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Citation Analysis of Masters' Theses and Doctoral Dissertations: Balancing Library Collections With Students' Research Information Needs

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ABSTRACT

This study analyses the citation patterns of masters' theses and doctoral dissertations between 2005 and 2014 in the Faculty of Engineering at the Cape Peninsula University of Technology (CPUT). The analysis included establishing the types of materials, differences between resources used across the departments within the faculty, the journals referenced most frequently and the holdings of such titles by the library and lastly the age, language and country of publication of journal articles referenced. The study used a bibliometric approach using various indicators to analyze the citation patterns. The conclusion of the study shows that both masters' and doctoral students are utilizing resources provided by the library and that the most used resources were journals, followed by books. The study is unique in that it provides a pattern of how both masters' and doctoral students cite resources in their studies. It is also important in that it provides CPUT Libraries with information on how well utilized its resources are as well as pointing to possible areas of strengthening the holdings. The study concludes that together with other approaches, citation analysis still remains one of the most important tools to assess the usefulness of library holdings for postgraduate students' research activities.

INTRODUCTION

The growth and development of engineering education is an important agenda for the South African government in the growth and development of its infrastructure in order to support a growing economy. Government has been targeting the training of more engineering students to support its infrastructural development programs. However the output rates from traditional, comprehensive and technology universities have been low. This is due in part to the low number of school graduates who qualify to enroll for engineering disciplines at various institutions and the high dropout rates at most of the higher education institutions in the country (Case, 2004).

The result of a merger between two technikons in the post-independence re-organization of the higher education landscape in South Africa, the Cape Peninsula University of Technology (CPUT) is one of the six universities of technology in the country — offering mainly skills-based courses at certificate, diploma and Bachelor of Technology levels. Students undertaking postgraduate studies at Master of Technology (MTech) and Doctor of Technology (DTech) levels at CPUT constitute about 7% of the total enrolment of 34,000 students and are playing a key role in increasing the research activities at the university. The University also has a number of specialized research units and centers in various disciplines and has started appointing research chairs — who bring along postgraduate and post-doctoral students to their units. Collaborative research with colleagues at other national and international institutions has been growing in the last five years, supported mainly by sound research infrastructure and good funding models both from government and the institution.

One of six faculties at CPUT, the Faculty of Engineering is made up of eight departments and covers a broad range of engineering disciplines including: Construction Management and Quantity Surveying, Chemical Engineering, Civil Engineering & Surveying, Clothing & Textile Technology, Electrical, Electronic and Computer Engineering, Industrial & Systems Engineering, Maritime Studies and Mechanical Engineering.

Library resources which include some of the leading electronic full text databases to support science and technology education like Science Direct, IEEE, ACM Digital Library, Cement and Concrete Databases, ICE Virtual Library, Engineering Village, Textile Technology Complete as well as eBooks, print books, electronic journals, the Institutional Repository and other information resources, form part of the large collections that assist students, lecturers and research units in their work. The level of utilization of these resources is often the concern of not only the university library but also the various university budget committees responsible for resource allocations as a meaningful return on investment that must be shown in order to continue with the expensive journal and database subscriptions as well as the purchase of expensive engineering text books and resources. Library budgets have been a target for cuts

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and many libraries are being forced to cut back on essential resources. The introduction of 14% value added tax on imported electronic information resources has added pressure to South African university libraries.

The use of citation analysis as a bibliometric technique in libraries is an established credible way of assessing library collections, generating core lists of publications, and identifying items for possible selection, cancelation or storage (Abeyrathne, 2015; Enger, 2009; Johnson, 2009). According to Eckel (2009), citation analysis of science and engineering journal literature has been used by librarians primarily as a means of guiding journal collection development and local collection use and strength. Citation analysis is also being used for developing book collections (Enger, 2009). Several techniques are applied and vary from assessing the types of resources used, the frequency of citation, and the age of items cited to existence of cited resources in library holdings.

The citation analysis of theses and dissertations is one way of applying these methods and several studies in varying disciplines have been carried out to help establish students' citation characteristics (Gadd, Baldwin, & Norris, 2010) and patterns and use the results to improve reference instruction as well as identifying gaps in library collections and even justifying expenditure in financially constrained environments. Stephens, Hubbard, Pickett, and Kimball (2013) points out that there are few citation analyses involving engineering publications or engineering faculty research. Pancheshnikov (2007, p. 675) also notes that "fewer publications pertain to student theses and dissertations, or both groups of users and very few contain comparative data". In South Africa there are a number of studies on citation analysis (Afful & Janks, 2013; Naude, Rensleigh, & du Toit, 2005; Swanepoel, 2008) covering analysis of theses and dissertations across disciplines, but none cover engineering as a single discipline and more research is required to determine how postgraduate students and researchers in engineering and other disciplines are using various institutional information resources held by their libraries or more importantly their overall patterns of citation behavior. This study will add to that body of knowledge in the South African science and technology postgraduate education and research and hopefully stimulate more similar research.

This study sought to analyze the relationship between postgraduate students' information needs and the library's holdings by analyzing citations used in masters' theses and doctoral dissertations. Citation analysis is an important tool in assessing collection value and identifying gaps and building cases for retention or cancelation of journals and also for determining the value of monographic collections within CPUT Libraries.

LITERATURE REVIEW

The literature on citation analysis of masters' and doctoral dissertations covers a range of indicators which include types (e.g., journal articles, books, technical reports, websites, gray literature, government documents, etc.) of resources used by researchers. This also includes their age, country of publication, language, disciplines and holdings of specific libraries.

Differentiation of resources in the citation analyses of masters' theses and doctoral dissertations in engineering postgraduate studies and other disciplines is one of the indicators used by researchers (Eckel, 2009; Fransen, 2012; Gadd et al., 2010; Young, 2014). According to Stephens et al. (2013, p. 452) "objectives, methodologies, and subject granularity of these studies differ, but characterization of the formats types is common". In most studies the citation evaluations look at the use of books, journals, websites, reports, conference proceedings, theses and dissertations, lecture notes and special reports (Gadd et al., 2010). In many of these studies monographs, journals, websites and conference papers are the most widely used resources. Some of the studies (Eckel, 2009) show that researchers can get access to a broader range of sources than in the past because they are stored and available on the open web. These include information from government documents, gray literature, technical reports, and trade magazines. This is a positive development as some of these publications were never really easily accessible to students before the internet age.

Disciplinary categorization is an important aspect in citation analysis of masters' theses and doctoral dissertations. According to Waugh and Ruppel (2004, p. 277) "recent studies reflect an apparently growing trend among student researchers to cross-discipline boundaries when conducting reviews of literature" in social sciences and related fields. In vocational and technical education the pattern does not reflect interdisciplinary citations and shows that students tend to use resources in their specific fields. In his study on engineering and computer science research Fransen (2012) shows that computer science students tend to cross cite while engineering students do not. The conclusion then is that engineering students tend to use resources in their field. Eckel (2009, p. 11) on engineering students also confirms "an overreliance on certain sources by some authors and shows numerous examples of both master's and doctoral students citing the same journal over and over again". The study by Johnson (2014, p. 29) shows a difference by department and that students in the electrical engineering field rely more on "conference proceedings than their peers in other departments, while civil engineering students used more government documents than other students".

The age of resources also forms an important element of citation analysis in postgraduate students' utilization of library resources. Nabe and Imre (2008) note that "citation studies of dissertations in the sciences are infrequent" and that in the few studies that "have been done little or no data analysis on the age of citations" is provided. The literature shows varying time spans for citation analyses in different disciplines and Dulle et al. (2004) quote a study by Snyder & Bonzi (1998) that reports the age of cited publications among disciplines as follows: all disciplines (13 years); Asian studies (19.1 years); art (16.8 years); chemistry (11.1 years); geology (13.3 years); economics (8.8. years) and sociology (10.9 years). An analysis by Eckel (2009, p. 9) between engineering masters' theses and doctoral dissertations shows "that sources less than five years old made up a higher percentage of masters' references than doctoral students references". The study further points out that the "average age of scholarly journals and monographs was higher for dissertations than for theses". Fransen's (2012) study on literature use in engineering and computer science dissertations and theses shows that for engineering in general and civil engineering in particular, the average age of journal citations was 12 years. There seems to be a variation in age ranges across disciplines which may be influenced by many other contributing factors including the structure and nature of the research being undertaken. The Nabe and Imre (2008) study also demonstrates that "conventional wisdom that the sciences rely disproportionately on current sources of research is not accurate at least in the disciplines of plant biology and zoology". Williams and Fletcher (2006), show that the age of information sources cited varies within the engineering discipline and that older materials are more often cited in mechanical, aerospace and chemical engineering while more recent materials are cited in industrial engineering.

The one area of greatest importance to library managers is how well collections of a particular library are being utilized by their students and staff and hence the importance of evaluating what internal resources have been used in various research projects. This area of analysis assists library managers in decision-making with regard to the current and future collection management strategies especially in times of resource constraints. Feyereisen and Spoiden (2009) conclude in a study on this subject that "numbers are informative but will never be sufficient to mechanically evaluate a journal's utility". Citation analysis then should be part and parcel of a more holistic approach to determining the usefulness of resources within a given environment as several critical factors also count in the final decisions made on retention or cancelation of subscriptions.