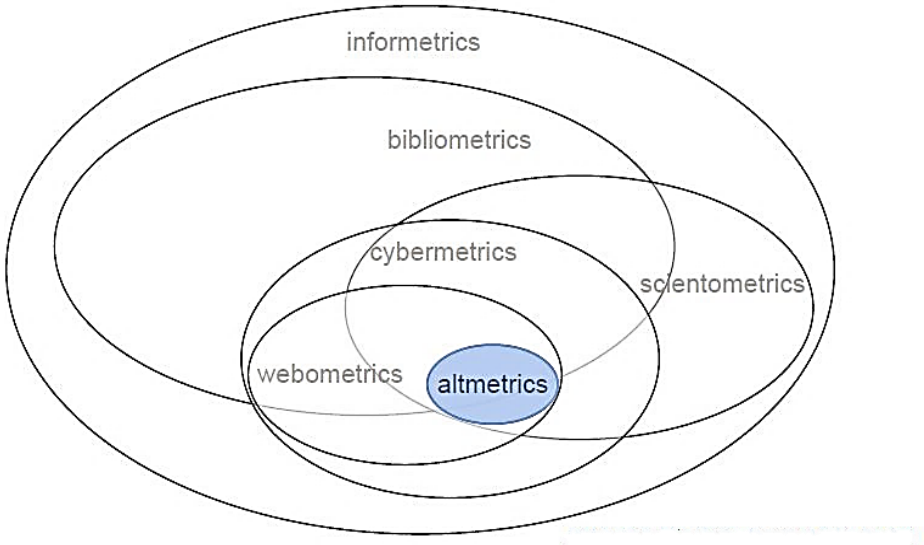


*Figure 4: The relationship between the metrics terms* (Haustein, 2016)

### 2.3.1.1. Bibliometrics

Bibliometrics is the study of the quantitative aspects of production, dissemination and utilisation of documented or recorded information (Tague-Sutcliffe, 1992: 1; McKiernan, 2005: 2). It can be seen as a quantitative analysis of research publications in order to ascertain certain patterns. Tague-Sutcliffe (1992: 1) further opines that bibliometrics develop mathematical measures and models for evaluating these information processes, which in turn assist in prediction and decision making. Jacobs (2010: 3) and Galyavieva (2013: 91) introduce three types of bibliometrics, namely: descriptive, evaluative and relational bibliometrics.

### 2.3.1.2. a) Descriptive bibliometrics

This type of bibliometrics is concerned with the characteristics of literature related to time period, geographic areas, disciplines etc. (Galyavieva, 2013: 91). In general, the descriptive bibliometrics describe the nature of a particular body of literature. Descriptive bibliometrics involved analysing literature based on geographical areas, institutions, departments, disciplines and time periods (Jacobs, 2010: 4).

### 2.3.1.3. b) Evaluative bibliometrics

The evaluative bibliometrics put focus on the evaluation of the impact of the scholarly research and the comparison of the relative scholarly contributions of two or more scientists (Galyavieva, 2013: 91). The typical bibliometrics provide a retrospective analysis of literature or authors. According to Jacobs (2010: 4), the citation counting is a type of evaluative bibliometrics.

### 2.3.1.4. c) Relational bibliometrics

According to Galyavieva (2013: 91), this type of bibliometrics is aimed at the exploration of relationships within the study, such as the cognitive structure of a research area, the development of new research fronts, and national and international examples of the joint authorship. The co-citation counts help produce patterns on typical relationship between authors or affiliated institutions.

### 2.3.1.5. Scientometrics

Scientometrics is the study of the quantitative and statistical aspect of science as a discipline or economic activity (Tague-Sutcliffe, 1992: 1; Jacobs, 2010:5). Scientometrics includes all aspects of the science of science (Hood and Wilson, 2001: 293). According to Jacobs (2010: 5),

scientometrics forms part of the sociology of science and have application to science policy-making. Milojević and Leydesdorff (2013: 4) add that scientometrics was first published in 1978. Much of bibliometrics research is published in the journal *Scientometric* as a result of which much of scientometrics is indistinguishable from bibliometrics (Hood and Wilson, 2001: 293).

#### 2.3.1.6. Cybermetrics

Sen (2004: 117) describes cybermetrics as that branch of knowledge which uses mathematical and statistical methods to quantify internet and its components and concepts. The introduction of internet motivated the emergence of cybermetrics.

#### 2.3.1.7. Webomtetrics

Webometrics is the quantitative analysis of web-related information (Jacobs, 2010: 10). According to Bar-Ilan (2008: 19), the analysis of Web links, Web Impact Factor (WIF), Journal Web sites, University Web sites and counting links is one of the main methods for webometrics.

#### 2.3.1.8. Altmetrics

Peters and Bar-Ilan (2014: 2) describe the altmetrics as the newest branch of informetrics which is aimed at capturing the "impact" through social media. For example, altmetrics include (but not limited to) peer reviews on Faculty of 1000, citations on Wikipedia and in public policy document, discussions on research blogs, mainstream media coverage, bookmarks on reference managers like Mendeley, and mentions on social networks such as Twitter. Galyavieva (2013: 94) defines altmetrics as the creation and study of the scientific communication outside the traditional channels of scientific communication systems.

### 2.3.2. Mapping of science

The scope of informetrics has been relatively broad in both practical and theoretical perspectives since the 20$^{th}$ century. In the past, informetrics covered a variety of areas including: statistical aspect of language, word and phrase frequencies; characteristics of author/s; characteristics of publication sources; citation analysis; growth of subject literature, and literature obsolescence (Rajan and Sen, 1986: 2; Tague-Sutcliffe, 1992: 2). Aside from the mentioned historical areas of informetrics, Tague-Sutcliffe (1992: 1) broadens the scope of informetrics by adding "measurements of information". Furthermore, Bradford's, Zipf's, and Lotka's informetrics laws have been identified to play crucial roles in the development of informetrics as regards the

"measurements of information"; some authors conceptualise informetrics using the above named laws (Erar, 2002: 114).

#### 2.3.2.1. The informetrics laws

There are three mostly highlighted informetrics laws since the dawn of informetrics. These laws are used to describe and define systematic regularities in science communication (Wormell, 1998: 257; Davis, Wilson and Horn, 2005: 200; Asernova, 2013: 678).

##### a) Bradford's Law

The Bradford's law is basically known as the "law of scattering" (Wormell, 1998: 257). In this sense, the Bradford's law of scattering focuses on the distribution of topics about journals, and can cater valuable strategies for deciding which resources to subscribe to or how to rank results list in an information retrieval system (Peters and Bar-Ilan, 2014: 1; Erar, 2002: 115). From this point of view, the term "scattering" denotes the manner in which the scientific contributions in the single discipline are scattered over a vast array of journals. According to Peters and Bar-Ilan (2014: 2), the Bradford's law often has practical implications for the acquisition of library resources.

##### b) Zipf's Law

Zipf's law analyses the frequency of word occurrence in the text (Erar, 2002: 115; Tague-Sutcliffe, 1992: 2). According to Erar, the Zipf's law is also known as the productivity law of words. The words analysis of a book is arranged according to the ascending order based on their number of occurrences (Erar, 2002: 115). Erar (2002: 115) further explains that the number of occurrences of a word is inversely proportional to its rank.

##### c) Lotka's Law

Lotka's law studies the productivity of authors in terms of scientific outputs (Erar, 2002: 115). According to Erar, the Lotka's law is also known as the productivity law of authors in the realm of scientific literature.

### 2.3.3. Dimensions of informetrics

The informetrics studies can be approached from three standpoints. According to Guns (2013: 298), the three dimensions of informetrics are: the social dimension, documentary dimension,

and the epistemic dimension. Based on his point of view, informetrics may put concern on the quantitative analysis of documents, such as journals, patents, articles, webpages and other documents (document dimension). Further, informetrics may also quantitatively analyse the way in which authors, reviewers, readers, and other information users interrelate (social dimension). Lastly, informetrics may put focus on the statistical analysis of information processes and knowledge organisation (epistemic dimension).

## 2.3.4. Informetrics indicators

The research influence and impact is generally assessed through the attention given to the research output, and such attention is manifested in the form of citations.

### 2.3.4.1. Citation analysis and scholarly impact

Every scientific work develops from existing knowledge within the field. Therefore, existing literature has notable impact on knowledge growth. The relationship between a new study and published work is manifested in the form of citations. The Ohio State University website (2018), Meho and Yang (2007: 1) and Waltman (2016: 366) conclude that the citation analysis is a way of analysing the relative importance and impact of a publication, author, or article by counting a number of times an author, publication or article is being cited by other works. Citations are formal explicit linkages between two or more scientific works that have particular points in common. According to Meho and Yang (2007: 2), the citation analysis works on the assumption that the influential scientists and important works will be cited more frequently than others. The Ohio State University website (2018) reports that the citation analysis can be conducted for the purpose of: establishing the impact that a particular work has by identifying the citations it receives; learning more about the field by identifying seminal works in that field; determining a particular author's impact within an area by analysing his/her total number of citations broken down by discipline or country; and, promotion and tenure purposes by looking at the quality of sources where a researcher's work has been published and cited. Waltman (2016: 366) reveals that the citations, as an indicator of scientific performance are complementary and alternative to journal rankings. Relatively, the citations seem to take precedence over the journal impact factors (JIFs), which will be discussed in section 6.4.2. Meyer *et al* (2017: 25) support that the JIFs (as an indicator), are too aggregated since different articles in a journal receive varying citation numbers, while others receive no citations. Therefore, the citation counts for each article bringing solution to such incongruity.

Further, it is important that the quantitative methods are used appropriately. Pendlebury (2008: 3) introduces the ten rules for using publication and citation analysis. These rules are:

1. Consider whether available data can address the question.
2. Choose publication types, field definitions, and years of data.
3. Decide on whole or fractional counting.
4. Judge whether data require editing to remove "artefact".
5. Compare like with like.
6. Use relative measures, not just absolute counts.
7. Obtain multiple measures.
8. Recognise the skewed nature of citation data.
9. Confirm that the data collected are relevant to the question.
10. Ask whether the results are reasonable.

### 2.3.4.2. Impact Factor (IF)

The impact factor is a measure that determines an average number of citations published in science and social science journals (Solarino, 2012: 474; Khan and Idrees, 2015: 884). The IF was conceptualised by Eugen Garfield and Irving H. Sher in the 1960s to assist in evaluating the journals so that they could be included in the Current Contents® and the Science Citation Index®.

#### a) Journal Impact Factor (JIF)

The IF of a journal is an average number of citations received by each article within that journal during the two preceding years (Solarino, 2012: 474), as shown in figure 2 below. According to Khan and Idrees (2015: 884), the JIF justifies the importance of a journal within its field. The JIF plays an integral role in developing rankings for journals. Generally, the older and larger journals would receive more citations than later or small journal. Therefore, it is necessary to consider a time period of a journal when assessing its impact factor. Cross (2009: 1) shares the typical formula for calculating the JIF:

$$\text{2007 impact factor} = \frac{\text{citations in 2007 to articles published in 2005 and 2006}}{\text{number of articles published in 2005 and 2006}}$$

*Figure 5: Formula for calculating the JIF (Cross, 2009: 1)*

### b) Web Impact Factor (WIF)

Peter Ingwersen was the first to introduce the indicators exclusively for the Web (Bar-Ilan and Peritz, 2002: 382). The WIF is solely dedicated to the assessment of web links and pages to determine the impact of the website. Ingwersen (1998: 237) defines WIF as a natural analogue of the Impact Factor. The number of hyperlinks divided by the number of web pages for a particular website make up the value called Web Impact Factor (Khan and Idrees, 2015: 884). As a part of webometrics analysis, Khan and Idrees (2015: 884) reveal that the website can be analysed in four approaches: web page analysis, web links, usage analysis and technology analysis. The WIF clarifies the relative importance of a website in relation to others in the same field. Below is a formula for calculating the WIF:

$$\frac{A}{D} = \frac{\text{total linked pages (all inlink and self-link pages)}}{\text{number of web pages published on the website which are indexed by a search engine (not all web pages of the website)}}$$

$$\text{WIF} = A/D$$

*Figure 6: Formula for calculating the WIF (Khan and Idrees, 2015: 884)*

## 2.3.4.3. H-Index

The h-index is a statistical measure of an author's productivity and the impact of published work (Costas and Bordons, 2007: 193). Cabos and Campanario (2018: 10) reveal that the h-index was developed by Jorge Hirsch in the year 2005, and that makes it to be referred to as the Hirsch Index. According to Hirsch (2014: 161), the h-index originates from the notion that the citation rate received by an author is a best indicator of relevance of his/her work than his/her

productivity rate. The h-index enables an author's work to be ranked without being improperly influenced by other articles which have received substantial citations. Costas and Bordons (2007: 193) mark the following advantages of the h-index:

- Can be obtained by anyone with access to the Thomson ISI Web of Science,
- Both quantity and impact of publications are assessed,
- The scientific work of a research is characterised with objectivity, and it is
- Easy to understand

## 2.4. 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 (2017: 298) 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 (2017: 298); whereas the researcher of this study witnesses that it is offered (University of Zululand). As this study sought to examine the status of informetrics education in LIS departments within South Africa, the findings were expected to 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.

### 2.4.1. 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: 5). 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, Wilson and Horn, 2005: 199). 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 (Sun, Nishizawa, Markscheffel, 2016: 1). 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: 89). Sun, Nishizawa, and Markscheffel (2016: 1) 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, Wilson and Horn, 2005: 209).

The importance of informetrics education extends to both practical and theoretical perspectives within formal and informal communications. As Davis, Wilson and Horn (2005: 196) 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, Wilson and Horn (2005: 196) further note that informetrics provide a picture of where the boundaries of a specific field intersect with other fields or disciplines.

According to Sun, Nishizawa, and Markscheffel (2016: 1), "To carry out research evaluation properly, it no doubt needs more education and training courses on informetrics". Davis, Wilson and Horn (2005: 209) and Kennan, Corrall, and Afzal (2014: 674) opine that informetrics education has to be offered as research course components to students taking information-related degree programmes.

### 2.4.2. The status of informetrics education

In Japan, the education in informetrics is integrated into LIS education (Sun, Nishizawa, and Markscheffel, 2016: 2). Sun, Nishizawa, and Markscheffel 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 institution of higher education (Ocholla and Bothma, 2007: 56). There is evidence that some academic libraries do offer informetrics education in the form of seminars, in-training programs and workshops (Kennan, Corrall, and Afzal, 2014: 673). This study sought to find out if LIS students in SA do receive informetrics training outside the framework of LIS curriculum. Kennan, Corrall, and Afzal (2014: 673) 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, the course of informetrics is offered to both undergraduate and postgraduate students (Zhao, Guo and Fu, 2016: 541). 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, Nishizawa, and Markscheffel, 2016: 2). 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, Nishizawa, and Markscheffel, 2016: 2).

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, Guo and Fu, 2016: 541). In Australia, there was no university offering an informetrics course in 2005 (Davis, Wilson and Horn, 2005: 199). Sun, Nishizawa, and Markscheffel (2016: 2) 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, Wilson and Horn (2005: 199) 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: 298) recognises the Democratic Republic of Congo (ranked number 14), the Kingdom of Morocco (ranked number 15), and Uganda (ranked number 30) as only African countries with informetrics education in a world scale.

### 2.4.3. 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, Guo and Fu, 2016: 544). 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 as a compulsory module to Information Science (IS) undergraduate student at level three of the Information Science degree (University of Zululand, 2017) for a semester. 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, Nishizawa, Markscheffel, 2016: 3). The informetrics course content offered by the Wuhan University (in China) to undergraduate students encompasses the informetrics concepts, laws, methods, and practical application (Zhao, Guo and Fu, 2016: 544).

### 2.4.4. 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: 183; Wormell, 1998: 259), unaffordable analytical tools, and inadequate data collection tools (Ajiferuke, 2011: 183; Wormell, 1998: 259). It is also noted that LIS professionals generally show little interests in the incorporation of quantitative analysis for their services (Wormell, 1998: 259). Some more shortcomings that hamper the development of informetrics as noted by Wormell (1998: 259) include: informetrics subfields drifting apart and a lack of consensus among informetrics specialists. Kennan, Corrall, and Afzal (2014: 673) emphasised that "the need for informetrics is extensive, resources are limited, particularly people" in higher education. The shortage of people who are competent with statistical research methods poses a great challenge to the success of informetrics education.

## 2.5. 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 20$^{th}$ century. The first scientometrics studies were undertaken in 1987 to meet the needs of the Nation Research Foundation (NRF). At that time, NRF was the Foundation for Research Development (FRD) (Pouris, 2012: 1). According to Pouris, the country was ranked the 21$^{st}$ 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: 186) 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: 179-180). Therefore, SA could be the leading African country in informetrics productivity.

## 2.6. The link between informetrics and LIS education

The issues touching informetrics have been controversial for many years within the framework of LIS education (Galyavieva, 2017: 297). 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: 21). 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: 297). 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: 298) 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: 12) 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, Wilson and Horn (2005: 208) 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, Wilson and Horn (2005: 208) 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: 208) 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 study contributes to existing literature on the strength of informetrics education within LIS departments in SA.

## 2.7. The LIS teaching and learning methods

In this study, the teaching methods refer to the instructional processes and resources used for academic communication between an instructor and students that may be adopted for informetric 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: 38). It is commonly known that ICTs have transformed the pedagogic nature of higher education and training. According to Raju (2013: 4) and, Bitso and Raju (2015: 21), 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: 8) and, Le Roux and Evans (2011: 11) 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: 5) 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: 9) 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: 9). 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: 38) 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: 38) further provides the following applicable teaching/learning methods in the LIS education [that can be used for informetrics education]:

### 2.7.1. Lecture method

The lecture method fits into the in-class mode of teaching/learning. According to Rajkoomar (2015: 39), the lecture method is still the most dominant method of teaching in higher education setting. Lockwood (2013: 7) 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: 39).

### 2.7.2. Group discussion

In a group discussion, students are actively participating on a topic within a classroom environment. Rajkoomar (2015: 39) 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.

### 2.7.3. 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: 557) observe that e-learning has proved to accelerate the LIS education process by increasing the accessibility to a wide range of information, supporting the efficient knowledge sharing among students and increasing knowledge storing capacity significantly. Rajkoomar (2015: 42) 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/).

### 2.7.4. 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 at different geographic places. The University of South Africa, UNISA, is an example of academic institutions that offer distance learning. Raju (2009: 9) 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.

### 2.7.5. Blended learning

Dangwal (2017: 129) 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: 131), 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: 208) 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: 175) 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 is informetrics require the availability of ICTs and face-to-face interaction between a student and an instructor.

## 2.8. 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: 14) 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 the recognisable LIS education. Kumbhar (2018: 150) 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. The current study reveals the availability of resources in LIS departments that provide informetrics education in SA.

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: 56). 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: 14). 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: 25) 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. The current study was aimed at finding out the challenges that are solely related to informetrics education in LIS departments within South Africa.

## 2.9. Summary

The Heutagogical Teaching and Learning Theory (HTLT) and the Curriculum Development Model (CDM) moulded a solid theoretical foundation of this study. It is clear that the scope of informetrics area 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. 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. 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 employed through blended method of learning. There is paucity of literature on informetrics education worldwide, hence the need for the current study. The following chapter will discuss the research methodology and design.

# CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

## 3.1. Introduction

The preceding chapter reviewed literature on informetrics education in SA and abroad within the framework of LIS education. This chapter explains the methodological aspects of this research. A research is a systematic effort to investigate a specific problem that needs a solution (Gray, 2018: 7). In the context of scientific research, the concept "systematic" denotes that the procedures implemented when undertaking an investigation follow a certain logical sequence. Such sequence involves enunciating the problem, the hypothesis formulation, collection of data, analysing the data and coming up with conclusions which may serve as solutions to a relevant problem (Kothari, 2005: 2; Walliman, 2017: 7). Based on the criteria for quality research that include validity, objectivity and reliability (Neuman 2014: 387; Pandey and Pandey, 2015: 21; Chimhundu, 2018: 140), a scientific research has to be undertaken using an appropriate scientific plan. Wayne and Stuart (2001: 1) further supports that a good research is systematic in that it is planned, organised and has specific goal. The comprehensive research plan is often referred to as research design. Bhattacherjee (2012: 35) defines research design as the structure of research, which serves as a master plan that describes how, when and where research data are to be collected and analysed. Further, Creswell (2009: 5) views a research design as a plan to conduct research which involves the intersection of philosophy, strategies of enquiry, and specific methods.

Researchers are often challenged to clearly address two main questions before they undertake a scientific research; these questions are: (1) what needs to be researched? (2) how do we find desirable research results? These two questions are addressed along the methodological and philosophical assumptions that inform the study. Creswell (2003: 4), Vosloo (2014: 299) and Neuman (2014: 58) agreed that the philosophical assumptions and the procedures for data collection and analysis have a significant influence on the subject that is being studied. Therefore, the research paradigm has to be considered in a research design. The research paradigm is defined as general organising framework for the research that encompasses general assumptions, models of quality research, underlying issues, traditions and sets of shared beliefs

that inform the meaning or interpretation of research data (Weber, 2010: 3; Neuman, 2014: 96; Vosloo, 2014: 301). Creswell (2009: 6) uses the term "worldview" to describe the research paradigm. The research paradigm links the researcher, the methodological aspects of the research and the object or phenomenon being researched. This could be clearly observed in Kivunja and Kuyini (2017: 26), as they define paradigm as "the conceptual lens through which the researchers examine the methodological aspects of their research projects to determine the research methods that will be used and how data will be collected". Therefore, research paradigm provides an insight on what should be studied, how it should be studied, and the way in which the results of the study should be presented. Thomas (2010: 292) discloses three main research paradigms, which are; ontology, epistemology and the methodology. Excluding the methodology, the ontology and epistemology are philosophical perspectives of research (Thomas, 2010: 292; Neuman, 2014: 96). The interrelationship among these terms, and as positioned in this study, will be disclosed below. In addition, the research design onion provided in figure (7) demonstrates how this research was conducted.

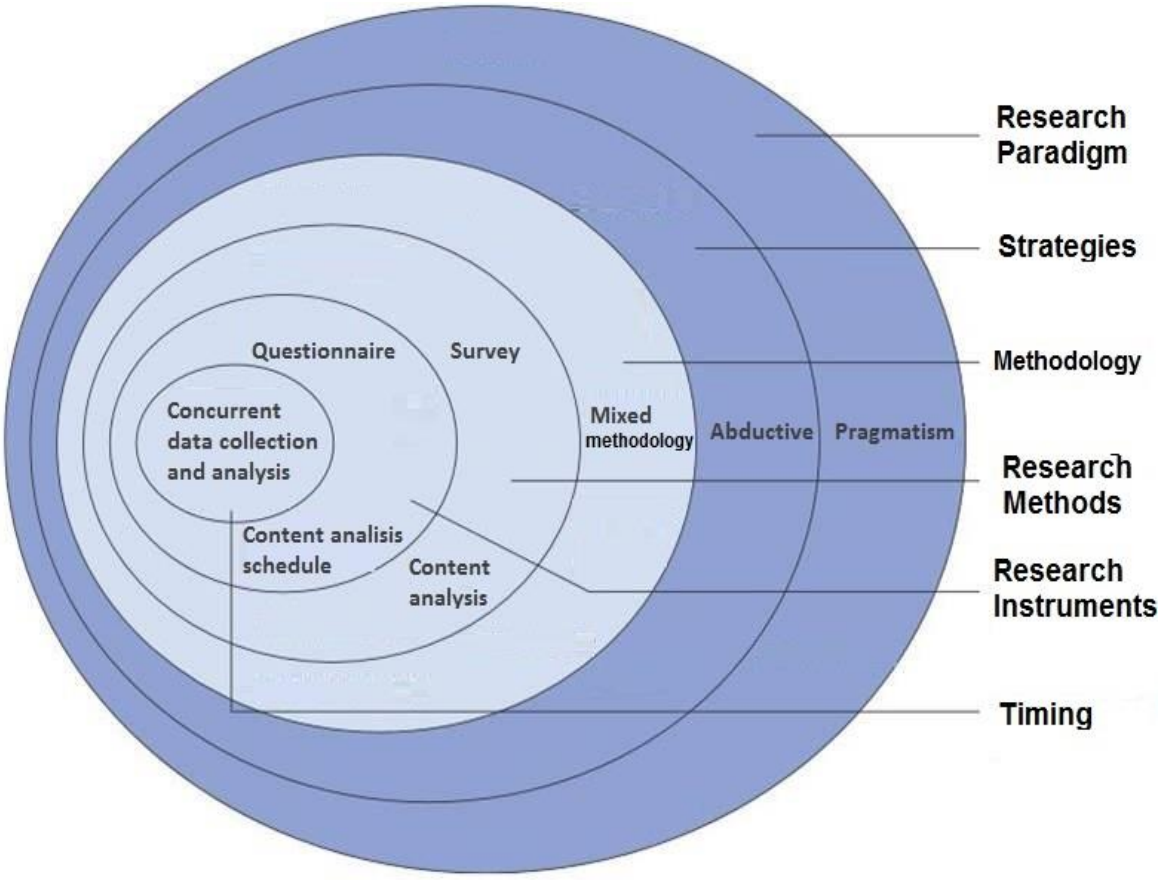


*Figure 7: Research design for the current study*

## 3.2. Research paradigm

The research paradigm in the process of undertaking scientific practice makes it possible to understand people's philosophical assumptions about the world and the nature of knowledge (Creswell, 2009: 16; Neuman, 2008: 3). Thus, taking such knowledge into consideration when doing research is important, as such assumptions constitute the essential idea of the notion behind the term 'paradigm' in research methodology. Saunders, Lewis and Thornhill (2009: 106) and Kivunja and Kuyini (2017: 26) agree that research paradigm guides an investigation. The way humans view the world has a considerable influence on the perceived importance of reality (Thomas, 2010: 292). Below is a clarification of ontology and epistemology as branches of philosophical perspective of research.

### 3.2.1. Ontology

Ontology is an aspect of philosophical assumptions which is solely concerned with the nature of reality. As Krauss (2005: 758), Maree (2007: 53), Saunders, Lewis and Thornhill (2009: 110), Neuman (2014: 93) and Kivunja and Kuyini (2017: 27) describe it, ontology refers to the philosophy of existing facts. It is actually concerned with the assumptions one makes in order to believe that something really exists. The reality exists independently of the knower or the researcher. In simple terms, ontology offers a justification that a phenomenon or object exists whether researched or not. According to Dudovskiy (2016), ontology concerns perceiving social entities as being either objective or subjective. Saunders, Lewis and Thornhill (2009: 110) reveal that objectivism presents reality as objective and singular apart from the researcher, while subjectivism presents reality as subjective and multiple as seen by participants in the study. The pluralistic (pluralism) branch of ontology as introduced in Turner (2009: 420) uses multiple existential quantifiers to bridge a gap between objective and subjective ontological perspectives. Ngulube (2015: 128) supports that the pluralism ontology is well fitted in the mixed methods research. Therefore, this mixed methods study points to the pluralistic ontology. In this sense, the ontological perspective of this research put 'inclusive' focus on the nature of informetrics education within LIS department in SA.

### 3.2.2. Epistemology

Epistemology is the philosophy of knowledge and how people come to know (Krauss, 2005: 758; Kelly, 2016: 21; Rehman and Alharthi, 2016: 52). In simple terms, epistemology focuses on

the link between the researcher and the ontology. In contradiction with ontology, epistemology can be regarded as being a dependent variable; as the researcher's view of the world can change. One may also view epistemology as a philosophy of how knowledge is created, acquired and communicated. Epistemology can either be positivism or interpretivism (Maree, 2007: 57; Dudovskiy, 2016; Kelly, 2016: 22). The researchers further inform that positivism is generally appropriate in a quantitative research and interpretivism in a qualitative research. The mixed methods research is based on the philosophy of pragmatism (Johnson and Onwuegbuzie, 2004: 16; Antwi and Hamza, 2015: 224; Kivunja and Kuyini, 2017: 26). Both qualitative and quantitative approaches were mixed to achieve the objectives of this study. Therefore, the study fits into pragmatism epistemology, because the analysis of informetrics education in SA would not be limited to either qualitative or quantitative procedures. In addition, Ngulube (2015: 127) and Yang and Yoo (2018: 308) support the fact that pragmatism or methodological pluralism were initially introduced to bridge a gap between positivist and interpretivist epistemologies. Informetrics education within LIS departments in SA was explored from all possible viewpoints using pragmatic epistemology.

#### 3.2.2.1. Pragmatism

Shannon-baker (2016: 322) introduces four paradigmatic perspectives for a mixed methods research, which are: pragmatism, dialectics, transformative-emancipation, and critical realism. Among these paradigmatic perspectives, the pragmatic paradigm was identified and observed to be relevant to this study. The pragmatism paradigm provides a strong emphasis on research questions, communication and shared meaning (Shannon-baker, 2016: 331). Pragmatism has its grounds in the mixed methods approach. According to Creswell (2003: 18) and Johnson and Onwuegbuzie (2004: 16), the pragmatic paradigm offers the best avenue for answering both qualitative and quantitative research questions. Shannon-baker (2016: 322) inputs that pragmatism places primary importance on the research questions. Based on the research questions for this study, the appropriate data collection instruments were: a questionnaire and a content analysis schedule. Yang and Yoo (2018: 308) agree that the pragmatic epistemology facilitates good communication between different research methods in one study.

## 3.3. Research strategy

Having established a set of research questions to be answered, the way in which they are answered depends highly on the type of research questions (whether quantitative or qualitative responses are anticipated). The research strategy (also seen as logic of enquiry) provides a starting-point and set of steps by means of which the "what" or the "why" questions can be answered. The inductive or deductive approaches are common strategies of enquiry in social research. According to Kelly (2016: 23) and Gabriel (2013), the qualitative research is often described as inductive, as it describes the process of exploring new phenomena or looking at previously researched phenomena from a different perspective. Trochim (2006) and Ngulube (2015: 127) reveal that the inductive reasoning is more open-ended and explanatory. It starts with a general statement or hypothesis; and data analysis precedes theory construction (Kelly, 2016: 23; Trochim, 2006; Langkos, 2014: 6; Mamabolo, 2009: 42). On the other hand, the quantitative research strategy is regarded as deductive, as it is normally conducted with the aim of testing a theory (Gabriel, 2013). When each of the approaches is not enough to sufficiently respond to the research questions, the abductive strategy is an alternative and it fits into the mixed methods research (Dubois and Gadde, 559: 2002). This research adopted the abductive strategy, as the research was a mixed methods research aiming to analyse and find unabridged results. The abductive research strategy was appropriate since the study was conducted with the use of both open-ended and close-ended questions to accommodate both qualitative and quantitative standpoints.

## 3.4. Methodology

Research methodology is the way of carrying out an enquiry throughout the research process (Kothari, 2005: 8; Thomas, 2010: 301; Smith and Small, 2017: 16). It answers the "how" questions upon the research process. Research methodology helps determine the correct methods for data collection (Rajasekar, Philominathan, and Chinnathambi, 2006: 5; Neuman, 2013: 91). In the field of social sciences, research methodologies are classified as either quantitative or qualitative, and the combination of the two is called mixed research methodology (Creswell, 2003: 18; MacDonald and Headlam, n.d: 8, Maree, 2007: 263). The Xavier University Library (2012:1) and Thomas (2010: 302) posit that quantitative research designs allow the collection of data in the form of numbers and statistics, while qualitative research designs allow the collection of data in the form of words, images or objects.

A mixed research methodology was therefore suitable for this study. The study sought to find descriptive facts and statistical figures where appropriate, concerning informetrics education by LIS departments in SA. Numerous studies of this nature have successfully adopted mixed research methods. Examples are: Ocholla and Ocholla (2014) and, Ndwandwe (2009). Romm and Ngulube (2015: 7) confirm that mixed methods research help to attain the comprehensive and accurate picture of reality. Furthermore, mixed research methods enabled this research to accommodate both quantitative and qualitative responses for greater understanding. The triangulation was applied in this research.

### 3.4.1. Methodological triangulation

In this study, quantitative and qualitative research methods were used concurrently in order to yield desired results accurately. The practice of employing both qualitative and quantitative research methods is referred to as triangulation, and is associated with the mixed research methods (Maree, 2007: 274; Lund, 2012: 155). The two research approaches were combined to complement each other towards achieving the objectives of the study. As Johnson and Onwuegbuzie (2004: 17) explain, in triangulation, the research approach is inclusive, pluralistic, and complimentary. Through the application of methodological triangulation, the qualitative methods can extend findings derived from quantitative research, and/or vice-versa. The triangulation was applied at a data collections and data analysis levels of this research, as seen in the next chapters.

### 3.4.2. Research methods

The research method is a set of techniques and procedures discovered by most scientists as being appropriate for the collection, gathering and analysis of research data (Creswell, 2003: 6; Bellamy, 2011: 9; Walliman, 2017: 7). These techniques fall under research methodology. According to Rehman and Alharthi (2016: 52), research methodology informs the researcher's choice of research method. That is, an appropriate research method matches with a particular research methodology. Like research methodologies, the research methods are classified as either quantitative or qualitative. According to Creswell (2003: 14) and Neuman (2012: 26), the quantitative research methods involve experiments, content analysis, existing statistics and surveys. On the other hand, qualitative research methods involve case-studies, ethnographies, grounded theory, qualitative surveys, historical-comparative, phenomenological research, and

narrative research (Creswell, 2003: 14; Neuman, 2012: 26). Based on the nature of research questions this study posed, the surveys and content analysis were identified as appropriate research methods.

#### 3.4.2.1. Survey research methods

The survey research methods are based on the collection of research data from individuals. Neuman (2014: 49) clarifies that in survey research, the researcher asks the same set of question from a number of individuals and records their responses. According to Ocholla and Ocholla (2014: 2) and Neuman (2014: 48), the survey research is generally conducted with the use of questionnaires or interviews. This study adopted the survey research methods to collect data from the HODs that represent the nine LIS departments in South Africa. The structured questionnaire was designed and administered to all nine HODs (Appendix 1). Where informetrics education is offered, the questionnaire designed for informetrics lecturers was forwarded to them (Appendix 2). The structured questionnaire had both quantitative and qualitative enquires which would be treated concurrently.

#### 3.4.2.2. Content analysis

The content analysis as a research method is concerned with analysing the contents within information entities such as books, magazines, newspapers, and other materials, including audio-visuals (Besen-Cassino and Cassino, 2018: 158; Kothari, 2004: 110). In a content analysis method of research, the researcher analyses the selected issues within information sources to capture desirable data as per study objectives. As Neuman (2014: 49) states, the content of a communication medium is systematically recorded and analysed. This study focused on the documents used for informetrics education within LIS field in SA. Such materials included study guides and course outlines. The content analysis schedule was designed to systematically record and analyse data (Appendix 3).

### 3.4.3. Target population

The target population is a group of individuals or objects from which research data is collected. As Neuman (2014: 252) defines, the target population is a specific collection of elements which a researcher seeks to study. The research target population could be human beings, animals, literature or any items that hold the subject of research. There is a very close link between a target population and data collection methods. The appropriate data collection method depends

on the nature of target population. For example: a research which targets literature would require content analysis as the research method. Again, the survey methods would mostly cater for the research that targets humans. This study targeted the population of LIS heads of departments, lectures who provide informetrics education, and educational materials for informetrics education (study-guides, course outlines and recommended literature). In this regards, the study classified its population into two categories: human and non-human population. As a result, survey methods were applied to human population (HODs and Lecturers) and content analysis was applied to non-human population (course materials). Library and Information Association of South Africa (2015: 42) presents nine tertiary academic institutions with LIS departments in South Africa, as given in Table 3.1 below:

**Table 3.1.: LIS academic institutions**

| HIGHER EDUCATIONAL INSTITUTION | DEPARTMENT NAME |
|---|---|
| Durban University of Technology (DUT) | Library and Information Studies |
| University of Fort Hare (UFH) | Library and Information Science |
| University of Cape Town (UTC) | Library and Information Studies |
| University of Kwa-Zulu Natal (UKZN) | Information Studies |
| University of Limpopo (UL) | Information Studies |
| University of Pretoria (UP) | Information Science |
| University of South Africa (UNISA) | Information Science |
| University of Western Cape (UWC) | Library and Information Science |
| University of Zululand (Unizulu) | Information Studies |

## 3.4.4. Sampling

Involving the entire target population, especially with very large population, in a study could make the study unmanageable or to sometimes yield invalid results. When the population is too large, it is necessary to select few units of the target population to represent the population in the study, and that practice is called sampling (Kothari, 2004: 55). Bhattacherjee (2012: 65) and Neuman (2014: 246) agree that sampling is a statistical process of selecting a subset of the target population for the purpose of making observations and statistical inferences about the entire population. Bhattacherjee further states that a subset of population selected for that purpose is called a sample. A sample therefore facilitates efficient data collection. However, sampling is not

necessary for the current study, as the target population is manageable in its entirety. Hence, the study targets all HODs, informetrics lecturers, and informetrics study materials within LIS academic institutions in South Africa.

## 3.4.5. Data collection

Data collection is the process of obtaining desired data from the target population. It is a stage of research when the researcher directly engages with the study's target population. In every social science study, the data is collected with the research questions in mind (Besen-Cassino and Cassino, 2018: 162). The research questions guide the process of data collection by ensuring that obtained data is relevant and has a sufficient potential to fulfil the study objectives. This study collected both quantitative and qualitative data concurrently (triangulation applied). The data collection has to be undertaken using a predefined data collection instruments, which will be discussed below, followed by the data analysis.

The data collection instrument is also called data collection tool. A data collection instrument is chosen in accordance with the nature of the study, whether the study is quantitative or qualitative. According to Mahesh and Neena (2011: 41), data collection instruments include schedule, questionnaire, checklist, rating scale and score board. This study used questionnaires for the collection of quantitative data (Appendix A and B), and content analysis schedule to gather qualitative data from course material (Appendix C).

### 3.4.5.1. Data collection instrument: Questionnaire

The questionnaire was considered for data collection instrument. Creswell (2008: 12) and Neuman (2014: 48) agree that questionnaires are appropriate for a survey research. The questionnaire helps to capture responses in a standardised manner (Bhattacherjee, 2012: 74). For this research, the data was collected from humans with the use of a questionnaire containing both close-ended and open-ended questions. Two questionnaires were designed: the first questionnaire was for the HODs (Appendix 1) and the second questionnaire for informetrics lecturers (Appendix 2). Both questionnaires covered all objectives of the study. Emails were used to send the questionnaires to all nine HODs in different LIS departments in SA. The participants were requested to return the questionnaire, via email, within a period of two weeks.

### 3.4.5.2. Data collection instrument: content analysis schedule

In the content analysis (as a research method), the contents of text are gathered and analysed (Neuman, 2014: 371). This study sought "to analyse the contents of informetrics education in LIS departments in SA". It is in this regard that content analysis was employed as a complimentary research method. The qualitative content analysis schedule was designed with blank spaces for capturing the course name, course/module units, and unit components (Appendix 3). The respondents were asked to provide the study materials and/or course-outline used for informetrics education through the electronic mail.

## 3.4.6. Data analysis

As a mixed method research, data was analysed both quantitatively and qualitatively. This research was not based on sequential ordering of either qualitative or quantitative phase of the study, but research data was handled 'concurrently'. As Creswell (2009: 205) explains, that the timing of the quantitative and qualitative data collection in the mixed methods research is based on whether it will be 'sequential' or 'concurrent". The concurrent triangulation is when both quantitative and qualitative data are gathered and analysed simultaneously. On the other hand, the sequential triangulation is when data collection is undertaken in phases, for example: deciding whether qualitative or quantitative data comes first, depending on the initial intent of the researcher (Creswell, 2009: 206). To clarify this, Johnson and Onwuegbuzie (2004: 16) introduce two mixed methods research typologies: mixed-model and mixed-method. The mixed-model design is that which mixes qualitative and quantitative research approaches within or across the stages of research process, while the mixed-method model is that which makes inclusion of a qualitative phase and a quantitative phase in an overall research study (Johnson and Onwuegbuzie, 2004: 16). This study adopted the concurrent triangulation, as qualitative and quantitative research data were gathered and analysed at once.

# 3.5. Summary

This chapter addressed the research design for this study. Regarding the philosophical foundations, this study adopted the pragmatic epistemology and pluralistic ontology. The abductive approach has been considered appropriate for this study. Based on the objectives of this study, the mixed research methods were chosen in order to yield sufficient and unabridged outcomes. The two research methods (survey and content analysis) were used. The survey

research methods, through questionnaires were employed to collect data from the LIS heads of departments (HODs) and informetrics lecturers. On the other hand, content analysis was employed to analyse the content of the informetrics course materials such as study-guides and course outlines. The content analysis schedule was designed and used for content analysis. The study covered the entire population, which are the nine LIS departments in South Africa. Emails were used for communication and transfer of documents. Both quantitative and qualitative data were collected and analysed concurrently; therefore triangulation was applied.

The two research methods adopted (surveys and content analysis) were anticipated to complement each other towards achieving the study's objectives, but they brought some methodological challenges. Fortunately, the encountered challenges did not influence the research results. The researcher observed that respondents generally replied beyond the stipulated time when approached using online communication (email) than face-to-face interaction; sometimes, they did not reply at all. Some respondents actually required the researcher's reminder to respond to, and return the research questionnaires. Considering the ethics for a scientific research, it is noted that regular reminders have the probability of interfering with the respondent's freedom of participation in research. Secondly, some respondents who were requested to share their course outlines (two of five respondents) did not accede to this request. However, the received course materials were enough to achieve the research objective that required course materials. The next chapter deliberates on the data presentation and analysis.

# CHAPTER 4: DATA PRESENTATION AND ANALYSIS

## 4.1. Introduction

The previous chapter provided an insight on the methodology used for this research. The aim of this chapter is to present the data and provide the analysis of contents as was collected. The data was collected from LIS heads of departments, the lecturers who provided informetrics, and the informetrics study materials. As stated in chapter three, the study targeted nine LIS departments in South Africa. Two different questionnaires were designed: one for HODs and the other one for lecturers. The questionnaires were sent to the HODs via email. Where informetrics education was offered, the HOD was requested to forward questionnaire designed for the informetrics lecturer to the respective individual. Accordingly, the informetrics lecturers were requested to return their questionnaires with the study material so that content analysis could be undertaken.

All nine recognised LIS departments in South Africa were approached via emails sent to HODs. The responses were received from eight (8) departments, which makes 89% response rate. Out of the eight (8) departments which participated in the study, only five (5) departments indicated the presence of informetrics education. The lecturers responsible for informetrics education were then approached and requested to participate in the study, only three (3) lecturers responded. In terms of content analysis, only three (3) lecturers managed to share their informetrics course outlines. The presentation of data that was collected through the survey questionnaires will begin below, and then the data collected through content analysis will follow later in this chapter. The questionnaire results from HODs covered the research objective focused on the status of informetrics education. The questionnaire results from informetrics lecturers covered three objectives of the study, with focus on contents, methods and challenges of informetrics education. Finally, the results of the contents analysis respond to one research objective, which was on contents of the syllabus.

## 4.2. Survey questionnaire results from HODs

The survey results were collected from HODs in eight LIS departments in South Africa. The survey questionnaire to HOD (Appendix A) sought for response to the objective, ‘to examine the status of informetrics education in LIS departments within South Africa.’ The HODs were

involved in the study because HODs play major roles in curriculum development. As the curriculum development model (chapter two) asserts, the HODs are key participants in the curriculum development process. Therefore, the participation of LIS HODs was very necessary for the achievement of the above stated objective.

## 4.2.1. General Information

It was important for this study to evaluate the general information about LIS departments in South Africa. Such general information would help provide a vivid overview of each LIS department and validate its relevance in the current study.

### 4.2.1.1. Academic offerings

Table 4.1 presents basic information for the eight LIS departments that participated in the study.

**Table 4.1: LIS Academic offerings**

| Institution | Name of Dep. | Qualifications offered | Duration |
|---|---|---|---|
| Durban University of Technology (DUT) | Information and Corporate Management | N. Dip in Library and Information Studies | 3 Years |
| | | Diploma in Library and Information Studies | 3 Years |
| | | B.Tech in Library and Information Studies | 1 Year (Full-time)<br>2 Years (Part-time) |
| | | M.Tech in Library and Information Studies | 1 Year (Full-time)<br>2 Years (Part-time) |
| | | PhD in Library and Information studies | 3 Years (Full-time)<br>4 Years (Part-time) |
| University of Cape Town (UCT) | Library and Information Studies Centre | PGDipLIS | 1 Year |
| | | MLIS | 2 Years (1 Year full-time) |
| | | MPhil (Digital Curation) | 2 Years (1 Year full-time) |
| | | MPhil (Research) | Up to 3 Years |
| | | PhD | Up to 5 Years |

| | | | |
|---|---|---|---|
| University of KwaZulu-Natal (UKZN) | Information Studies | PG Diploma Information Studies | 1 Year |
| | | PG Diploma Records and Archives Management | 1 Year |
| | | MIS | 1 Year |
| | | PhD | 3 Years |
| University of Limpopo (UL) | Communication, Media and Information Studies | Bachelor of Information Studies (BIS) | 4 Years |
| | | Post-graduate diploma in Information Studies | 1 Year |
| University of Pretoria (UP) | No data provided | No data provided | No data provided |
| University of South Africa (UNISA) | Information Science | H.Cert. in Archives and Records Management | 1 Year |
| | | Bachelor of Information Science | 3 Years |
| | | Archives and records management major in BA | 3 Years |
| | | BINF Honours | 1 Year |
| | | Masters of Information Science | 2 Years |
| | | DPhil Information Science | 4 Years |
| University of Western Cape (UWC) | Library and Information Science | B.LIS | 4 Years |
| | | PG Diploma (Part-time) | 2 Years |
| | | MLIS | 2-3 Years |
| | | PhD | 3-4 Years |
| University of Zululand (UNIZULU) | Information Studies | BA Information Science | 3 Years |
| | | B. Library and Information Science | 4 Years |

Table 4.1 above shows a wide variety of academic offering by LIS departments in South Africa. A variation of department names can be observed, and the commonalities in terms of academic offering can be noted.

### 4.2.1.2. Mission of the LIS departments

It was important for the study to find out the mission of the department. The mission of the department could have a significant impact on the department's decision to integrate an informetrics education. It was said early in chapter one that informetrics education can bring competitive advantages to the department's quality of education. In this perspective, only five (5) participants disclosed the mission of their departments. Results are presented below.

University of Zululand:

"*To be a leading LIS department, nationally and globally, based in a rural setting, providing quality career oriented programmes and service in information studies through our teaching, research and community engagement*."

Durban University of Technology

"*Our mission is to excel through: A teaching and learning environment that values and supports the university community, promoting excellence in learning and teaching, technology transfer and applied research, external engagement that promotes innovation and entrepreneurship through collaboration and partnership."*

University of Limpopo:

Under construction

University of KwaZulu-Natal

"*To educate and train library and information professionals who are able to apply their knowledge and skills in local and global contexts in a socially-responsive way. Our programme is characterized by innovative research and scholarship which informs a broad-based curriculum with opportunities to specialize at post-graduate level*"

University of Cape Town:

*"To take the leadership role in providing transformative and innovative Library and Information Studies teaching, learning and research, informed by our location in Africa and by global scholarship*".

University of South Africa:

"*The Department of Information Science strives for excellence in tuition, research, and community engagement in pursuit of shaping futures in the service of humanity"*

University of Western Cape:

"*Our department is alert to its African and international context as it strives to be a place of quality, a place to grow from hope to agency through knowledge. Its mission is to contribute significantly towards the development of an information literate South African society. Therefore, it focuses on educating and training Library and information service personnel while maintaining well-recognized international standards in its curricula*".

University of Pretoria

"*To be a leading research-intensive university in Africa, recognised internationally for its quality, relevance and impact, as also for developing people, creating knowledge and making a difference locally and globally".*

### 4.2.1.3. The teaching mode and duration of modules

Assumable, some LIS departments may not offer informetrics education because of the teaching mode they use. In this context, the teaching mode refers to whether the education is offered through contact or distance teaching and learning. It is in this regard that this research sought to find out the teaching mode used by LIS departments in SA. Again, this study could not turn a blind eye to the differences in terms of duration of teaching as can be observed amongst the institutions, because the duration of teaching has influence on the quality of the contents being taught. The results are presented in the Table 4.2 below.

**Table 4.2: Teaching mode and duration**

| Institution | Teaching mode | Duration of teaching semester |
|---|---|---|

| | | |
|---|---|---|
| Durban University of Technology (DUT) | Contact | Semester and annual |
| University of Cape Town (UCT) | Contact | Semester |
| University of KwaZulu-Natal (UKZN) | Contact | Semester |
| University of Limpopo (UL) | Contact | Semester |
| University of Pretoria (UP) | No data provided | No data provided |
| University of South Africa (UNISA) | Distance | Semester and annual |
| University of Western Cape (UWC) | Contact | Semester |
| University of Zululand (UNIZULU) | Contact | Semester |

Based on Table 4.2 above, six LIS departments offer contact mode of teaching. The University of South Africa is the only department which indicated the distance mode of education. The UNISA and the DUT are the only two LIS departments that have both semester and annual long modules, while other LIS departments only offer semester long modules.

### 4.2.2. The status of informetrics education in SA

This section is associated with the first objective of the study. The HODs were introduced into this section by the question on necessity of informetrics. The aim of starting with this question was to determine the perceptions of LIS HODs on informetrics education, irrespective of whether it is offered or not in their departments. The presence of informetrics and other questions relating to informetrics education were ask in order to respond to the objective about the status (presence, levels and extent) of informetrics in LIS departments.

#### 4.2.2.1. The necessity of informetrics

The HODs were requested to indicate if they recognise the necessity of informetrics within LIS education. While one respondent did not respond, seven respondents agreed that an informetrics education is necessary within LIS education.

To justify:

The University of KwaZulu-Natal respondent- "*constant changes in scholarly communication and the influence of ICT s have changed the academic world and influences the LIS field. Global ranking systems of higher education institutions have meant that we need to constantly measure and evaluate research output. In terms of access to information and research output, there is therefore a need for LIS professionals to understand such informetrics measures*."

The University of Western Cape respondent - "*Scholarly communication is very important in an academic world. We are constantly trying to find ways of measuring the quality of academic output. We did this firstly with bibliometrics and as the Internet evolved we have broadened this measure to informetrics and webometrics.*"

The University of South Africa respondent- "*informetrics can enhance the research and analytic skills of students*"

The University of Limpopo respondent- "*in LIS, we deal with information from various subject fields. We will therefore be in a position to measure the growth and development of information and knowledge in a specific field, and this will assist us in collection development decisions that we make".*

The University of Cape Town respondent – *"informetrics is an integral part of the LIS disciplinary domain and one of the new services especially among academic libraries."*

The University of Zululand respondent – informetrics in necessary in order "*to equip students with fundamental theoretical and practical knowledge and skills in informetrics, scientometrics and webometrics".*

#### 4.2.2.2. The presence of informetrics education

The respondents were asked if their departments offer informetrics education. This section aimed at addressing the first objective of this study, which is to examine the status of informetrics education in LIS departments within South Africa. Five of eight HODs indicated that informetrics education is offered in their departments. These were LIS departments at the University of Limpopo, University of Zululand, University of KwaZulu-Natal, University of Western Cape, and the University of Cape Town. The responses revealed that only one department offers informetrics education as a full module, and some offer it as a chapter in a module. To be specific, the University of Zululand offers informetrics education as a full module in the programme (Module name: Informetrics /Module code: AINF332). In addition, the University of Zululand offered the informetrics education as a chapter in the module (Advanced Information Retrieval Indexing and Abstracting: AINF422). The University of KwaZulu-Natal offers informetrics education as a chapter in a module (Module name: Advance Literature Searching and Evaluation /Module code: LIIS833). The University of Western Cape offers informetrics education as a chapter in a module (Module name: ICT Trends in LIS /Module code: LIS821) at postgraduate masters level. The University of Cape Town offers informetrics education as a chapter in a module (Module name: Research and Librarianship /Module code: LIS5033). The University of Cape Town again had a component of informetrics in the module (Information Resources: LIS4051W) at postgraduate level (PGDipLIS). The University of Limpopo offered informetrics education as a chapter in a module (Module name: Collection Development).Where informetrics is offered as a unit or chapter in another course module, there does not seem to be a uniform cluster for its location. For example, departments offer it in different programmes such as research, information retrieval, information resources and collection development.

While LIS department at the University of South Africa recognises that informetrics education can enhance the research and analytic skills of students, the department does not offer informetrics education, stating that "*it has not been considered as being core/necessary to Information Science students*". The UNISA representative/HOD further indicated uncertainty whether or not the informetrics education is offered outside the LIS department. The University of Pretoria representative/HOD's response via the email was that "*this Department does not offer informetrics, so I shall not be able to answer most of the questions*". The representative/HOD of

the LIS department at Durban University of Technology indicated that informetrics education is not offered in their department. The reason for this was not given.

The researcher is aware that informetrics education may not form part of the curricula for some LIS departments, but could be offered by non-academic departments, such as an institutional library. No department indicated the awareness of informetrics education of this nature.

#### 4.2.2.3. Who teaches informetrics course and what is the field of expertise of the instructor?

The question of who teaches informetrics was based on the academic rank of the instructor. The instructor's expertise has a significant influence on the quality of education offered. This is often associated with the research background or experience the instructor has in a specific field. In order to respond to this question, the HODs had to choose the following: junior lecturers, lecturers, part-time lecturers, senior lecturers, associate professor, and professor. The respondents were allowed to indicate multiple selections, where appropriate. The results are shown in Table 4.3 below.

**Table 4.3: The instructor's academic rank**

| LIS Department | Instructor's Academic Rank |
|---|---|
| University of Cape Town | Lecturer |
| University of KwaZulu-Natal | Senior lecturers |
| University of Limpopo | Lecturer |
| University of Western Cape | Part-time lecturer |
| University of Zululand | Professor |

Table 4.3 reveals the wide variation of ranks for informetrics instructors. Within the five LIS departments that offered informetrics training, the instructors are: lecturer, senior lecturer, part-time lecturer, and a professor. In terms of the field of expertise of the instructors, all five departments indicated the field of Library and Information Science (LIS).

### 4.2.2.4. Academic department responsible for informetrics education

This section sought to establish if there is any other department that is responsible for offering informetrics education. All respondents agreed that the informetrics is relevant in the LIS education. The UL representative recognizes that the Informetrics "*is part of the Information Science, in which people should learn about the growth of knowledge in a particular field. Subject or field specialists will be able to provide research support to the academic in their fields of interests*". Further, the UL representative/HOD disclosed that the relevance of informetrics within LIS education is up to an extent that it helps students learn about ways of making collection development decision, and deciding better on journals in which to publish their papers. The UKZN representative/HOD presented that it is the LIS professionals or workers who conduct bibliometrics studies for or on behalf of academics, scholar or researchers. The informetrics education at UNIZULU "*equips students with fundamental theoretical and practical knowledge and skills in informetrics, scientometrics and webometrics*".

### 4.2.2.5. At which study level is informetrics education offered in LIS departments?

This section was based on the educational levels at which informetrics education is offered. Considering the variation in the levels of study across LIS departments, and that some departments do not offer undergraduate qualifications, it was necessary to determine the levels of study at which informetrics education is offered. The results from the HODs indicated that post-graduate students are the common target for informetrics education. The University of Cape Town, University of Western Cape and University of KwaZulu-Natal offer informetrics education to postgraduate students. On the other hand, the University of Zululand and University of Limpopo offer it to undergraduate students.

The University of Western Cape offers informetrics education to postgraduate students (Masters). To justify this choice, the UWC representative responded "*At the UG level, students are just about to be introduced to research and the meaning of citation. At Masters level, where students themselves have to conduct research and write a thesis, any form of metrics will make more sense to them*".

Informetrics education at the University of Limpopo is offered at level two, three, four and the honours class. According to the UL representative, "*as a part of Collection Development in level two, students should know all the methods for evaluating the collection in the library. Bibliometrics is one of those methods*". Again, "*as a part of Collection Development module at postgraduate level, students should know all the processes involved in scholarly communication*". Lastly, "*Students doing research should know about the journals that they use in their research, and informetrics and bibliometrics are ways of knowing the high impact journals in a specific fields*".

The University of KwaZulu-Natal offers informetrics education to postgraduate students (Masters). As the HOD put it, "*We do not offer an undergraduate programme. Also, post-graduate Masters students conduct individual research projects and therefore must understand and apply informetrics in their own studies*".

At the University of Zululand, informetrics education is offered to level three undergraduate students. The UNIZULU representative/HOD justified that "*the advance nature of the subject*" is the reason why it was offered at level three, not at level one or two.

Table 4.4 below summarises the levels of teaching informetrics education in SA's LIS departments:

**Table 4.4: Levels offered informetrics**

| LIS Department | Level of Study |
|---|---|
| University of Western Cape | postgraduate (Masters) |
| University of Limpopo | two, three, four and honours |
| University of KwaZulu-Natal | postgraduate (Masters) |
| University of Zululand | undergraduate (level three) |
| University of Cape Town | postgraduate (Masters and Dip) |

#### 4.2.2.6. The extent of informetrics education offered

This section sought to establish the extent of informetrics education offered in LIS departments within SA. The respondents were to choose from: a chapter in a module, or a module/course in a programme, or a full programme. UNIZULU offers it as a module in one qualification and a

chapter in another qualification. While UKZN, UWC, UCT and UL offered it as a chapter in a module.

#### 4.2.2.7. The duration of informetrics education offered

At UNIZULU, the informetrics module is offered for a period of one semester (approximately six months) and for about four weeks as a chapter in a separate module; at UKZN, the informetrics chapter is taught for about six hours and at UWC, the informetrics chapter is taught for three hours. The UCT and UL did not specify the duration for which informetrics education is offered within their semester long modules. Evidently, the time allocated for informetrics in the two universities is very short.

## 4.3. Survey questionnaire results from informetrics lecturers

The second questionnaire was designed for lecturers who provide informetrics education (Appendix B). Out of five departments that indicated the presence of informetrics education, only three lecturers returned a completed questionnaire (the UNIZULU, UCT and UWC informetrics lecturers). The aim of involving lecturers was to obtain information that would support the achievement of the last three objectives of the study, which were:

(a) To analyse the content of informetrics education in LIS departments in SA
(b) To determine the teaching method/s of informetrics education in LIS departments in SA
(c) To determine challenges associated with informetrics education in LIS departments in SA

### 4.3.1. Demographics for lecturers/instructors

The background data for informetrics lecturers/instructors was collected. Table 4.5 below presents the title and area of expertise for each informetrics lecturer.

**Table 4.5: Demographics for lecturers/instructors**

| INSTITUTION | TITLE | AREA OF KNOWLEDGE AND EXPERTISE |
|---|---|---|
| University of Zululand | Prof. | Library and Information Science (LIS) |

| | | |
|---|---|---|
| University f Limpopo | Mr. | Library and Information Science (LIS) |
| University of Cape Town | Ms. | Library and Information Science (LIS) |
| University of KwaZulu Natal | Ms. | Library and Information Science (LIS) |
| University of Western Cape | Ms. | Library and Information Science (LIS) |

Based on the Table 4.5, the titles for informetrics lecturers varied. However, the majority are females. Notably, the area of knowledge and expertise for all informetrics lecturers was Library and Information Science.

## 4.3.2. The content of informetrics education

This section presents the results that were required to achieve the second objective of this study. The informetrics lecturers were an ideal source of data relating to the content of informetrics education. However, the content analysis on course material was still necessary to complement the responses given by lecturers in this regard. This section presents results from lecturers and the results of the contents analysis will be presented later in section 4.4.

### 4.3.2.1. The proportion informetrics within offered education

This section sought to establish if informetrics education was solely devoted to informetrics. The UNIZULU respondent indicated that the one module offered is solely devoted to informetrics while in another informetrics is offered as a chapter. At UCT and UWC, informetrics is a chapter in a module.

### 4.3.2.2. The aim of the module

At UNIZULU, the informetrics module aimed "*to equip students with knowledge of applied informetrics and bibliometrics for information retrieval, research performance data evaluation and research policy*". As mentioned above, UNIZULU offers informetrics education as a chapter in the module 'Advanced Information Retrieval Indexing and Abstracting: AINF422'. The aim of the module is "*to equip students with advanced knowledge and skills on information retrieval and evaluation*".

At UCT, the module that involves informetrics (Research Librarianship: LIS5033) aims to "*equip librarians with knowledge and skills to support the research agenda of their institution,*

*region and country*". Again, UCT offers elements of informetrics in the module 'Information Resources: LIS4051W', but further details on this was not accessible.

The aim of the module that involves informetrics at UWC is "*to give students an overview of a few of the ICT trends that are current and how they can be used and applied to libraries and librarianship*".

#### 4.3.2.3. Learning outcomes of the informetrics unit or module

Upon the completion of an informetrics module (AINF322) at UNIZULU, the students are expected to be able to:

- Conceptualise and contextualise informetrics theories, methodologies and applications such as publication count and citation analysis.
- Describe and compare the various informetrics laws and models
- Examine and evaluate impact factors (JIF, AIF and WIF)
- Examine and evaluate altmetrics
- Identify and evaluate the source of bibliometrics data
- Apply informetrics analysis and produce a report
- Demonstrate understanding of current issues, trends, challenges and opportunities of IR, informetrics, indexing and abstracting.

Again, the module 'Advanced Information Retrieval Indexing and Abstracting: AINF422' set to enable students to:

- Work effectively as individuals and with others as members of a team;
- Organise and manage themselves and their activities responsibly and effectively;
- Identify and solve problems and make decisions, using critical and creative thinking;
- Collect, analyse, organise and critically evaluate information;
- Communicate effectively, using visual, symbolic and/or language skills in various modes;
- Use science and technology effectively and critically; showing responsibility towards the environment and the health of others; and

- Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

At the University of Cape Town, the course outcomes for the module Research Librarianship: LIS5033were to equip students with the ability to: investigate, analyse and support the demands of the scholarly community, and to propose appropriate strategies to enhance research productivity and visibility among emerging and established researchers.

The informetrics education offered at the University of Western Cape is offered within the module named ICT Trends in LIS: LIS821. In terms of the module outcomes, it was anticipated that students should be able to:

- Discuss the role of the web in the knowledge/information society;
- Use an evaluation tool to evaluate websites;
- Discuss the open source movement and its implications for the LIS sector;
- Apply knowledge of the web design theory;
- Decide the value and application of new ICTs for libraries e.g. weblogs, RSS and Wikis, e-books, etc.; and
- Create a website for a specific audience.

### 4.3.3. Educational methods for informetrics

The fourth objective of this study was to determine the teaching method/s of informetrics education in LIS departments in SA. At UNIZULU and UWC, informetrics education is offered along blended learning. The HOD of UL indicated that they combine the lecture method (face-to-face) and group discussion methods for informetrics education. UCT provided informetrics education using lecture method (face-to-face).

**The University of Cape Town**

The lecturer responsible for informetrics education at UCT reported that the practical application of informetrics and self-directed learning are method they also use. Specifically, the lecturer used to give students grounding insight on the theoretical concepts of bibliometrics and altmetrics.

Case studies were used to illustrate the concepts. As the informetrics education was at masters level, students are provided with a reading list and are encouraged to learn independently. Practical exercises on Scopus, Web of Science and/or Google Scholar were then used to allow students to apply their knowledge and build their skills in the use of the bibliometrics databases which are often used in academic libraries

**The University of Zululand**

The UNIZULU respondent revealed that blended learning (inclusive of case studies, face-to-face and group discussion) "*enables the student to identify a current research theme, conduct basic bibliometrics study and produce and report the results*". Again, "*face-to-face lectures are largely used for learning and understanding the bibliometrics concepts and how they are applied in the real world*". In the blended learning method, as used at UNIZULU, "*lectures are normally followed by group discussions for grounded learning*". The UNIZULU respondent further indicated that "*we do use Moodle platform for LMS where relevant lecture materials consisting largely of journal articles, book chapters, some e-books and power point presentations are placed for learning. We intend using this platform more intensively in the future by applying most of its functionalities*".

**The University of Western Cape**

Informetrics education was at master's level. This master's programme was designed as a face-to-face part-time course, and that is the method most appropriate although there is an online portal as well.

### 4.3.3.1. Methods of assessment

The lecturers were requested to indicate the assessment method used and the weightings as well. Table 4.5 below presents the results.

**Table 4.5: Method of assessment**

| **The University of Cape Town** | | **The University of Zululand** | | **The University of Western Cape** | |
|---|---|---|---|---|---|
| **Method of assessment** | **Weightings** | **Method of assessment** | **Weightings** | **Method of assessment** | **Weightings** |
| Formal end of module/course exam | 70% | Group and individual based assignments (Formative Assessment) | 20% | Practical Assessments | Website 40%<br>Practical metrics exercise 10% |
| Assignments | 30% | Topic based tests (Formative Assessment) | 30% | Assignments | Major essay and presentation 30%<br>Other assignments 15%<br>Participation 5% |
| | | final exam (Summative Assessment) | 50% | Learning journals (diary of learning created during the module/course) | Some self-reflection in one Assignment |
| **TOTAL** | 100% | | 100% | | 100% |

### 4.3.4. Challenges associated with informetrics education

One of the objectives of this study was to determine the challenges associated with informetrics education in LIS departments within SA. The informetrics lecturers were asked to share the challenges they encounter as informetrics lecturers. The UNIZULU respondent enumerated the following challenges:

1. Shortage of qualified lecturers to offer informetrics education as part of succession plan.
2. Informetrics curricula development
3. Lack of short courses on informetrics
4. Lack of wiliness to teach informetrics: LIS schools do not take informetrics education seriously.
5. Student preparedness for quantitative studies is weak

The UCT respondent disclosed that students find it hard to grasp informetrics concepts, particularly the elements that can be measured, e.g. individual, publication, author and institution. The concept of impact is also sometimes hard for them to grasp. She further revealed that "*practical are challenging in that, in the past, we have not had enough log-ins to access Scopus as a class. In addition, when students want to access Scopus or WoS from home, they have found the off-campus login system difficult to use*". In short, the access to and utilisation of databases poses a challenge to informetrics education.

The UWC respondent noted that it is hard to understand modern informetrics that is inclusive of Web 2.0 and social media, as they are different from traditional bibliometrics. She also noted that controversies in terms of the nature of altmetrics as a challenge. Lastly, the UWC respondent submitted that rapid developments in informetrics make it hard to teach; as it changes within a short space of time.

#### 4.3.4.1. Overcoming challenges associated with informetrics education

The respondents were asked to suggest ways in which identified challenges could be mitigated. The UNIZULU respondent brought forth the following suggestions:

- Create more awareness for bibliometrics education through LIS associations;

- Intensify staff development and capacity building in the domain;
- Provide short courses for capacity building; and
- Informetrics should be included in the LIS curricula as more academic and research libraries provide bibliometrics services to their researchers.

The UCT respondent suggested the use of case studies, because it is believed that they help students understand concepts. Again, the respondent advised that the use of Google Scholar can mitigate the challenge of accessing a paid-for database (such as Scopus or WoS) when not on campus.

The UWC respondent stated that "*I believe in presenting all information and letting the students make up their own minds*". She further recommended that students should familiarise themselves with platforms like Google Scholar, Scopus, Web of Science, etc., and make practical use of them.

#### 4.3.4.2. Suggestions for improving informetrics education

This section sought to solicit suggestions for improving the informetrics education offered by LIS departments. The respondent from UNIZULU suggested that LIS departments should do the following: awareness increase, benchmarking, capacity building by educating and training more informetricians, carry out need analysis/research, design relevant reading/books/manual for the course, to meet specific needs, use novel teaching methods and exchange experiences.

The respondent from UCT suggested that examples of informetrics works that have been carried out locally should be used when teaching informetrics. Lastly, the respondent from UWC enumerated the following suggestions:

- Providing practice through exercises and practical workshops;
- Exploring and keeping up to date with developments; and
- Working with metrics, understanding the differences to know which ones are best suited to particular contexts.

### 4.3.4.3. Additional information

For information sharing purpose, this section sought to allow the inclusion of any necessary information that may form part of informetrics education.

### 4.3.4.4. Reading recommendations by lecturers

This study intended to provide a prolific centre of knowledge sharing among LIS departments and informetrics lecturers. It is in this regard that this study asked the informetrics lecturers to provide recommended readings that could be useful for informetrics education.

The respondent from the UNIZULU recommended, but not limited to, the following readings:

**Books**

- Chowdhury, C.G. (2010). Introduction to modern information Retrieval. Facet Publishing Todeschini, R., & Baccini, A. (2016). *Handbook of bibliometric indicators: Quantitative tools for studying and evaluating research*. John Wiley & Sons.
- Gingras, Y. (2016). *Bibliometrics and research evaluation: Uses and abuses*. MIT Press.
- Holmberg, K. J. (2015). *Altmetrics for information professionals: Past, present and future*. Chandos Publishing.
- Stuart, D. (2014). *Web metrics for library and information professionals*. Facet publishing.
- Zafarani, R., Abbasi, M. A., & Liu, H. (2014). *Social media mining: an introduction*. Cambridge University Press.
- Egghe, L. (Ed.). (2005). *Power laws in the information production process: Lotkaian informetrics*. Emerald Group Publishing Limited.
- Wolfram, D. (2003). *Applied informetrics for information retrieval research* (No. 36). Greenwood Publishing Group.
- Tiwari, A. (2006). *Bibliometrics, informetrics and scientometrics: Opening new vistas of* ***information science*****. RBSA Publishers.**
- Onyancha, Omwoyo Bosire. (2007). An informetric analysis of HIV/AIDS research in Eastern and Southern Africa, 1980-2005. (PhD thesis, UNIZULU).

**Journal articles**

- Bar-Ilan Judit (2008). Informetrics at the beginning of the 21st Century-A review. Journal of Informetrics, Vol 2, N1:1-52

- HOOD, WILLIAM W.; WILSON CONCEPCIÓN S.(2001).The literature of bibliometrics, scientometrics,and informetrics. *Scientometrics,Vol. 52, No. 2 (2001) 291–314*
- Jacobs, Daisy. 2010) Demystification of Bibliometrics, Scientometrics, Informetrics and Webometrics.11th DIS Annual Conference 2010, 2nd – 3rd September, Richardsbay, University of Zululand, South Africa (http://www.lis.uzulu.ac.za/research/conferences/2010/DIS%20conference%202010%20DJacobs.pdf )
- Kumar R.P. & Fortunato,S(2014).Author Impact Factor: tracking the dynamics of individual scientific impact,Scientific Reports 4, Article number: 4880 (2014)( see - http://www.nature.com/articles/srep04880
- Noruzi, A. (2006). The Web Impact Factor: a critical review. *The Electronic Library*, 24.
- Pendlebury, D.A.( 2008) . Using Bibliometrics in Evaluating Research.


**Additional Readings**


- Thelwall Mike and Kousha Kayvan.( 2015). ResearchGate: Disseminating, communicating, and measuring Scholarship. *Journal of the Association for Information Science and Technology*, Volume 66, Issue 5, pages 876–889,
- Onyancha, OB. (2015). Social media and research: an assessment of the coverage of South African universities in ResearchGate, Web of Science and the Webometrics Ranking of World Universities. *South African Journal of Libraries and Information Science*, 81(1), 8-21.
- Ocholla, Dennis N., Ocholla, L., Onyancha, O. Bosire.(2013). Insight into Research Publication Output of Academic Librarians in Southern African Public Universities from 2002 -2011. *African Journal of Libraries Archives and Information Science*, Vol.23, No1;5-22
- Ocholla, Dennis, Ocholla Lyudmila and Omwoyo Bosire Onyancha (2012). Research visibility, publication patterns and output of academic librarians in sub-Saharan Africa: The case of Eastern Africa. *Aslib Proceedings*, Vol.64(5)**,**478-493
- Onyancha, O. B. and Ocholla**, DN** (2008) A co link analysis of institutions of higher learning in Eastern and Southern Africa: preliminary findings. *Mousaion*, 26(1),46-70

- Onyancha, O. Bosire and Ocholla, Dennis (2007), The performance of South African and Kenyan Universities on the World Wide Web: a Web link analysis. [Online] *Cybermetrics. International Journal of Scientometrics, Informetrics and Bibliometrics*,Vol.11C1.Available: http//www.cindoc.csic.es/cybermetrics/articles/v11i1p.2.html
- Onyancha, O.B. & Ocholla, D.N. (2005). An Informetric Investigation of the Relatedness of Opportunistic Infections to HIV/AIDS. *Information Processing and Management,* 41:1573-1588

Respectively, the respondent from the UCT recommended the following:

- Coughlin D.M. & Jansen B.J. 2016. Modelling journal bibliometrics to predict downloads and inform purchase decisions at university research libraries. ASIS&T. 64(9): 2263-2273.
- Cronin, B. & Sugimoto, C.R. Eds. 2014. *Beyond Bibliometrics: harnessing multidimensional indicators of scholarly impact*. Cambridge, Mass.: MIT.
- Garfield, E. 1955. Citation Indexes for Sciences: A new dimension in documentation through association of ideas. *Science.* 122(3159): 108-111.
- Gorraiz, J., Wieland, M. & Gumpenberger, C. 2016. Individual bibliometric assessment @ University of Vienna: from numbers to multidimensional profiles.
- Hicks, D., Wouters, P., Wlatman, L., de Rijcke, S. & Rafols, I. 2015. Bibliometrics: the Leiden Manifesto for research metrics. *Nature*. 520. 429-431
- Kerchhoff, G. 2017. The Institute for Poverty, Land and Agrarian Studies (PLAAS) research outputs between 1995 and 2015: impact on the scholarly domain and in social media. Masters dissertation. University of Cape Town. (Unpublished).
- Nassi-Calò, L. 2015. Bibliometric indicators of the European scientific production. *SciELO in Perspective*. Onyancha, O.B. 2017. Altmetrics of South African journals: Implications for scholarly impact of South African research. *Pub Res Q*. 33:71-91.
- Priem, J. Taraborelli, D. Groth, P. & Neylon, C. 2010. *Altmetrics: A manifesto*.
- Roemer, R.C. & Borchardt, R. Eds. 2015. *Meaningful metrics: a 21st century librarian's guide to bibliometrics, altmetrics, and research impact*. Chicago: ACRL.

Finally, the respondent from UWC recommended:

- Borgman, C.L. & Furner, J. 2002. Scholarly communication and bibliometrics. V. 36.
- Gadd, E. 2018. Better, fairer, more meaningful research evaluation in seven hashtags.
- Galloway, L.M., Pease, J.L. & Rauh, A.E. 2013. Introduction to Altmetrics for Science, Technology, Engineering, and Mathematics (STEM) Librarians. Science & Technology Libraries. 32(4):335 –345.
- Loria, P. Altmetrics as indicators of public impact. Open Access and Research Conference QUT, Brisbane Australia, 31 Oct – 1 Nov 2013.
- Neylon, C. 2017. Citation metrics are making headlines, but what does citation really mean?
- Priem, J. 2010. Altmetrics: a manifesto. Available: http://altmetrics.org/manifesto/
- Priem, J., Groth, P. & Taraborelli, D. 2012. The Altmetrics Collection. PLOS ONE. 7(11):e48753.
- Roemer, R.C. & Borchardt, R. 2015. Meaningful metrics: a 21st-century librarian's guide to bibliometrics, altmetrics and research impact. Chicago: Association of College and Research Libraries.
- Wilsdon, et al., J. 2015. The metric tide: Report of the independent review of the Role of Metrics in Research Assessment and Management. United Kingdom: HEFCE


## 4.4. Results from content analysis

The content analysis schedule (appendix C) was designed to guide the content analysis. As stated in chapter three (the methodology), this research was conducted using both the survey method and content analysis. The content analysis was necessary for the achievement of the third objective of this study, which was to analyse the contents of informetrics education in LIS departments in SA. This section presents the results of the content analysis; collected from the course outlines as they were requested from informetrics lecturers. Out of five departments that indicated to have informetrics education, only three departments shared their course outline (UNIZULU, UCT, and UWC).

### 4.4.1. The content of informetrics education offered

As stated earlier in the introduction, only three informetrics lecturers shared their course outlines for content analysis. The findings are presented below.

#### 4.4.1.1. The University of Zululand

At UNIZULU, the module of Informetrics (AINF332) was offered within a qualification programme (BA in Information Information Science) and Advanced Infromation Retriaval, Abstracting and Indexing (AINF 422) in a four year BLIS qualification programme. In the BA(IS) qualification, the module is taught at level three, which is the final year for the BA Information Science qualification programme. The informetrics module at UNIZULU is a semester long (approximately six months).

**Module contents**

The module contents are:

- Conceptions, evaluation and applications of informetrics, bibliometric, scientometrics, cybermetrics, webometrics and altmetrics;
- Informetrics theories/models, methodologies and applications in multiple environments( e.g. e-information environments, internet, social media);
- Publication counts and Citation analysis- co-citations, bibliographic coupling, impact factor ( JIF,AIF,WIF);
- Understanding and evaluation of sources of informetric data;
- Application of informetrics ( e.g. library services);
- Scientific communication- scope, models, processes, role/importance, challenges/opportunities;
- Case studies; and Current status and challenges of bibliometrics.

The informetrics chapter offered at UNIZULU in the module: Advanced Information Retrieval, Abstracting and Indexing (AINF 422), cover the following aspects of informetrics;

- Informetrics theories/models
- Methodologies and application in multiple environments
- Publication count and citation analysis
- Bibliographic coupling, and
- Impact Factor (IF)
- Understanding and evaluation of sources
- Challenges/opportunities

### 4.4.1.2. The University of Cape Town

The UCT offered informetrics education as a chapter in the module (LIS5033: Research Librarianship).

**Module contents**

The contents of the mentioned module are:

- The research agenda and landscape;
- Institutional research policies and research evaluation;
- Scholarly publishing;
- The practice of research librarianship and its challenges in the South African context;
- Open access and institutional repositories;
- Bibliometrics and altmetrics;
- eResearch, eScience and Digital Humanities;
- Research data management;
- Libraries in the publishing process; and
- Performance evaluation and impact assessment.

### 4.4.1.3. The University of Western Cape

The UWC offers informetrics education as a chapter in the module (LIS821: ICT Trends in LIS).

**Module contents**

The informetrics components within the module are:

- Citation counting,
- H-Index,
- Journal Impact Factor,
- Bibliometrics,
- Informetrics,
- Altmetrics, and
- Change in scholarly communication.

## 4.5. Summary

This research collected data from three data sources: the HOD from LIS departments, the informetrics lecturers, and the course outlines. The questionnaires designed for HODs and questionnaires designed for informetrics lecturers were administered via email, with follow-up calls. Out of nine officially recognised LIS departments in SA, eight HODs responded. Only seven HODs responded to the questionnaires. The variations in department's names and offerings were noted. The LIS department at UNISA was the only department that used distance mode of teaching. All seven HODs did recognise the importance of informetrics education; however, only five HODs indicated to have informetrics education in their departments, out of which four of them offer informetrics education as a chapter in a module. The LIS department at the University of Zululand was the only department that offered informetrics education as stand–alone module in its three year BA (IS) qualification programme. The results corroborated the submission that Informetrics education is essential. In terms of the educational methods, the blended learning method was widely used. The informetrics education was offered at both undergraduate and postgraduate levels of education. Despite the fact that informetrics education was offered in different levels across the sampled LIS departments, there is no uniformity most areas such as the contents of informetrics education offered from institution to institution.

The challenges surrounding informetrics education were noted, and the HOD provided suggestions for mitigating such challenges. The informetrics lecturers also shared recommended readings, which, although should always be up-dated, are useful for informetrics education. The results indicated a significant shortage of informetrics education within LIS in SA. No LIS department offered informetrics education as a full course, not even a short course. Again, the uniformity in LIS education can be confirmed by differences in their curricula offerings for informetrics education. This study hopes to provide a point of juncture for all LIS departments that offer informetrics education, to create a degree of uniformity in their curricula offerings. The following chapter will be a discussion of these findings.

# CHAPTER 5: DISCUSSION AND INTERPRETATION OF FINDINGS

## 5.1. Introduction

This chapter discusses the findings of the study. The purpose of this chapter is to discuss findings in a manner that provides responses to the study's research questions. This chapter is organised in the order of the study's research questions. The study targeted nine LIS departments in South Africa. Rajkoomar (2015: 109) and the Library and Information Association of South Africa (2015: 42) were the recent notable sources to provide the number of LIS academic departments in South Africa. The results of this study revealed that LIS departments in South Africa have different names, such as: Information and Corporate Management; Information Studies; Communication, Media and Information Studies; Information Science; Library and Information Science; and Information Studies. According to the Library and Information Association of South Africa (2015: 41), this variation of names is influenced by diversification of programmes embracing rapidly evolving trends in the information age. It can also be noted that departments have changed their names recently. For example, the Library and Information Association of South Africa (2015: 42) presented the LIS department at DUT as the department of Library and Information Studies, but the current study found it to be the department of Information and Corporate Management. It is the same case with the LIS department at the UL (e.g. Table 3.1 and Table 4.1). The academic offerings by LIS departments in SA range from certificates, diplomas, bachelor's degrees, honours degrees, masters degrees and doctoral degrees. The curriculum variations among LIS departments are brightly visible (see Majanja, 2009: 3).

The mission statements for all LIS departments (eight departments) that participated in the study were considered. Remarkably, the departments share a common aspect of 'global competitiveness' in their mission statements. However, the global competitiveness may not be achieved if the department itself does not sharpen its curriculum to keep up with the trends in LIS in a global context. The informetrics education should be important for LIS department that seeks to achieve global competitiveness. As Sun, Nishizawa, and Markscheffel (2016: 1) articulate, "To carry out research evaluation properly, it no doubt needs more education and

training courses on informetrics". Therefore, LIS departments that are passionate about global competitiveness are challenged to consider informetrics education in their curricula.

All respondents in this study agreed that informetrics is necessary within LIS education. This supports the idea of Milojević and Leydesdorff (2012: 1) that informetrics has its roots in Library and Information Science. The respondent from the University of KwaZulu-Natal opined that scholarly communication and rapid development of ICTs change the academic world and influence the LIS field; therefore, the LIS field is challenged to constantly evaluate their research outputs using informetrics. Similarly, Raju (2017: 12) acknowledges that the field of LIS is responsible for providing research support which includes bibliometrics. As found out in this study, the respondent from the University of South Africa concur with Raju (2017: 12) that informetrics can enhance the research and analytic skills of students.

The respondent from University of Limpopo supported the fact that informetrics is relevant to the LIS education. He revealed that informetrics education at University of Limpopo formed part of the Collection Development module. According to him, informetrics is a "*part of the Information Science, in which people should learn about the growth of knowledge in a particular field*". The necessity of informetrics within the LIS curriculum is doubtless.

It is mentioned in chapter three, the research process for this research adopted the concurrent mixed method. Therefore, the findings of this study are also discussed in the order of research questions; regardless of whether the research question is qualitative or quantitative in nature. This chapter responds to the following research questions:

- What is the status of informetrics education within LIS departments in South Africa?
- What is the content of informetrics education in SA's LIS departments?
- What are the methods for teaching informetrics in LIS departments in SA?
- What are the challenges surrounding informetrics education in LIS departments in SA?

## 5.2. What is the status of informetrics education within LIS departments in SA?

As addressed in this study's research problem statement, not so much is known in terms of informetrics education in South Africa, particularly in the field of Library and Information Science. The current study sought to determine the status of informetrics education in LIS within SA. The results demonstrated that there are five LIS departments that offer informetrics education. These departments were the University of Zululand, University of Limpopo, University of KwaZulu-Natal, University of Cape Town and University of Western Cape. However, there was only one department (University of Zululand) that offered it as a module devoted to informetrics. Other four departments offered it as a chapter in a module. The three institutions, University of KwaZulu-Natal, University of Western Cape, and University of Limpopo offered informetrics education as a chapter in a module. The University of Zululand is the only university that offered informetrics education as a module in a full qualification programme.

The evidence given by Kennan, Corrall, and Afzal (2014: 673) that some institutional libraries do offer informetrics education was considered in this study. The respondents were asked to indicate if they know or are aware of any aspect of informetrics education that is taking place outside their departments. No respondent indicated the presence of informetrics education of that nature within their institutions. The University of South Africa does not consider informetrics as core/necessary to information science students. Wormell (1998: 259) and Ajiferuke (2011: 182) reported the shortage of informetrics skills among LIS professionals. As a result, one may deduce that the shortage of professionals with informetrics skills contributes to informetrics not being offered in some LIS departments.

Regarding the level at which informetrics education is offered in the LIS departments, it was found that the University of Zululand offers informetrics education to undergraduate students level three and level four. The University of Western Cape, University of Cape Town and University of KwaZulu-Natal offer it at postgraduate level (masters). The University of Limpopo offers informetrics education to undergraduate students at level two, three, four and honours. The respondent from the University of Western Cape justified that "*At the UG level students are just about to be introduced to research and the meaning of citation. At Masters level, where students*

*themselves have to conduct research and write a thesis, any form of metrics will make more sense to them*". On the other hand, the respondent from University of Limpopo believed that "*as a part of Collection Development module in level two, students should know all the methods for evaluating the collection in the library.* One can deduce that informetrics education is well suited to both undergraduate and postgraduate levels of education. Zhao, Guo and Fu (2016: 541) too, reported that informetrics education in China is offered to both undergraduate and postgraduate levels of education. The fact that some librarians learn bibliometrics on-the-job (Kennan, Corrall, and Afzal, 2014: 673) necessitates LIS schools to provide informetrics education, both as formal and informal qualifications through continuing education in the form of short courses and workshops.

## 5.3. What is the content of informetrics education in SA's LIS departments?

The informetrics lecturers were requested to share their course outlines, which were analysed using the content analysis schedule that was designed. The content analysis was conducted to establish what is actually taught by LIS departments that offer informetrics education. Noting the lack of uniformity among LIS departments in South Africa and abroad, the current study sought to figure out the contents of informetrics from both course outlines and questionnaires as were provided by the informetrics lecturers. The aim was to establish the contents of informetrics education offered by the LIS department in SA. There is no uniformity among the course content for informetrics. However, the term 'bibliometrics' was more commonly used than the term 'informetrics'. The bibliometrics concepts and the application of informetrics seem to be the most noticeable focus point of informetrics education. This finding validates the idea in chapter two, that the content of informetrics education from around the world is not the same. However, the concepts, theories, laws and application of informetrics were found to be common in most LIS departments that offer informetrics education. The lack of consensus among informetrics specialists was also noted by Wormell (1998: 259) as a challenge facing the subject of informetrics; but not only informetrics, but the entire field of LIS has been criticised for its lack of uniformity across it departments (Majanja, 2007: 4). Thus, guidelines on what must be included or excluded in informetrics education at UG and PG levels still remain an issue.

## 5.4. What are the methods for teaching informetrics in LIS departments in SA?

This study confirmed the findings in Raju (2005: 76) and Majanja (2007: 4) concerning the lack of uniformity in which the LIS education is offered, locally and globally. While there are differences in their curriculum offerings, there seem to be similarities in their teaching methods. The blended teaching and learning method seems to dominate many LIS institutions. However, UCT uses only face-to-face method, while UL combines the lecture method (face-to-face) and group discussion methods for informetrics education. The case studies and group discussion methods are mostly used to provide informetrics education. All respondents agreed that students are encouraged to work independently exploring the concepts and application of informetrics. This approach supports the notion pointed out in the Heutagogical Teaching and Learning Theory (in chapter two), that students are major participants in their own learning in order to meet the educational demands of the 21st century. It is clear that the blended method of teaching and learning is more appropriate when offering informetrics education. This can be explained by the reliance of informetrics education on ICT resources (e.g. databases and online information retrieval) which change quite rapidly. As Dangwal (2017: 129) acknowledges, the blended learning covers the merits of both conventional and ICT supported education. Ndwandwe (2009: 89) acknowledges that students come from diverse backgrounds and have different range of knowledge and practical experiences; therefore, they require diverse methods of education. Similarly, the Curriculum Development Model suggests that a well functional curriculum involves identification of useful resources and relevant methods for teaching, learning and assessments (Wolf, 2007). The blended learning presents variety of avenues for students to take responsibility of their own learning.

The assessment methods vary from department to department, on the bases that some departments offer informetrics education at a Masters level, where the exam is not a part of assessment. LIS education at the University of KwaZulu Natal and at the University of Cape Town is offered at Masters and Phd levels. They both do not offer Undergraduate LIS qualifications. The University of Cape Town sets the formal end of module/course exam (weightings=70%) and the assignments (weightings= 30%). The University of Zululand sets group and individual based assignments (weightings=20%), topic-based tests (weightings=20%) and the exam (weightings=50%). The University of Western Cape sets practical assessments

(Weightings=40%) and assignments (Weightings=60%). Universities do offer guidelines on assessment methods that academic departments/faculty are required to comply with therefore deviation from such policy/guideline was not expected.

## 5.5. What are the challenges surrounding informetrics education in LIS departments in SA?

The informetrics lecturers/respondents were requested to highlight the challenges they encounter as they are responsible for informetrics education. Most of the challenges reported are old and have been noted by many scholars as challenges affecting the field/domain of informetrics (Wormell, 1998: 259; Ajiferuke, 2011: 182; Hood and Wilson, 2003: 593; Kennan, Corrall, and Afzal, 2014: 673). The shortage of qualified lecturers, lack of informetrics curriculum, lack of short courses on informetrics, and lack of interest to teach informetrics were challenges outlined by the respondent from University of Zululand. The challenge of limited qualified informetrics professionals has been the most commonly mentioned by researchers. The access to ICT resources (including subscription databases) was highlighted by the respondent from University of Cape Town. It was noted that the LIS professionals find it hard to keep up with the trends in ICTs. The respondent from University of Western Cape stated that "*it is hard to understand modern informetrics, which includes Web2.0 and social media, as they are different from traditional bibliometrics*". The rapid development of informetrics was found to make it hard to teach informetrics. Bitso and Raju (2015: 21) confirm that the rapid evolvement of ICTs challenges LIS to produce graduates who are able to effectively mediate this dynamic information society.

The current research sought to solicit suggestions for overcoming challenges associated with informetrics education. The creation of awareness of bibliometrics education was suggested by the respondent from University of Zululand. This suggestion came from an observation that there are still few LIS professionals and departments who attend to the development of informetrics. Intensifying staff development and capacity building could help mitigate the challenge of shortage of informetrics specialists. Further, provision of short courses for capacity building

could also assist in increasing the number of informetrics specialists. The incorporation of informetrics education within the LIS curriculum was suggested as well

The respondent from University of Cape Town had noted the challenge of students struggling to grasp informetrics concepts. In this regard, it was suggested that the use of case studies to ease informetrics education is essential. Noting that informetrics intensely rely on databases, the respondent suggested the use of Google Scholar to cut costs.

The challenge of keeping up with the rapidly evolving nature of informetrics was noted. The respondent from the University of Western Cape suggested that students should familiarise themselves with platforms like Google Scholar, Scopus, Web of Science, etc. She further suggested that students do their work more independently.

Informetrics education is very important across scholarly cycles, and therefore needs to be improved. The respondents were requested to share their views on how informetrics education can be improved. According to the respondent from University of Zululand, the LIS departments should intensify awareness, benchmarking, and capacity building by producing more bibliometricians. Further, he added that LIS departments and professionals should exchange experiences, use novel teaching methods, read relevant books/manuals for the course designed for specific needs, and do analysis/research. The respondent from the University of Cape Town advocated the use of examples of informetrics works that were locally conducted when teaching informetrics. According to the respondent from the University of Western Cape, informetrics education could be improved by providing practice through exercises and practical workshops; exploring and keeping up to date with developments; and getting familiar with metrics. As Ocholla and Ocholla (2014: 5) acknowledge, modern libraries are increasingly computerised, the LIS departments have the responsibility to equip their professionals with necessary skills to operate in the modern world. As Raju (2013: 76) supports, if the LIS department do not make appropriate curriculum innovations to respond to technological changes, they will face challenges.

## 5.6. Summary

This chapter provided a discussion of the research findings. The research questions, theoretical foundation that underpinned the study and the literature review guided the discussion of findings. The results revealed a wide variation of names for LIS departments in SA. In the country, the LIS department at the University of South Africa was the only LIS department that does not offer contact mode of teaching. All respondents confirmed that informetrics is important and relevant within LIS education. Informetrics education was found to be adopted in only five of eight departments that participated in the study. Three LIS departments (UCT, UKZN, and UWC) offer it at postgraduate level (masters), and two departments (UNIZULU and UL) offer it at an undergraduate level. The LIS department at the University of Zululand is the only LIS department that offers informetrics education as a module; others offer it only as a chapter in a module. The blended learning method was found to be commonly used among LIS departments with informetrics education. There is no uniformity in the content coverage of informetrics education of the studied LIS departments. Numerous challenges were outlined and suggestions for overcoming those challenges were addressed. The next chapter (six) will provide summary, conclusions and recommendations for the entire study. Suggestions for further research are also provided.

# CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATION

## 6.1. Introduction

The aim of this chapter is to summarise the entire research, draw conclusions and provide recommendations. The summary will be provided in line with the research questions of the study, which were addressed as:

(a) What is the status of informetrics education, within LIS departments, in South Africa?
(b) What is the content of informetrics education in SA's LIS departments?
(c) What are the methods for teaching informetrics in LIS departments in SA?
(d) What are the challenges surrounding informetrics education in LIS departments in SA?

## 6.2. Summary of the findings

The summary is presented from sections 6.2.1 to section 6.2.4 by research questions.

### 6.2.1. Research Question 1: What is the status of informetrics education within LIS departments in SA?

The aim of this research question was to explore the presence of informetrics education in Library and Information Science departments in South Africa. The objective was motivated by the existing literature and the researcher's observation that not so much is known in terms of informetrics education is South Africa. In order to determine this, the heads of LIS departments in South Africa were requested to indicate if their departments offer informetrics education. The study found that only five LIS departments offer informetrics education in SA and the length and content varied significantly. These were the LIS department in the University of Zululand, University of Cape Town, University of KwaZulu-Natal, and University of Limpopo. While some universities without informetrics education do acknowledge its importance, they do not see informetrics as core/necessary to information science students. Assumable, the skill shortage (as reported in many cases) on informetrics could have contributed to the absence of informetrics

education in some LIS departments. This is because informetrics education cannot be offered when no one can teach it.

The LIS education generally offers both undergraduate and postgraduate programmes. The duration of undergraduate programmes normally range from NQF level 7(Undergraduate three year Bachelor degree) to four years Undergraduate (or Honours Degree) or Postgraduate Diploma at NQF level 8 followed by Masters (NQF level 9) and Doctorate (NQF level 10). It was desirable to establish the level at which informetrics education is offered by LIS departments in South Africa. The study found that three LIS departments (University of Cape Town, University of KwaZulu-Natal, and University of Western Cape) offer informetrics at postgraduate level (masters). The two universities (University of Cape Town and University of KwaZulu-Natal) do not offer undergraduate LIS qualifications. The University of Limpopo offers it at an undergraduate level (one, two, three and PG honours). The University of Zululand offers it to undergraduate students (level three and four).

### 6.2.2. Research Question 2: What is the content of informetrics education in SA's LIS departments?

The research sought to analyse the content of informetrics education being offered. The findings of this study revealed that there is no uniformity in what is taught as elements of informetrics in LIS departments. It is assumed that the dynamic nature of informetrics has a considerable impact on the lack of uniformity on its education. Again, the lack of consensus among LIS departments was also pointed out. The extent of what is offered in informetrics education varies from one department to another. However, the informetrics/bibliometrics concepts, theories/models, laws, citation analysis and applications were common in most educational aspects of informetrics. Considering the extent of informetrics education offered, the University of Zululand offers informetrics education as a semester long module in a full programme and also in the Advanced Information Retrieval module as a chapter for two- weeks. The University of Cape Town offers it as chapters in two modules: the Research Librarianship and the Information Resources. The University of Limpopo offers it as a chapter in a module (Collection Development). The University of KwaZulu-Natal offers it as a chapter in a module (Advanced Literature Searching and Evaluation). The University of Western Cape offers informetrics education as a chapter in a

module (ICT Trends in LIS). There does not seem to be uniformity on the module or course where it is offered as a part of a module/course.

### 6.2.3. Research Question 3: What are the methods for teaching informetrics in LIS departments in SA?

The study sought to determine the methods used for informetrics education. The findings of the study revealed that the blended learning method of teaching was commonly used across LIS departments. The blended method is complex in nature and it allows a wide range of teaching and learning strategies. This method of teaching is compatible with both conventional and modern ways of teaching that involve Web 2.0. The University of Cape Town uses case studies to drive home the theoretical concepts of bibliometrics. The online databases are used for practical exercises where students are encouraged to work independently. The University of Zululand uses case studies and discussion groups for learning and understanding bibliometrics concepts. Students end up producing basic bibliometrics research reports on a variety of themes (e.g crime, Obesity, HIV/AIDS, etc.). Moodle online platform was used as a learning management system (LMS), and the online databases were used for practical experience. The University of Western Cape uses lecture method on part-time basis. However, there is an online portal in place.

In terms of the assessment methods, The University of Cape Town had the formal end of module/course exam (weightings= 70%) and the assignments (weightings=30%). For the University of Zululand, the group and individual based assignments (weightings=20%), topic-based tests (weightings=30%) and exam (weightings=50%). For the University of Western Cape, practical assessments (weightings=40%), assignments (60%) and there was no exam. The University teaching methods are largely regulated by their respective teaching and learning policies and divisions.

### 6.2.4. Research Question 4: What are the challenges surrounding informetrics education in LIS departments in SA?

It was important for this study to expose the challenges that surround informetrics education. Exposing such challenges would enable LIS departments and informetrics lecturers to share views on how to deal with the challenges. The study revealed the following challenges:

- Shortage of qualified lecturers to teach informetrics education as part of succession plan.
- Lack of informetrics curricula;
- Lack of short courses on informetrics;
- Lack of willingness to teach informetrics: LIS schools do not take informetrics education seriously;
- Difficulty of access to and utilisation of databases (subscription databases);
- Keeping up with the dynamics of informetrics;
- Broad scope of informetrics raising controversies and confusion; and
- Rapidly changing nature of informetrics making it hard to teach.

## 6.3. Conclusions

The aim of this study was to explore informetrics education in Library and Information Science departments in South Africa. The study targeted all LIS departments in South Africa. Nine LIS departments were found in SA. The heads of LIS departments and informetrics lecturers were requested to participate in the study through survey questionnaire. The course outlines were also requested from informetrics lecturers for content analysis. The study used both survey and the contents analysis methods. Out of nine HODs in SA, only eight participated in the study. The results obtained were sufficient to achieve the objectives of the study.

Out of eight HODs who participated, only five indicated the presence of informetrics education. In all five departments, informetrics is taught as a chapter or part of a module. However, among the five departments, only one department offered a stand-alone module in a programme/qualification that is devoted to informetrics. Where informetrics is offered as part of a module, the content appears in the following areas: the Research Librarianship, Collection Development, Advanced Literature Searching and Evaluation, and ICT Trends in LIS and

Advanced Information Retrieval Abstracting and Indexing. Informetrics is offered at both undergraduate and postgraduate levels of education. Postgraduate education occurs in two universities that do not offer undergraduate LIS education. There is no consensus on the content of informetrics education from one department to another. The blended education (inclusive of case studies, group discussions, and e-learning) is commonly used. A number of challenges were noted and most of them are rooted in the nature of informetrics being broad, ICT reliant and dynamic. The study concluded that informetrics education is insignificant in South Africa.

This study focused only on the LIS departments within South Africa. Even though the literature had provided evidence that some institutional libraries do offer informetrics education in the form of workshops, this study was limited to the informetrics education offered by academic departments of Library and Information Science. The current study suggests that the challenges that were noted with regards to informetrics and informetrics education are placed on the agenda of supporting the LIS education in Africa and abroad

The originality of this study is based on the study being done for the first time in the country in a field that has not yet received substantial recognition in academic cycles, but retains a great value for research evaluation and measurement. The literature review and results of the current study showed that informetrics education is limited worldwide. This study hoped to help LIS department realise the importance of informetrics education and research results and a platform for exploring and developing informetrics education among LIS departments. Both local and international students who wish to study informetrics in SA will benefit from the study. The recommendations are provided below.

## 6.4. Recommendations

The study proposes the following recommendations towards overcoming noted challenges and improving the informetrics education in the field of LIS.

### 6.4.1. The status of informetrics in LIS education

In terms of the presence of informetrics education, the current study confirmed that the informetrics education is still not given enough attention in LIS education in South Africa. The

study recommends that the LIS departments should intensify the creation of awareness on informetrics education so that it can be recognised by other departments that do not offer it. Such awareness could be undertaken through domain-based conferences, seminars and workshop, research, invited lectures, curriculum development, continuing education, partnership with other related bibliometrics or research evaluation and measurement units within the universities..

Since informetrics is at the centre of research evaluation and the majority of LIS professionals recognise its importance, informetrics should be a core, or at least an elective, module of LIS education.

Benchmarking and capacity building of more informetricians through education and training are also recommended. For capacity building, LIS departments are encouraged to offer short courses on informetrics. Such short courses (e.g. higher certificate and diploma), or non-qualification based courses, would enable already qualified LIS professionals to acquire informetrics skills.

Informetrics education cannot be popular without students studying informetrics. Therefore, they should be encouraged and supported to develop interest in informetrics. This can be done by using relevant information/library service examples, such as: collection evaluation, metrics analysis for scholars/academics, databases analysis, subject analysis, link analysis, and faculty/department research performance analysis, among other.

### 6.4.2. The content of informetrics education

Most LIS departments sampled offer informetrics as a chapter or part of a module. This implies a considerable weakness of informetrics education within LIS education as such content is quite inadequate. Thus, some of the LIS departments offered it for few hours in a whole year. This study therefore recommends that the content of informetrics education offered is broadened to full modules and that the offering, in terms of notional hours, be revisited and extended.

Considering the differences in what is taught as informetrics from department to department, the study recommends that LIS departments meet, exchange experiences and partner/collaborate to develop suitable curricula. The challenges associated with informetrics could be efficiently dealt with if there is some degree of uniformity in core content offerings among LIS departments. In the case where consensus is not feasible among LIS departments; the departments need

analysis/research, relevant reading/books/manual for the course designed for specific needs (e.g. informetrics).

It is recommended that the lower levels (at undergraduate level) are offered with introductory perspective of informetrics, such as concepts, theories/ laws and application. At the postgraduate level, the study recommends that students engage with the applications of informetrics where theory has been covered at the basic level.

### 6.4.3. The teaching methods for informetrics education

In order to make informetrics teaching easier, the LIS departments should use novel teaching methods such as blended learning. The examples of informetrics studies that have been conducted locally and regionally should be used for a start when teaching informetrics along a blended learning approach, as it would help students quickly grasp the informetrics skills. Based on this authors experience as a student in the informetrics module, LIS/informetrics lecturers should encourage students to work independently as they learn a lot that way.

It has been reported in several instances that it is not easy to master informetrics skills, based on the fact that nature of informetrics changes as technology evolves. In that regard, it is important for both LIS professionals and students to explore and keep up with the trends and developments in LIS. To achieve that, the study recommends that the LIS professionals and students familiarise themselves with, and possibly master the databases like Google Scholar, Web of Science and Scopus, to enable better informetrics analysis.

### 6.4.4. Challenges surrounding informetrics

The study found that many challenges associated with informetrics emanate from its ICT reliant nature. Generally, the field of LIS is becoming more ICT controlled. Therefore, the study recommends that LIS curricula should be designed in a manner that exposes students to a variety of ICT resources. Informetrics resources are generally expensive; hence, it is recommended that LIS departments market their academic offerings to funding bodies, such as parental institutions and government, so that they can acquire funding for informetrics resources. The lack of interest in informetrics by LIS professionals can be dealt with through rewarding those researchers who make notable contributions informetrics.

## 6.5. Further Research

It is recommended that further studies are conducted beyond the limitations of the current study. The recommendations for further research are, but not limited to:

- Explore informetrics services in academic and research libraries to review informetrics education.
- Establish which other tertiary institutions offer informetrics related studies such as research evaluation and performance measurement.
- Explore informetrics workshops and on-going short courses offered in academic institutions.

# References


Ajiferuke, I., 2011. How to overcome some of the challenges that African scholars are facing in conducting informetrics research. South African Journal of Libraries and Information Science, 77(2), pp.179-183. Available: http://dx.doi.org/10.7553/77-2-59 [Accessed: 18/01/2018]

Antwi, S.K. and Hamza, K., 2015. Qualitative and quantitative research paradigms in business research: A philosophical reflection. European Journal of Business and Management, 7(3), pp.217-225.

Asernova, I., 2013. New application of bibliometrics. Procedia-Social and Behavioural Sciences, 73, pp.678-682.

Bar-Ilan, J. and Peritz, B.C., 2002. Informetric theories and methods for exploring the Internet: An analytical survey of recent research literature. Available: https://www.ideals.illinois.edu/bitstream/handle/2142/8413/librarytrendsv50i3f_opt.pdf?sequence=1 [Accessed: 23/05/2018]

Bar-Ilan, J., 2008. Informetrics at the beginning of the 21st century: A review. Journal of informetrics, 2(1), pp.1-52.

Bellamy, C., 2011. Principles of methodology: Research design in social science. Sage.

Besen-Cassino, Y. and Cassino, D. 2018. Research Methods by Example. Pearson.

Bhattacherjee, A. 2012. Social science research: principles, methods, and practices. Available: http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1002&context=oa_textbooks [Accessed: 07/02/2018]

Bhavnani, S.K. and Wilson, C.S., 2010. Information scattering. Encyclopedia of Library and Information Sciences, 2564.

Bitso, C. & Raju, R. Eds. 2015. LIS education and research in a dynamic information landscape: proceedings of the Library and Information Studies Centre 75 years commemorative conference. Cape Town: University of Cape Town Libraries.

Björneborn, L. and Ingwersen, P., 2004. Toward a basic framework for webometrics. Journal of the Association for Information Science and Technology, 55(14), pp.1216-1227. Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.95.1068&rep=rep1&type=pdf [Accessed: 26/01/2018]

Blaschke, L.M., 2012. Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. The International Review of Research in Open and Distributed Learning, 13(1), pp.56-71. Available: http://www.irrodl.org/index.php/irrodl/article/viewFile/1076/2113 [Accessed: 20/05/2019]

Cabos, W. and Campanario, J., 2018. Exploring the Hjif-Index, an Analogue to the H-Like Index for Journal Impact Factors. *Publications*, *6*(2), p.14. Available: https://www.mdpi.com/2304-6775/6/2/14/pdf [Accessed: 16/04/2018]

Canning, N., 2010. Playing with heutagogy: Exploring strategies to empower mature learners in higher education. Journal of Further and Higher Education, 34(1), pp.59-71. Available: https://www.tandfonline.com/doi/pdf/10.1080/03098770903477102?needAccess=true [Accessed: 12/06/2018]

Chimhundu, R. (2018). Research Paradigm, Research Method and Research Design. In Marketing Food Brands (pp. 125-150). Palgrave Macmillan, Cham. Available: https://doi.org/10.1007/978-3-319-75832-9_6 [Accessed: 10/07/2018]

Costas, R. and Bordons, M., 2007. The h-index: Advantages, limitations and its relation with other bibliometrics indicators at the micro level. Journal of informetrics, 1(3), pp.193-203. Available:https://pdfs.semanticscholar.org/fc45/e37fb04546819494c2c64d259bffeded1844.pdf [Accessed: 26/05/2018]

Creswell, J. W. 2003. Quantitative, qualitative and mixed methods approaches: 2nd Ed. SAGE: London

Creswell, J.W. 2009. Research design: qualitative, quantitative and mixed research approaches. 3rd Ed. SAGE: London

Cross, J., 2009. Impact factors–the basics. The E-resources management handbook, 10, pp.9552448-0. Available: https://www.uksg.org/sites/uksg.org/files/19-Cross-H76M463XL884HK78.pdf [Accessed: 23/05/2018]

Dangwal, K.L., 2017. Blended learning: An innovative approach. Universal Journal of Educational Research, 5(1), pp.129-136. http://www.hrpub.org/download/20161230/UJER16-19508256.pdf [Accessed: 23/06/2018]

Davis, M., Wilson, C.S. and Horn, A., 2005. Informing decision-making in libraries: Informetric research as input to LIS education and practice. Australian Academic & Research Libraries, 36(4), pp.195-213. Available: http://www.tandfonline.com/doi/abs/10.1080/00048623.2005.10755310 [Accessed: 07/03/2018]

Department of Higher Education and Training. 2015. The Department of Higher Education and Training Government Gazette. Available: http://www.dhet.gov.za/Policy%20and%20Development%20Support/Research%20Outputs%20policy%20gazette%202015.pdf Accessed: [04/03/2018]

Dubois, A. and Gadde, L.E., 2002. Systematic combining: an abductive approach to case research. Journal of business research, 55(7), pp.553-560. Available: http://www.pm.lth.se/fileadmin/_migrated/content_uploads/6._Dubois_Gadde_Systematic_Combining.pdf [Accessed: 14/03/2018]

Dudovskiy, J. 2016. Ontology. Available: https://research-methodology.net/?s=ontology&submit=Search [Accessed: 20/03/2018]

Egghe, L. and Rousseau, R., 1990. Introduction to informetrics: Quantitative methods in library, documentation and information science. Elsevier Science Publishers. Available: http://eprints.rclis.org/6011/1/pt01.pdf [Accessed: 24/01/2018]

Egghe, L., 1994. Bridging the gaps: conceptual discussions on informetrics. Scientometrics, 30(1), pp.35-47. Available: https://link.springer.com/content/pdf/10.1007%2FBF02017211.pdf [Accessed: 05/05/2018]

Egghe, L., 2005. Expansion of the field of informetrics: Origins and consequences. Available: https://pdfs.semanticscholar.org/b7a2/dd1d7bcdd827c3297a751deb7058008b47e6.pdf?_ga=2.124557642.175278869.1519815650-131185161.1519815650 [Accessed: 13/02/2018]

Erar, A., 2002. Bibliometrics or informetrics: Displaying regularity in scientific patterns by using statistical distributions. Hacettepe Journal of Mathematics and statistics, 31, pp.113-125. Available: http://www.hjms.hacettepe.edu.tr/uploads/b8fd01bd-6ec8-4728-bb1c-1c9b62ba0e3f.pdf [Accessed: 06/05/2018]

Fiala, D. 2013. Morden informetrics methods: for the evaluation of scientific research. Available: https://www.researchgate.net/profile/Dalibor_Fiala/publication/263174287_Modern_Informetric_Methods_for_the_Evaluation_of_Scientific_Research/links/0046353a18debefa09000000/Modern-Informetric-Methods-for-the-Evaluation-of-Scientific-Research.pdf?origin=publication_detail [Accessed: 19/01/2018]

Gabriel, D., 2013. Inductive and deductive approaches to research. *Accessed on February*, *13*.

Galvan, J.L. and Galvan, M.C., 2017. Writing literature reviews: A guide for students of the social and behavioural sciences. Routledge.

Galyavieva, M.S. and Elizarov, A.M., 2017. Informetrics in the World System of Higher Education. Scientific and Technical Information Processing, 44(4), pp.297-301. Available: https://link.springer.com/content/pdf/10.3103%2FS014768821704013X.pdf [Accessed: 12/04/2016]

Galyavieva, M.S., 2013. On the formation of the concept of informetrics. Scientific and Technical Information Processing, 40(2), pp.89-96.

Garfield, E., 1980. Citation indexing: Its theory and application in science, technology, and humanities (Vol. 8). New York: Wiley.

Glänzel, W., 2014. Analysis of co-authorship patterns at the individual level. Transinformação, 26(3), pp.229-238. Available: http://www.scielo.br/pdf/tinf/v26n3/0103-3786-tinf-26-03-00229.pdf [Accessed: 26/05/208]

Grant, C. and Osanloo, A., 2014. Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your "house". Administrative Issues Journal, 4(2), p.4

Gray, L. 2018. Research and the research problem. Available: https://www.nyu.edu/classes/bkg/methods/010072.pdf [Accessed: 24/05/2018]

Guns, R., 2013. The three dimensions of informetrics: a conceptual view. Journal of Documentation, 69(2), pp.295-308.

Haustein, S. 2016. Exploring the meaning of altmetrics. Available: https://figshare.com/articles/Exploring_the_meaning_of_altmetrics/3180367 [accessed: 03/02/2018]

Hirsch, J.E. and Buela-Casal, G., 2014. The meaning of the h-index. *International Journal of Clinical and Health Psychology*, *14*(2), pp.161-164.

Hlongwane, I.K., 2014. Recognition of prior learning (RPL) implementation in Library and Information Science (LIS) schools in South Africa (Doctoral dissertation). Available: http://uir.unisa.ac.za/bitstream/handle/10500/18312/thesis_hlongwane_ik.pdf?sequence=6&isAllowed=y [Accessed: 23/06/2018]

Hood, W.W. and Wilson, C.S., 2003. Informetric studies using databases: Opportunities and challenges. Scientometrics, 58(3), pp.587-608.

Ingwersen, P. 2012. Scientometric Indicators and Webometrics--and the Polyrepresentation Principle Information Retrieval. Ess Ess Publications. Available: http://www.peteringwersen.info/publications/0240_bangalore_phamflet_draft_v1_with_refs.pdf [Accessed: 23/03/2018]

International Society for Scientometrics and Informetrics website. 2018. About the society. Available: http://issi-society.org/about/ [Accessed: 04/05/2018]

Islam, S., Kunifuji, S., Hayama, T. and Miura, M., 2011. E-learning in LIS education: an analysis and prediction. Library Review, 60(7), pp.544-559. Available: https://www.emeraldinsight.com/doi/pdfplus/10.1108/00242531111153579 [Accessed: 23/06/2018]

Jacobs, D., 2010. Demystification of bibliometrics, scientometrics, informetrics and webometrics. In 11th DIS Annual Conference (pp. 1-19). Available: http://www.lis.uzulu.ac.za/research/conferences/2010/DIS%20conference%202010%20DJacobs.pdf [Accessed: 20/01/2018]

Johnson, R.B. and Onwuegbuzie, A.J., 2004. Mixed methods research: A research paradigm whose time has come. Educational researcher, 33(7), pp.14-26. Available: http://www.jstor.org/stable/3700093 [Accessed: 12/03/2018]

Kelly, A. P. 2016. Social research methods. Available: http://www.londoninternational.ac.uk/sites/default/files/programme_resources/lse/lse_pdf [Accessed: 07/01/2018]

Kennan, M.A., Corrall, S. and Afzal, W., 2014. "Making space" in practice and education: Research support services in academic libraries. Library Management, 35(8/9), pp.666-683. Available: http://www.emeraldinsight.com/doi/abs/10.1108/LM-03-2014-0037 [Accessed: 12/02/2018]

Kenyon, C. and Hase, S., 2001. Moving from Andragogy to Heutagogy in Vocational Education. Available: https://files.eric.ed.gov/fulltext/ED456279.pdf [Accessed: 23/06/2018]

Khan, A. and Idrees, H., 2015. Calculating Web impact factor for university websites of Pakistan. The Electronic Library, 33(5), pp.883-895.

Kivunja, C., & Kuyini, A. B. 2017. Understanding and Applying Research Paradigms in Educational Contexts. International Journal of Higher Education, 6(5), 26-41. Available: https://files.eric.ed.gov/fulltext/EJ1154775.pdf [Accessed: 02/07/2018]

Kothari, C. R. 2005. Research methodology: methods and techniques. 2nd Ed. New Age International Publishers: New Delhi

Krauss, S.E., 2005. Research paradigms and meaning making: A primer. The qualitative report, 10(4), pp.758-770. Available: http://nsuworks.nova.edu/cgi/viewcontent.cgi?article=1831&context=tqr [Accessed: 20/01/2018]

Kumbhar, K. N. 2018. Information literacy for academic libraries. Available: https://www.researchgate.net/publication/325594823 Information_literacy_for_academic_libraries [Accessed: 23/04/2018]

Langkos, S. 2014. Research methodology: data collection methods and research tools. Available: https://www.researchgate.net/publication/270956555_CHAPTER_3_-_RESEARCH_METHODOLOGY_Data_collection_method_and_Research_tools?enrichId=rgreq-4431faa2bf250a37607212fd6510fcf0-XXX&enrichSource=Y292ZXJQYWdlOzI3MDk1NjU1NTtBUzoxODY1NTYyNjY1OTAyMDlAMTQyMTQ4OTg4ODczOQ%3D%3D&el=1_x_2&_esc=publicationCoverPdf [Accessed: 20/02/2018]

Le Roux, C.J.B. and Evans, N., 2011. Can cloud computing bridge the digital divide in South African secondary education? Information development, 27(2), pp.109-116. Available: http://www.lis.uzulu.ac.za/2010/Leroux%20RTA%20revised%2023%20Jan%202011.pdf [Accessed 20/06/2018]

Library and Information Association of South Africa. 2015. The state of libraries in South Africa. Available: http://www.liasa-new.org.za/wp-content/uploads/2015/09/State-of-SA-libraries-2015.pdf Accessed: 23/05/2018]

Lockwood, F. ed., 2013. Open and distance learning today. Routledge. Available: https://books.google.co.za/books?hl=en&lr=&id=eMdcAgAAQBAJ&oi=fnd&pg=PP1&dq=Centre+for+Instructional+Development+and+Distance+Education&ots=bVDlx2I9k3&sig=suDXPArj8VRjj2oJPMmeuuTx5XE#v=onepage&q=Centre%20for%20Instructional%20Development%20and%20Distance%20Education&f=false [Accessed: 05/04/2018]

Lund, T., 2012. Combining qualitative and quantitative approaches: Some arguments for mixed methods research. Scandinavian journal of educational research, 56(2), pp.155-165.

Luo, L. 2017. Diversified research methods in LIS: Thinking outside the box. Journal of education for Library and Information Science, 58(2): 49-63.

MacDonald, S. and Headlam, N. n.d. Research methods handbook: Introductory guide to research methods for social research. CLES: Manchester

Mahesh, C. and Neena, T. T. 2011. Social research methods. Available: http://www.universityofcalicut.info/SDE/Social_Research_Methods_on25Feb2016.pdf [Accessed: 06/01/2018]

Majanja, M.K., 2009, September. Which way for LIS education and training in South Africa? Some considerations from contact and distance learning. In Proceedings of DLIS 10th Annual Conference, University of Zululand, 10-11 September 2009 (pp. 17-34). Available: http://www.lis.uzulu.ac.za/2009/UniZulu%20conference%202009_Minishi-Majanja.pdf [Accessed: 23/01/2018]

Maluleka, J.R. and Onyancha, O.B., 2016. Research collaboration among Library and Information Science schools in South Africa (1991–2012): an informetrics study. Mousaion, 34(3), pp.36-59. Available: https://link.springer.com/content/pdf/10.1007%2Fs11192-016-1846-0.pdf [Accessed: 12/06/2018]

Mamabolo, L.R.C., 2009. The experiences of registered nurses involved in termination of pregnancy at Soshanguve Community Health Centre (Doctoral dissertation). Available: http://uir.unisa.ac.za/bitstream/handle/10500/1962/00front.pdf;jsessionid=3B9F48B9E8456F5E865EFEA4E8C8E6B3?sequence=4 [Accessed: 20/01/2018]

Maree, K. 2007. First steps in research. Revised Ed. Van Schaik: Pretoria

Markscheffel, B., 2016. Education in Informetrics: An overview for Germany–and–An Approach in an Information Retrieval Context. Trends in Bibliometrics and Scientometrics Studies.–Athena Academics, pp.59-69.

Mayr, P. and Scharnhorst, A., 2015. Combining bibliometrics and information retrieval: preface. Scientometrics, 102(3), pp.2191-2192. Available: https://link.springer.com/content/pdf/10.1007%2Fs11192-015-1529-2.pdf [Accessed: 03/05/2018]

McKiernan, G., 2005. Bibliometrics, cybermetrics, informetrics, and scientometrics sites and sources. Science & Technology Libraries, 26(2), pp.107-115. Available: https://doi.org/10.1300/J122v26n02_06 [Accessed: 24/05/2018]

Meho, L.I. and Yang, K., 2007. Impact of data sources on citation counts and rankings of LIS faculty: Web of Science versus Scopus and Google Scholar. Journal of the American society for information science and technology, 58(13), pp.2105-2125. Available: https://onlinelibrary.wiley.com/doi/epdf/10.1002/asi.20677 [Accessed: 21/04/2018]

Meyer, M., Waldkirch, R.W., Duscher, I. and Just, A., 2017. Drivers of citations: An analysis of publications in "top" accounting journals. Critical Perspectives on Accounting. Available: https://ac.els-cdn.com/S1045235417300722/1-s2.0-S1045235417300722-main.pdf?_tid=9b903a3a-7474-4cd2-8eee-3e9e646cade6&acdnat=1527581596_df5b2698dc0c764de0546d5999b61880 [Accessed: 21/05/2018]

Milojević, S. and Leydesdorff, L., 2013. Information metrics (iMetrics): a research specialty with a socio-cognitive identity?. Scientometrics, 95(1), pp.141-157.

Majanja, M.K. 2007, August. Integration of ICTs in library and information science education in sub-Saharan Africa. In World Library and Information Congress: 73rd IFLA General Conference and Council. Retrieved from http://www. ifla. org/IV/ifla73/index. htm. Available: http://archive.ifla.org/IV/ifla73/papers/083-Minishi-Majanja-en.pdf [Accessed: 20/03/2018]

Ndwandwe, S.C., 2009. Teaching and learning of Information Ethics in Library and Information Science Departments/Schools in South Africa (Doctoral dissertation, University of Zululand). Available: http://uzspace.uzulu.ac.za/handle/10530/1281 [Accessed: 28/03/2018]

Neuman, W. L. 2014. Social research methods: qualitative, quantitative approaches. 7th Ed. Pearson Education Limited: Harlow.

Neuman, W.L. 2013. Social research methods: Qualitative and quantitative approaches. Pearson education.

Ngulube, P. 2015. Trends in research methodological procedures used in knowledge management studies. African Journal of Library, Archives and Information Science, 25(2), pp.125-143. Available:

http://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=1&sid=473a2db8-f3d9-4cc6-b235-df826423475e%40sessionmgr102 [Accessed: 23/03/2018]

Ocholla, D. and Bothma, T. 2007. Trends, challenges and opportunities for LIS education and training in Eastern and Southern Africa. New library world, 108(1/2): 55-78

Ocholla, D. and Shongwe, M., 2013. An analysis of the library and information science (LIS) job market in South Africa. South African Journal of Libraries and Information Science, 79(1), pp.35-43.

Ocholla, D.N., 2007. The International Society for Scientometrics and Informetrics Conference (ISSI) comes to South Africa. Report on the 11th ISSI International Conference, Madrid (Spain) June 25th-27, 2007: general contribution. South African Journal of Libraries and Information Science, 73(2), pp.186-188. Available: file:///C:/Users/20022948/Downloads/1352-2111-1-PB.pdf [Accessed: 07/11/2018]

Ocholla, L. and Ocholla, D., 2014. Cataloguing and classification education (CCE) and training in library and information science/Studies departments in South Africa. South African Journal of Libraries and Information Science, 80(1), pp.1-7. Available: https://journals.co.za/content/liasa/80/1/EJC156013 [Accessed: 21/03/2018]

Ohio State University website. 2018. Scholarly impact and citation analysis. Available: https://osu.libguides.com/oardc/citation_analysis/whatis [Accessed: 20/05/2018]

Pandey, P. and Pandey, M. M. 2015. RESEARCH METHODOLOGY: TOOLS AND TECHNIQUES. Bridge Centre: Romania. Available: http://euacademic.org/BookUpload/9.pdf [Accessed: 09/03/2018]

Papic, A., 2017, May. Informetrics: The development, conditions and perspectives. In Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2017 40th International Convention on (pp. 700-704). IEEE. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7973513 [Accessed: 30/05/2018]

Parslow, G.R., 2010. Commentary: Heutagogy, the practice of self-learning. Biochemistry and Molecular Biology Education, 38(2), pp.121-121. Available:

https://iubmb.onlinelibrary.wiley.com/doi/pdf/10.1002/bmb.20394 [Accessed: 24/06/2018]

Pendlebury, D.A., 2008. White paper: Using bibliometrics in evaluating research. Aavailable: http://www.citeulike.org/group/1212/article/3790152 [Accessed: 12/05/2018]

Peters, I. and Bar-Ilan, J., 2014. Informetrics, bibliometrics, altmetrics: What is it all about?. Proceedings of the Association for Information Science and Technology, 51(1), pp.1-4. Available: https://doi.org/10.1002/meet.2014.14505101015 [Accessed: 06/05/2018]

Pouris, A., 2012. Scientometric research in South Africa and successful policy instruments. Scientometrics, 91(2), pp.317-325. Available: http://hdl.handle.net/2263/19106 [Accessed: 02/05/2018]

Rajan, T.N. and Sen, B.K., 1986. An essay on informetrics: a study on growth and development. Available: http://nopr.niscair.res.in/bitstream/123456789/27883/1/ALIS%2033%281-2%29%201-12.pdf [Accessed: 06/05/2018]

Rajasekar, S., Philominathan, P. and Chinnathambi, V., 2006. Research methodology. arXiv preprint physics/0601009. Available: https://arxiv.org/abs/physics/0601009 [accessed: 14/04/2018]

Rajkoomar, M., 2015. The development of a framework for blended learning in the delivery of Library and Information Science curricula at South African universities (Doctoral dissertation). Available: https://ir.dut.ac.za/bitstream/10321/1397/1/RAJKOOMAR_2015.pdf [accessed: 14/04/2018]

Raju, J., 2003. The 'core'in library and/or information science education and training. Education for Information, 21(4), pp.229-242.

Raju, J., 2005. LIS education and training in South Africa: a historical review. South African Journal of Libraries and Information Science, 71(1), pp.74-84.

Raju, J., 2017. LIS professional competency index for the higher education sector in South Africa. Available:

http://openbooks.uct.ac.za/LISindex/index.php/LISindex/catalog/view/2/1/28-6 Accessed: [23/06/2018]

Rehman, A.A. and Alharthi, K. 2016. An Introduction to Research Paradigms. Available: https://www.researchgate.net/profile/Adil_Abdul_Rehman/publication/325022648_An_introduction_to_research_paradigms/links/5af1fb9caca272bf4256367b/An-introduction-to-research-paradigms.pdf [Accessed: 12/03/2018]

Rich, K. L. 2013. Introduction to ethics. Available: http://samples.jbpub.com/9781449649005/22183_CH01_Pass3.pdf [Accessed: 02/03/2018]

Ridley, D. 2012. The literature review: a step-by-step guide for students. 2nd Ed. SAGE: Los Angeles

Romm, N. and Ngulube, P., 2015. Mixed methods research. Addressing research challenges: Making headway for emerging researchers. Avialable: https://www.researchgate.net/profile/Patrick_Ngulube/publication/305728941_Mixed_methods_research/links/579ddf2408ae80bf6ea69223/Mixed-methods-research.pdf [Accessed: 02/03/2018]

Rousseau, R., 2012. A view on" big data" and its relation to Informetrics.

Sarmah, M. and Sen, D., 2014. Blended Learning Solution for the LIS Education: AU Perspective. Available: http://ir.inflibnet.ac.in:8080/ir/bitstream/1944/1823/1/20.pdf [Accessed: 01/04/20118]

Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students fifth edition (fifth). Available: https://eclass.teicrete.gr/modules/document/file.php/DLH105/Research%20Methods%20for%20Business%20Students%2C%205th%20Edition.pdf [Accessed: 20/06/2018]

Schaer, P., 2013. Applied informetrics for digital libraries: an overview of foundations, problems and current approaches. Historical Social Research/Historische Sozialforschung, pp.267-281. Available: http://eprints.rclis.org/22630/1/HSR_38.3_Schaer_a.pdf [Accessed: 22/11/2018]

Sen, B.K., 2004. Cybermetrics-meaning, definition, scope and constituents. Available: http://nopr.niscair.res.in/bitstream/123456789/4064/1/ALIS%2051(3)%20116-120.pdf [Accessed: 18/04/2018]

Shannon-Baker, P., 2016. Making paradigms meaningful in mixed methods research. Journal of Mixed Methods Research, 10(4), pp.319-334. Available: http://journals.sagepub.com/doi/abs/10.1177/1558689815575861 [Accessed: 12/03/2018]

Shukla, A. 2015. Conceptual Approach to Webometrics: An Exploratory Study. Available: https://www.researchgate.net/publication/277957810_Conceptual_Approach_to_Webometrics_An_Exploratory_Study [Accessed: 24/01/2018]

Smith, J. and Small, R., 2017. Is It Necessary to Articulate a Research Methodology When Reporting on Theoretical Research?. Bulgarian Comparative Education Society.

Solarino, S., 2012. Impact Factor, Citation Index, H-Index: are researchers still free to choose where and how to publish their results?. Annals of geophysics, 55(3). Available: https://www.annalsofgeophysics.eu/index.php/annals/article/download/5518/6048 [Accessed: 24/05/2018]

Stock, W.G. and Weber, S., 2006. Facets of informetrics. Information-Wissenschaft und Praxis, 57(8), pp.385-389. Available: http://www.elshami.com/Terms/I/Informetrics-Sutcliff.pdf [Accessed: 23/02/2018]

Sun, Y., Nishizawa, M. and Markscheffel, B., 2016. Education in informetrics: A case study for Japan. In Proc. of the 13th Int. Conference on Webometrics, Informetrics, and Scientometrics (WIS) and the 18th COLLNET Meeting 2017.

Tague-Sutcliffe, J., 1992. An introduction to informetrics. Information processing & management, 28(1), pp. Available: https://ac.els-cdn.com/030645739290087G/1-s2.0-030645739290087G-main.pdf?_tid=spdf-cacb56c7-7a10-4fa5-9f93-f5dce218f7d4&acdnat=1519678152_731c529c657350c56b93149c51c3ff90 [Accessed: 07/01/2018]

Thomas, P. W. 2010. Research methodology and design. Available: https://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact

=8&ved=0ahUKEwi5wOPi4d3RAhViCMAKHb6_AH4QFggYMAA&url=http%3A%2F%2Fuir.unisa.ac.za%2Fbitstream%2Fhandle%2F10500%2F4245%2F05Chap%25204_Research%2520methodology%2520and%2520design.pdf&usg=AFQjCNG-tD1lJFGUE97ipOaWKUWa63lvow&sig2=fen1ubXI06dEgawefBIRFA&bvm=bv.145063293,d.bGs [Accessed: 06/01/2018]

Trochim, W. M. K. 2006. Deduction and induction. Available: https://www.socialresearchmethods.net/kb/dedind.php [Accessed: 20/03/2018]

Turner, J., 2009. Logic and ontological pluralism. Journal of philosophical logic, 41(2), pp.419-448. Available: https://link.springer.com/article/10.1007/s10992-010-9167-x [Access: 21/03/2018]

Unirank. 2017. Top univeristies in South Africa. Available: http://www.4icu.org/za/ [Accessed: 22/02/2018]

University of Zululand. 2017. Bachelor of Arts Information Science. (AIDEG1). Available: http://www.unizulu.ac.za/course/bachelor-of-arts-in-information-science-aideg1/ accessed: 11/02/2018]

University of Zululand. 2012. Ethics integrity. Available: http://www.unizulu.ac.za/forms/#1492072068581-ad877b99-7373 [Accessed: 06/06/2018]

Vosloo, J. J. 2014. Research design and methodology. Available: http://dspace.nwu.ac.za/bitstream/handle/10394/12269/Vosloo_JJ_Chapter_5.pdf?sequence=6 [Accessed: 07/03/2018]

Walliman, N., 2017. Research methods: The basics. Routledge. Available: https://www.taylorfrancis.com/books/9781315529004 [Accessed: 20/04/2018]

Waltman, L., 2016. A review of the literature on citation impact indicators. Journal of informetrics, 10(2), pp.365-391

Wayne, G. and Stuart, M. 2001. Research Methodology: an introduction. 2nd Ed. Lansdowne.

Web of Science website. 2018. Informetrics. Available http://wcs.webofknowledge.com/RA/analyze.do [Accessed: 11/06/2018]

Weber, S. 2010. Design Science Research: Paradigm or Approach?. In AMCIS (p. 214). Available: https://pdfs.semanticscholar.org/7c31/a4019ab19db0123c90ba72250bc99d80ace5.pdf [Accessed: 02/07/2018]

Wolf, P., 2007. A model for facilitating curriculum development in higher education: A faculty-driven, data-informed, and educational developer–supported approach. New Directions for Teaching and Learning, 2007(112), pp.15-20. Available: http://onlinelibrary.wiley.com/doi/10.1002/tl.294/full [Accessed: 12/02/2018]

Wolfram, D., 2003. Applied informetrics for information retrieval research (No. 36). Greenwood Publishing Group. Available: https://books.google.co.za/books?id=FhPeRRKGLAUC&pg=PA39&lpg=PA39&dq=informetrics+Nacke&source=bl&ots=rVml3eMWmh&sig=Hk83m47tTnpgwxzRYrGfW-eb4RA&hl=en&sa=X&ved=0ahUKEwj81NbF0JLXAhVlBcAKHRpYBl4Q6AEISTAH#v=onepage&q=informetrics%20Nacke&f=false [Accessed: 23/03/2018]

Wormell, I. 1998. "Informetrics: an emerging sub-discipline in information science", Asian Libraries, Vol. 7 Issue: 10, pp.257-268, https://doi.org/10.1108/10176749810241838 [Accessed: 23/02/2018]

Xavier University Library. 2012. Qualitative versus quantitative research. Available: https://www.xavier.edu/library/students/documents/qualitative_quantitative.pdf [Accessed: 20/01/2018]

Yang, J.A. and Yoo, J.B. 2018. A Critique of Methodological Dualism in Education. Universal Journal of Educational Research, 6(2), pp.307-312. Available: https://eric.ed.gov/?id=EJ1170779 [Accessed: 23/05/2018]

Zhao, R., Guo, F. and Fu, Z., 2016. Investigation and analysis of Informetrics curriculum education in China. Library Hi Tech, 34(3), pp.539-548. Available: http://www.emeraldinsight.com/doi/pdfplus/10.1108/LHT-08-2015-0080 [Accessed:25/03/2018]

# APPENDIX A: QUESTIONNIARE TO HODs

## Questionnaire for Heads of Library and Information Science Departments (HODs)

Dear Respondent

I am a Masters student in the Department of Information Studies at the University of Zululand. I am conducting a study entitled "*Informetrics education in Library and Information Science (LIS) departments in South Africa*". The informetrics in this context includes bibliometrics, scientometrics, cybermetrics, webometrics and altmetrics. The aim of the study is to explore informetrics education in Library and Information Science departments in South Africa.

I wish to request that you kindly complete and return this survey questionnaire by the 28th of November 2018 to:

Nkosingiphile Mbusozayo Zungu, Email: zungumpilo7@gmail.com. Be assured that information provided will be used for academic purposes only and it will be treated with confidentiality.

The additional questionnaire is to be completed by the lecturer who teaches informetrics (if applicable). Please forward the questionnaire to the relevant lecturer.

Should you have any questions concerning the survey, please contact me at:

Email: zungumpilo7@gmail.com or my supervisor: Prof. D.N. Ocholla, email: OchollaD@unizulu.ac.za

Yours Faithfully

Nkosingiphile Zungu

078 6170 234

*Instruction: Please tick the appropriate answer where applicable*

**Section A: General Information**

1. Name of Institution: _____
2. Faculty/School:_____
3. Name of Department: _____

4. Qualifications offered and Duration

| **Qualification (e.g. Bachelor of Library and Information Science)** | **Duration (Years)** |
|---|---|
| | |
| | |
| | |
| | |
| | |

5. Mission of the Department:

   _____

   _____

   _____

6. What teaching mode is used by the Department? (e.g. contact or distance)

   _____

   _____

7. What is the duration of teaching in the year? (e.g. term or semester)

   _____

---

**Section B: Informetrics education**

8. In your own opinion, do you think informetrics is necessary within LIS education?

   Yes ☐

   ☐

No

9. Please justify your choice

_____

_____

_____

10. If your response to question 8 was NO, which department /discipline do you think should offer informetrics course?

_____

11. Please justify your response

_____

_____

12. Does your Department offer informetrics education?

Yes ☐

No ☐

13. If Yes, please provide the module title and code

_____

14. If No, please state the reason

_____

_____

_____

_____

15. Does the institution offers the informetrics education?

Yes ☐

No ☐

16. If yes, which department offers the informetrics education?

_____

17. Why is an informetrics education offered by the department indicated above?

_____

_____

18. Who is/are responsible for teaching informetrics? (*Multiple responses possible*)

Junior Lecturers ☐
Lecturers ☐
Part-time Lecturers ☐
Senior Lecturers ☐
Associate Professor ☐
Professor ☐
Other/s:_____

19. What is the field of expertise and knowledge of the instructor/lecturer?

Library and Information Science ☐
Philosophy ☐
Computer Science ☐
Economics ☐
Law ☐
Theology ☐

Other_____

20. Which in your opinion, in terms of academic discipline, is better suited to teach informetrics?

_____

21. Why do you think so?

_____

_____

_____

22. To whom is an informetrics education offered?

Undergraduate students ☐

Postgraduate students ☐

Both ☐

Other _____

23. At what study level is the informetrics education offered?

First Year ☐

Second Year ☐

Third Year ☐

Fourth Year ☐

Honours ☐

Masters ☐

Doctorate ☐

24. Why is the informetrics education offered at the level (s) indicated above?

_____

_____

25. What is the extent of informetrics education offered?

A chapter in the module ☐

A module/course in the program ☐

A full program/qualification ☐

26. How long is informetrics education offered?

One Term long ☐

One Semester long ☐

One Year long ☐

Throughout the program ☐

Short-course ☐

27. Why is the module/course offered for the period indicated above?

_____

_____

28. Please specify the methods used for teaching informetrics

Lecturer (face-to-face) ☐

Group discussion ☐

E-learning ☐

Distance education ☐

Blended education ☐

**Section C: Additional information**

29. If the department does not offer an informetrics course/module, is there any other courses/modules with informetrics related content? Please list them and the informetrics content they cover.

| **Course/Module** | **Informetrics content** |
|---|---|
| | |
| | |
| | |
| | |
| | |

30. In case the Department offers an informetrics course/module, what other courses/modules include informetrics related content, please list them and the informetrics course/module.

| **Course/Module** | **Informetrics content** |
|---|---|
| | |
| | |
| | |
| | |
| | |

**Thank You!**

# APPENDIX B: QUESTIONNIARE TO INFORMETRICS LECTURERS

## Questionnaire for informetrics lecturers in Library and Information Science departments in South Africa

Dear Respondent

I am a Masters student in the Department of Information Studies at the University of Zululand. I am conducting a study entitled "*Informetrics education in Library and Information Science (LIS) departments in South Africa*". The informetrics in this context includes bibliometrics, scientometrics, cybermetrics, webometrics and altmetrics. The aim of the study is to explore informetrics education in Library and Information Science departments in South Africa.

I am hoping to begin my data analysis by the 17th of December 2018. Please kindly complete the attached questionnaire and return it to: Nkosingiphile Mbusozayo Zungu, Email: zungumpilo7@gmail.com. I also wish to access the relevant course-material/guide, for my content analysis.

Be assured that information provided will be used for academic purposes only and it will be treated with confidentiality.

Should you have any questions concerning the survey, please contact me at:

Email: zungumpilo7@gmail.com or my supervisor: Prof. D.N. Ocholla, Email: OchollaD@unizulu.ac.za

Yours Faithfully

Nkosingiphile Zungu

078 6170 234

**Section A: Personal Information**

1. Title

| | |
|---|---|
| Mr | ☐ |
| Ms | ☐ |
| Mrs | ☐ |
| Dr | ☐ |
| Prof. | ☐ |

2. Areas of Knowledge and Expertise

| | |
|---|---|
| Library Information Science | ☐ |
| Philosophy | ☐ |
| Computer Science | ☐ |
| Economics | ☐ |
| Law | ☐ |
| Theology | ☐ |

Other_____

3. Name of Institution: _____

4. Name of Faculty:_____

5. Name of Department: _____

**Section B: Informetrics Education**

6. Please state the course/module title and code

_____

7. Please indicate the aim of the course/module

_____

_____

8. What are the learning outcomes of the course/module?

_____

_____

_____

9. Is the whole module/course, with informetrics content solely devoted to informetrics?

   Yes ☐

   No ☐

10. If not, what informetrics content does it cover?

_____

_____

11. Please indicate/itemize the units covered in the course (*Provide a course outline if possible*)

a)_____

b)_____

c)_____

d)_____

12. What teaching methods are used to teach the informetrics?

Case Studies ☐

Lecture (face-to-face) ☐

Group discussion ☐

Role Modelling ☐

E-learning ☐

Distance education ☐

Blended education ☐

Other, please specify: _____

13. Why is the selected method/s used?

_____

_____

_____

14. Please indicate how the students are assessed and the weightings for each method

| **Method of assessment** | **Weighting** |
|---|---|
| Formal end of module/course exam | |
| Interim tests during module/course | |
| Practical Assessments | |
| Assignments | |
| Fieldwork assessments | |
| Peer assessments | |
| Self-assessments | |
| Open book assessments | |
| One minute papers (quick reviews of knowledge gained held during learning sessions) | |
| Learning journals (diary of learning created during the module/course) | |
| Portfolios (notes written by learners at the end of a learning session to display knowledge gained) | |
| **Total** | 100% |

15. What are the challenges associated with teaching informetrics?

_____
_____
_____
_____
_____
_____

16. How are the challenges overcome?

_____
_____
_____
_____
_____

17. What do you think can be done to improve informetrics education?

**Section C: Additional Information**

18. Please provide recommended readings for informetrics education

**Thank You!**

# APPENDIX C: CONTENT ANALYSIS SCHEDULE

NAME OF INSTITUTION: ……..

NAME OF FACULTY: …….

NAME OF DEPARTMENT: …….

COURSE/MODULE TITLE AND

CODE:……

---

**Course/Module Content**

1. Units covered in Course/Module

**1.1. Unit One**

_____

1.1.1. Duration

_____

1.1.2. Unit components

_____

_____

_____

**1.2. Unit Two**

_____

1.2.1. Duration

_____

1.2.2. Unit components

_____

**1.3. Unit Three**

_____

1.3.1. Duration

_____

1.3.2. Unit components

_____

_____

_____

**1.4. Unit Four**

_____

1.4.1. Duration

_____

1.4.2. Unit components

_____

_____

_____

**1.5. Unit Five**

_____

1.5.1. Duration

_____

1.5.2. Unit components

_____

_____

_____

**1.6. Unit Six**

_____

1.6.1. Duration

_____

1.6.2. Unit components

_____

_____

_____

### 1.7. Unit Seven

_____

1.7.1. Duration

_____

1.7.2. Unit components

_____

_____

_____

### 1.8. Unit Eight

_____

1.8.1. Duration

_____

1.8.2. Unit components

_____

_____

_____

### 1.9. Unit Nine

_____

1.9.1. Duration

_____

1.9.2. Unit components

_____

# APPENDIX D: PARTICIPATION CONSENT DECLARATION

## PARTICIPATION CONSENT DECLARATION

## INFORMED CONSENT DECLARATION

## (Participation)

Project Title: **Informetrics education in Library and Information Science (LIS) departments in South Africa.**

**I ……..** from the **Department of…….……..…….at the……,** hereby acknowledge that the **University of Zululand** has requested my permission to participate in the above-mentioned research project.

The nature and the purpose of the research project, and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

1. The purpose of the research project is only for academic purposes
2. The University of Zululand has given ethical clearance to this research project and I have seen/may request to see the clearance certificate.
3. By participating in this research project I will be contributing towards making LIS education more valuable and relevant.
4. I will participate in the project by responding to the questionnaire and granting further access to necessary information sources.
5. My participation is entirely voluntary and should I at any stage wish to withdraw from participating further, I may do so without any negative consequences
6. I will not be compensated for participating in the research
7. There is a low chance of the risk materialising

8. The researcher intends publishing the research results in the form of articles in journals however, confidentially and anonymity of records will be maintained and that my name and identity will not be revealed to anyone who has not been involved in the conduct of the research.

9. I will receive a copy of work that will be produced after the research.

10. Any further questions that I might have concerning the research or my participation will be answered by the researcher.

11. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies.

12. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I have read the above information / confirm that the above informed has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished to ask and these have been answered to my satisfaction. I fully understand what is expected of me during the research.

I have not been pressurised in any way and I voluntarily agree to participate in the above-mentioned project.

..... .....

**Participant's signature** **Date**

# APPENDIX E: UNIZULU ETHICAL CLEARANCE CERTIFICATE

**UNIVERSITY OF ZULULAND**
**RESEARCH ETHICS COMMITTEE**
(Reg No: UZREC 171110-030)

**RESEARCH & INNOVATION**
Website: http://www.unizulu.ac.za
Private Bag X1001
KwaDlangezwa 3886
Tel: 035 902 6731
Fax: 035 902 6222
Email: DlaminiA@unizulu.ac.za

## ETHICAL CLEARANCE CERTIFICATE

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Certificate Number** | **UZREC 171110-030 PGM 2018/524** | | | | | | | | |
| **Project Title** | **INFORMETRICS EDUCATION IN LIBRARY AND INFORMATION SCIENCE (LIS) DEPARTMENTS IN SOUTH AFRICA** | | | | | | | | |
| **Principal Researcher/ Investigator** | NM Zungu | | | | | | | | |
| **Supervisor and Co-supervisor** | Prof Ocholla | | | | | | | | |
| **Department** | Information Science | | | | | | | | |
| **Faculty** | Arts | | | | | | | | |
| **Type of Risk** | Low Risk- Data collection from people | | | | | | | | |
| **Nature of Project** | Honours/4th Year | | Master's | X | Doctoral | | Departmental | | |

The University of Zululand's Research Ethics Committee (UZREC) hereby gives ethical approval in respect of the undertakings contained in the above-mentioned project. The Researcher may therefore commence with data collection as from the date of this Certificate, using the certificate number indicated above.

**Special conditions:**

**(1) This certificate is valid for 1 year from the date of issue.**
**(2) Principal researcher must provide an annual report to the UZREC in the prescribed format [due date- 08 October 2019]**
**(3) Principal researcher must submit a report at the end of project in respect of ethical compliance.**
**(4) The UZREC must be informed immediately of any material change in the conditions or undertakings mentioned in the documents that were presented to the meeting.**

The UZREC wishes the researcher well in conducting research.

**Professor Gideon De Wet**
**Chairperson: University Research Ethics Committee**
**Deputy Vice-Chancellor: Research & Innovation**
**08 October 2018**

CHAIRPERSON
UNIVERSITY OF ZULULAND RESEARCH ETHICS COMMITTEE (UZREC)
REG NO: UZREC 171110-30
02 -11- 2018
RESEARCH & INNOVATION OFFICE