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An Analysis of Master Dissertations: A Case Study of Central University of Technology (CUT), South Africa

Arthur James Swart
Central University of Technology
Bloemfontein, South Africa
drjamesswart@gmail.com

Abstract

Knowledge is built on the foundation of information which may be gathered from various sources, including from dissertations. Gathering information from postgraduate dissertations can highlight the differences between, and in, disciplines, with regard to specific variables. Moreover, it has been reported that African postgraduate students struggle to complete their dissertations, as they do not know how to structure them correctly, which may include not knowing how many words, pages, images and tables to include in their dissertations. The purpose of this article is to analyse 157 Master dissertations spanning a 10-year period in order to identify the average number of supervisors, words, pages, images and tables that have been used in successful research studies in order to highlight the differences between disciplines and to provide a guideline regarding the average length of a standard dissertation. An ex-post facto study is employed where informetric analysis is used to obtain quantitative data. Results reveal that the five variables vary dramatically per faculty. Management Sciences produced the highest number of average words (40 467), the highest number of average pages (194) and the highest number of average tables (28), while Engineering produced the highest number of average images (53) per dissertation. Health and Environmental Sciences had the

highest average number of supervisors (2.2) per dissertation. An important implication of this research is that it may help postgraduate students to better understand how to structure their dissertations when considering their length. A key recommendation is to include the results of this study in brochures which are distributed to postgraduate students at the start of their studies, giving them a better idea of the differences between, and in, disciplines with regard to the number of supervisors and the length of a standard dissertation.

Keywords: Supervisors, Words, Pages, Tables, Images

Introduction

“Information is not knowledge (Brainy Quote, 2018).” These words, by Albert Einstein, suggest that information cannot be considered as knowledge, as it only informs people of someone or something. However, “to know” means to dig deeper into the information, linking it with other pockets of information to foster understanding and create meaning. In fact, if one considers the definition of information, it only refers to facts provided or learned about someone or something. On the other hand, knowledge is defined as the theoretical or practical understanding of a subject (Oxford Dictionary, 2017). So, knowledge is built on the foundation of information which may be gathered from various sources, including from dissertations.

Why gather information from postgraduate dissertations? First, dissertations are useful for finding ideas (Leong and Muccio, 2006), which may be used for future research or for new topics in postgraduate research studies. Second, dissertations have changed

in terms of focus and scope over the past years (Shu et al 2016), which necessitates determining how and to what extent this change has occurred. Third, as dissertations have evolved in format from shelved print resources to electronic files housed in institutional repositories, recordkeeping practices have been developed to account for the description of their content and administration (Potvin and Thompson, 2016), which may require determining the effectiveness and efficiency of such practices. Fourth, dissertations are often only as good as the supervisors who oversee their completion (Scott, 2014) and are deeply embedded in the practices of the discipline (Hodges, 2017, Jewell et al 2017), which may lead to determining what differences exist between, and in, disciplines. Fifth, dissertations are the window to high-level research carried out in a university and high-profile publications of scholars in the making (Baro and Otiode, 2014), which may provide a glimpse of the quality and relevance of an institution's research in regard to global trends. Finally, some postgraduate students struggle to complete their dissertations through distance learning institutions (Ndlangamandla, 2015), while many struggle to prepare an acceptable research proposal (Hanyane, 2015) or to structure their dissertation correctly (Schulze, 2012). The structure of a dissertation encompasses a number of variables from the title page through the various chapters to the reference list and annexures (Flamez et al 2017). However, the structure may also include variables relating to the length of a dissertation (Tering, 2010), which may include the number of pages, words, images, and tables to use.

Undergraduate students often ask how long should a laboratory report be (Lobban and Scheffer, 2017). Postgraduate students may ask similar questions regarding the dissertation, given the fact that they may never have written one before. Providing a guideline with regard to the length of an acceptable dissertation (number of pages, words, images and tables) may help future postgraduate students to better understand the structure of a dissertation among different disciplines. This type of feedback may further help postgraduate students through their academic writing journey (Azkah et al 2016).

The research question thus arises "What differences exist between, and in, disciplines, with

regard to the length of an acceptable dissertation, which may help future postgraduate students to better structure their own dissertations in terms of the number of words, pages, tables and images to use? Gathering this information from dissertations to foster understanding or create meaning requires analysis techniques. These may be broadly grouped under the umbrella of informetrics.

The term informetrics, was defined by Tague-Sutcliffe (1992) as the study of the quantitative aspects of information in any form, not just records or bibliographies, and in any social group, not just scientists. Note that it involves the quantitative study of information; the awarding of numbers or values to information gathered from a specific source, which in turn may be used to build knowledge and recommendations for improvement. Informetrics is applied to develop and measure information in traditional (print-based) as well as proprietary electronic information environments (databases and databanks) (Ocholla and Onyanacha, 2005). Obtaining these electronic dissertations has become accessible to people, who cannot travel to an institution or who rely on interlibrary loans (Sterman and Borda, 2017), by means of institutional online repositories.

The purpose of this article is to present an analysis of 157 master dissertations over a 10-year period in order to identify differences between, and in, disciplines, while providing a guideline for students to consult in terms of the acceptable length of a dissertation. These dissertations are sourced from an institution's online repository and analysed using informetrics. This current study aims to analyse master dissertations, with the view to highlighting the differences between, and in, disciplines and providing a guideline regarding the length of an acceptable dissertation. Five variables are to be identified, namely the number of supervisors, the pages, the words, images and the tables that were used per discipline.

Study Context

The Central University of Technology (CUT) is located in the Free State Province of South Africa, and was originally designated as the Free State Technikon which was established in 1981. No real research agenda existed and no real need existed to improve student learning during the latter part of the 20th Century. However, in 2004, it was re-designated as a university of technology, named CUT. From then

on, a research agenda existed, and a need to improve student learning arose. The university was accredited by the Council on Higher Education (CHE) in South Africa to offer a variety of Master and Doctoral qualifications. The University has four faculties (Engineering and Information Technology (FEIT), Humanities (FH), Health and Environmental Sciences (FHES), and Management Sciences (FMS). The four faculties comprise 21 departments (FEIT, 6; FH, 5; FHES, 4; and FMS, 6)

The Faculty of Health and Environmental Sciences (FHES) has the least number of academic staff (55) and the lowest number of postgraduate students (38), while the Faculty of Management Sciences has 80 staff and 83 postgraduate students. The Faculty of Engineering and Information Technology (FEIT-86 staff and 216 postgraduate students) has the largest number of academic staff members. The Faculty of Humanities has the largest number of postgraduate students (588) and 74 staff.

Research Methodology

All the dissertations on the institution's repository were analysed which totals 157 Master dissertations. The study determined the differences between, and in, disciplines over a 10-year period (2005 – 2015) with regard to master dissertations at CUT, in order to suggest a guideline for future postgraduate students to consult in terms of the length of an acceptable dissertation.

The quantitative data was extracted using a software program that was specifically developed for this purpose by an external software developer. The software program automatically downloads the dissertations (which are in PDF format) from the institution's online repository. The program then extracts specific information from each PDF and inserts into a spreadsheet for further analysis and presentation. Using specific field codes, it extracts the number of pages and words. The program was also designed to identify the number of images and tables mentioned in the front matter (specifically the list of figures and the list of tables) of each dissertation. The number of supervisors was determined by the software program by only considering the title page of the dissertation (specific field code searching for the word 'supervisor'). This research is therefore limited to the results of the analysis of the front matter of the dissertation.

Systematic sampling was used to determine reliability. Systematic sampling involves using every *n*th sample from a predefined data stream. In this research, every 10th dissertations was selected and then personally reviewed by the author. The dissertations were first ranked chronologically according to the year of completion in a MS EXCEL spreadsheet, with every 10th dissertations then being selected for review. This provided a systematic sample of 15 Master dissertations which the author physically reviewed (PDF format used), comparing his findings to those of the software program. An average reliability score of 93% was observed. Some concerns with the software program lay in identifying the correct discipline, the faculty and the number of images (or figures) and the tables. Data extracted from all 157 dissertations using the developed software program were then analysed in MS EXCEL, with the results presented next.

Results and Discussions

Figure 1 highlights the number of dissertations produced over the 10-year period with regard to specific variables- year ranges, word ranges, page ranges, image ranges and table ranges are highlighted. The online repository shows no dissertations prior to 2005, which is due to the fact that the institution was a Technikon, with no real research agenda. No formal online repository either existed at that time. However, since becoming a university, a window of the institutions research needed to be provided to the outside world, which dissertations can provide, according to Baro and Oriode (2014).

Considering the *word* ranges reveal that 48% of the dissertations have between 20,000 and 29 000 words (75 of the 157 analysed). Only 12 have more than 49 000 words, while no dissertations contain less than 10 000 words. This is in contrast to a 2013 study that listed a dissertation with less than 10 000 words, although it was only limited to the discipline of Education (Azlan, 2013). A more recent study, focusing on the analysis of 20 postgraduate dissertations for the discipline of management, had an average length of 24 500 words (Shrivastava, 2016). The overall average word length for all 157 dissertations in this study was 31 831 words.

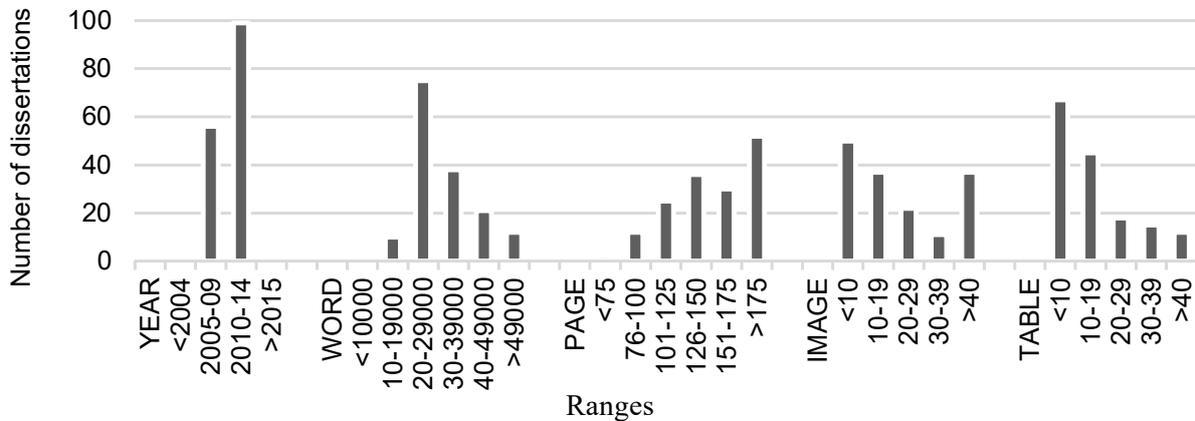


Figure 1: Dissertations per identified range for the entire university

One would expect the *page* ranges to follow a similar trend to that of the *WORD* ranges, which is not the case, as the majority of dissertations had more than 175 pages, which is at the top of the scale and not in the middle, as was the case for the *word* ranges. However, Pearson correlation does reveal a strong relationship ($r = 0,990$) between the number of words and number of pages for all the dissertations. Consequently, it may be deduced that a higher number of words would lead to a higher number of pages, although this is not readily deduced, which may be attributed to the presence of numerous images or tables that need to be considered. This strong relationship suggests that the font size, used for the paragraphs in the dissertations, has remained relatively consistent. This is due to the influence of font size on the text length and on the number of pages (Reinert et al 2014).

Fifty out of one hundred and fifty-seven of the dissertations had less than 10 images, or figures, while 37 dissertations have more than 40. One would expect that the number of images would impact on the number of words and pages. However, a weak relationship was found between the number of images and the number of words ($r = 0,496$) with a moderate relationship between the number of images and the number of pages ($r = 0,593$). This may suggest that the students were not really discussing, in depth, the significance of the images, requiring more pages for presentation, according to

the moderate relationship. Students need to reason on the figures and the tables that they present, interpreting their significance in the context of their study (Swart and Hertzog, 2016).

It seems that the postgraduate students at this university did not make use of many tables, as many of the dissertations (67 out of 157) had less than 10 tables. Most theses and dissertations did contain figures and tables in order to help simplify information (Lutabingwa and Jarbandham, 2007). It also seems that students were discussing them in more depth as compared to the figures, as a strong relationship exists between the number of words and the number of tables ($r = 0,812$).

Figure 2 illustrates the average, maximum and minimum number of words used in the 157 master dissertations per discipline; The FEIT, the FMS and the FH each have four disciplines, while the FHES has eight disciplines. These disciplines were identified from the front page of the dissertation along with the name of the Faculty to which the dissertation belonged. For example, the discipline of Electrical Engineering was listed under the FEIT. These results indicate that 20 disciplines exist at CUT, which are divided among the 21 departments.

A noteworthy observation relates to the range of words for dissertations within the discipline of Education, which is divergent. Why would one student produce over 90 000 words, while another student produces 20 000 words?

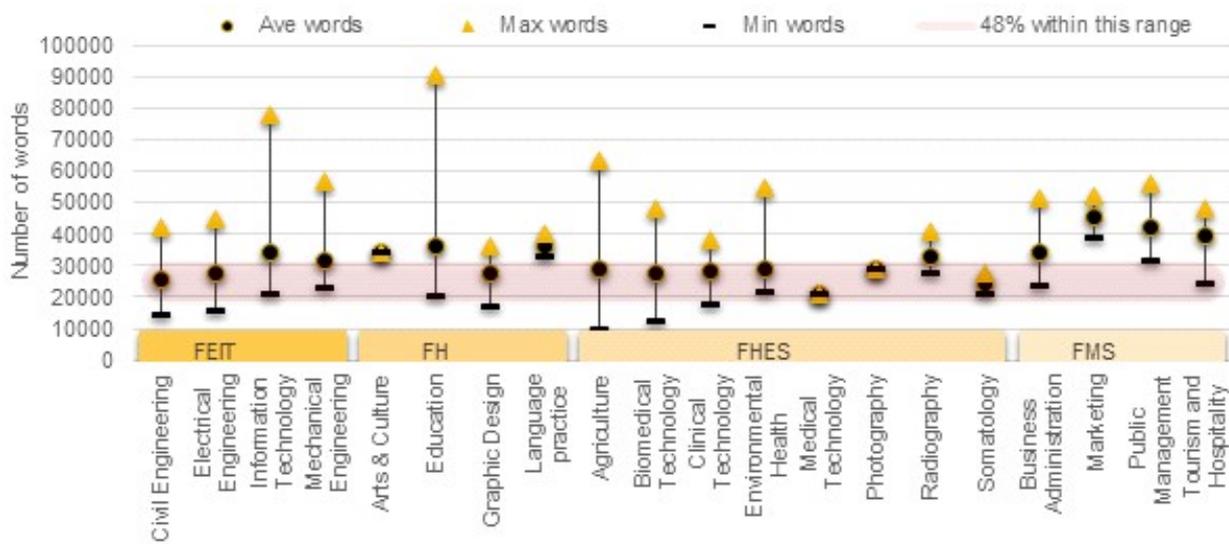


Figure 2: Number of words used in the Master dissertations per discipline

In South Africa, 1800 notional hours (180 credits) should be devoted to a Master’s in Education degree. These word variations would require significant different amounts of hours, taking into account the actual writing and editing of numerous drafts of the chapters making up these dissertations. Why should there be such a significant difference of 78% ((maximum – minimum) / maximum x 100%) in word counts between these dissertations? The same applies to the discipline of Information Technology (73% difference), Biomedical Technology (74% difference) and Agriculture (85% difference). The most consistent discipline, in terms of the number of words per dissertation, is Somatology, where the dissertations with the maximum and minimum number of words fall within the 48% range (transparent line between 20,000 and 30 000 words). The fields with the smallest percentage difference between the maximum and minimum number of words is Language Practice (18%), Somatology (23%), Marketing (25%), and Radiography (33%). It is noteworthy that research recommends that students need to adhere to the stated dissertation word-length for a master’s dissertation (Biggam, 2015), lest one becomes guilty of padding. This occurs when one includes irrelevant information just for the sake of beefing up the dissertation, but really it is an indication that the

student may not be able to write succinctly. Adopting an approximate word-length guideline per discipline would align more with the number of credits attached to the qualification.

Figure 3 presents the average, maximum and minimum number of pages used in the 157 Master dissertations per discipline. One would expect Figures 2 and 3 to look similar, as the number of words should correlate with the number of pages, as stated earlier. However, it is the presence of numerous figures and tables within specific disciplines which also impacts on the number of pages, which then needs to be considered. The largest variation in page numbers between dissertations occurs in the disciplines of Information Technology (79% difference), Agriculture (76% difference) and Education (68% difference). The least variation in page numbers occurs between dissertations in Business Administration (22%), Tourism and Hospitality (23%) and Marketing (29%). The average number of pages for all the dissertations is 161, with 42% falling between 125 and 175 pages. A similar study of the social sciences in 1985 reveals an average page length per dissertation of 201 (Hepburn and Dahler, 1985). No literature seems to exist, giving the average number of pages for all disciplines at a university of technology.

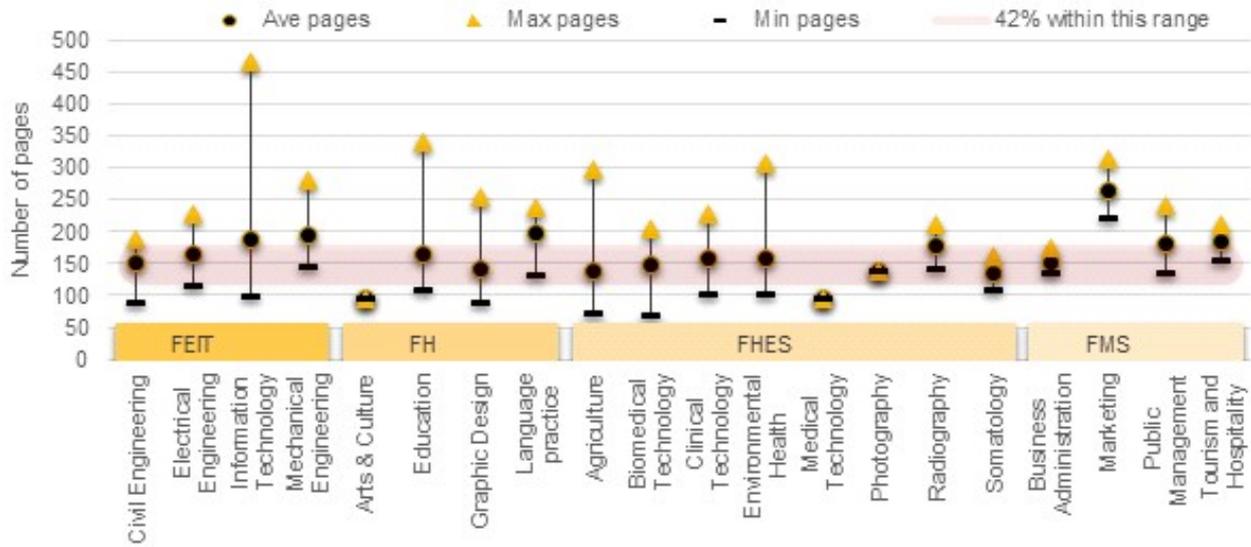


Figure 3: Number of pages used in the Master dissertations per discipline

Figure 4 contrasts the various disciplines with regard to the average, maximum and minimum number of images. The discipline of Electrical Engineering recorded the largest number of images, with an average of 72 images per dissertation with the discipline of Mechanical Engineering following in second place (64 images per dissertation). Competence in the understanding and analysis of electrical circuits is a fundamental requirement for electrical engineering students (Duffy et al 2016), which should be presented and explained by using many images or figures.

The disciplines with the lowest number is Photography (5 images per dissertation), followed by Arts and Culture and Public Management (each with 10 images per dissertation). This should not be strange for Photography, as this discipline has expanded and developed, incorporating fine art and journalism, as well as all points in-between (Campbell, 2015), which would not necessarily involve the use of many images. Figure 5 differentiates between the 20 different disciplines in terms of tables used.

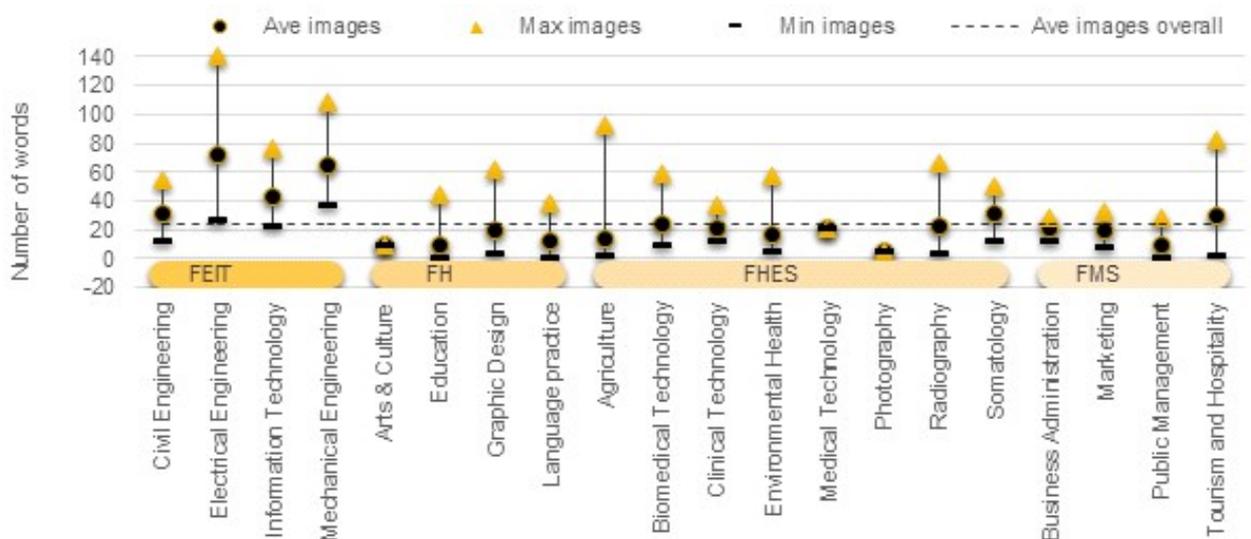


Figure 4: Number of images used in the Master dissertations per discipline

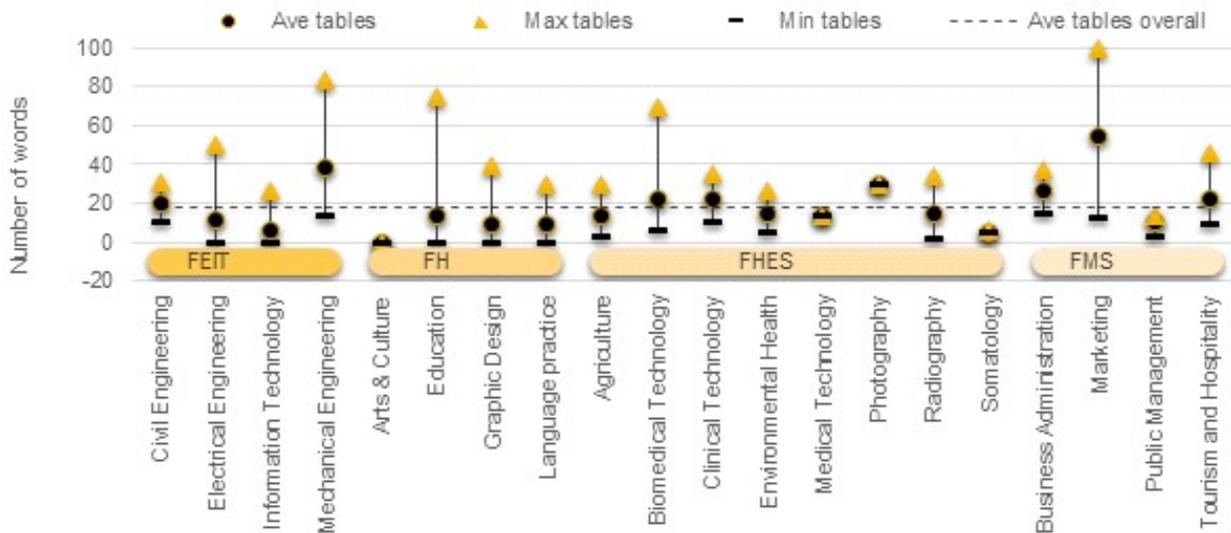


Figure 5: Number of tables used in the Master dissertations per discipline

The discipline of Marketing produced the largest number of tables, with an average of 54 tables per dissertation, with the discipline of Mechanical Engineering following in second place (38 tables per dissertation). The students in these disciplines were discussing much quantitative data (numbers and values) or qualitative data (direct quotes and statements) in their dissertations. Tables are helpful to organise extensive data into an accessible form, providing greater impact than text,

while maintaining precision (Horrocks et al 2013). The disciplines with the lowest number of tables include Language Practice (9) tables per dissertation and Somatology (6 tables per dissertation).

Figure 6 contrasts the number of dissertations per discipline to the total number of supervisors within that discipline. This figure reveals that the discipline of Education has almost an equal number of dissertations (27) to supervisors (32). This equates to an average of 1.2 supervisors per dissertation.

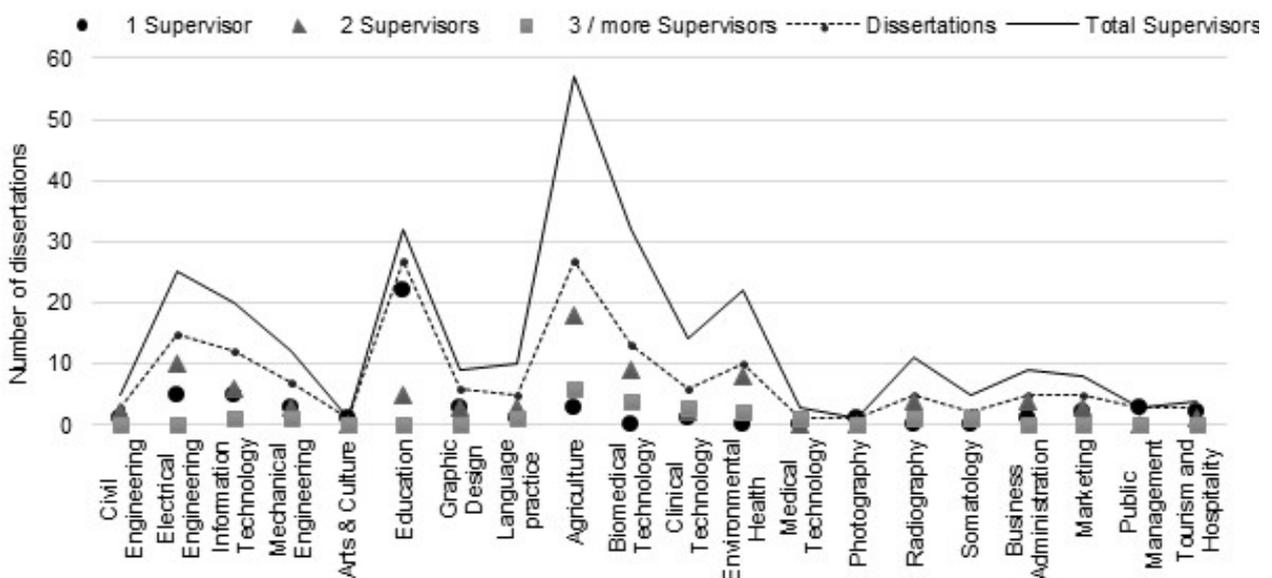


Figure 6: Number of supervisors used for the Master dissertations per discipline

Biomedical Technology has an average of 2.5 supervisors per dissertation. This suggests that this discipline had either a low number of experienced supervisors, or that they were engaging in cross-disciplinary research within their specific fields of interest. It must be noted that health sciences often covers research areas within nursing, public health and other health professions (Söderlund and Madison, 2015), while environmental sciences is often defined as an applied and interdisciplinary scientific field investigating human-nature relationships (Berkes and K yplal yodlu, 1990). This may lead one to conclude that more cross-disciplinary research is taking place as compared to a low number of experienced supervisors residing in the faculty. This can be determined by identifying which university the supervisors are affiliated to, which will require the analysis of the proposal or examiner appointment documents.

Furthermore, Pearson’s correlation reveals an inverse moderate relationship ($r = -0,594$) between the average number of supervisors per dissertation and the average number of words per dissertation for all the disciplines. This suggests that as the number of supervisors increase, the overall number of words seem to decrease for a dissertation. If more cross-disciplinary research existed, then a non-inverse moderate relationship should be expected, as the co-supervisors from other disciplines would more likely share their thoughts and inputs. More than one supervisor usually implies that the postgraduate student needs to evaluate multiple

opinions (Guerin and Green, 2015), suggesting more words. However, in this case, it seems that the co-supervisors are simply going along with what the main supervisor has suggested, as if they are still “learning the trade of supervision”. This may reinforce the thought that the higher number of supervisors per dissertation in Agriculture and Biomedical Technology may rather be due to the training of inexperienced supervisors, rather than cross-disciplinary research. The individual number of supervisors per dissertation is also shown. The discipline of Education had the highest number of dissertations (22 – black dot) with only one supervisor, while the discipline of Agriculture had the highest number of dissertations (18 – grey triangle) with two supervisors.

Figure 7 highlights the normalised percentages for the average words, pages, images and tables for the 20 disciplines within the four faculties at CUT over the 10-year period. This is obtained by determining which discipline produced the highest number of average values per dissertation, and then dividing all subsequent disciplines average values by that highest value. The average values are used as some disciplines are producing more dissertations than other disciplines. The results indicate that the discipline of Electrical Engineering produced the highest average number of images per dissertation, while the discipline of Marketing produced the highest average number of words, pages and tables.

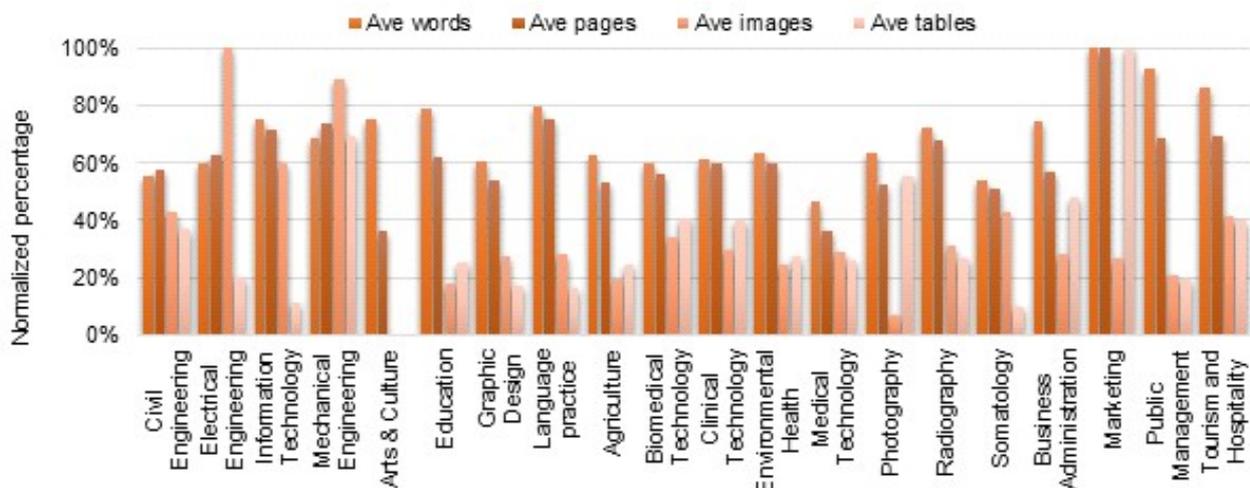


Figure 7: Averages per discipline for the 10-year period

From a faculty perspective, the FMS produced the highest number of average words per dissertation (40 467), the highest number of average pages per dissertation (194) and the highest number of tables per dissertation (28). Table 1 provides a concise breakdown of these results, along with the overall average for the university (right-hand column). The cross-disciplinary character of management sciences is based on the created theory and practical solutions

following logical compilation of knowledge about economy, praxeology, sociology, psychology, ergonomics and laws (Sexton et al 1989). This extensive discussion of theory would require many words and pages, which may easily be explained and summarized by means of tables. Tables may be used to present information that may be difficult to explain fully in the text (Labani et al 2017).

Table 1: Overall Differences between the Four Faculties

Information per dissertation (averages)	FEIT	FH	FHES	FMS	CUT
Number of supervisors	1.7	1.3	2.2	1.5	1.8
Number of words	29 685	33 710	27 646	40 467	31 831
Number of pages	175	150	144	194	161
Number of images	53	13	20	21	25
Number of tables	19	8	17	28	18

Students from the FEIT are using more images per dissertation (average value of 53), and would therefore make up the majority of dissertations falling under the >40 image range given in Figure 2. Images are widely used in engineering (Xiao and Zhang, 2014) as they may help to conceptualize solutions to problems (Wanjiru, 2016), which is one of the fundamental requirements of engineering. The FH (disciplines of Arts and Culture through Language Practice) is languishing in last place with regard to the use of images and tables. Writing in the humanities requires that phenomena must be established as consequential within a personal perspective so that the audience can be persuaded to accept a new insight (Erixon, 2017), which would not really require many images or tables.

The informetric analysis from this study reveals seven key aspects. First, the majority of dissertations listed two or more supervisors that speak to the type of supervisor or the type of collaboration. This tends to suggest that more inexperienced supervisors are being mentored (e.g. from the disciplines of Biomedical Technology and Agriculture) or that more experienced supervisors from a number of different disciplines are involved in the supervision of Master dissertations.

Second, differences between disciplines reveal that the disciplines of Marketing, Public Management

and Tourism and Hospitality produced the highest average number of words per dissertation. This suggests that the FMS produced more qualitative data, as it is based on created theory and practical solutions following the logical compilation of knowledge. The lowest average number of words per dissertation came from the FEIT, that would be more quantitatively orientated given their science, technology, engineering and mathematical backgrounds.

Third, differences within disciplines reveal a high variation between the maximum and the minimum number of words used in a dissertation. The highest variation occurs within the discipline of Agriculture (85%) with the lowest variation in the discipline of Language Practice (18%). This is a concern that needs to be addressed per faculty, as prospective postgraduate students should be informed about the average word length required for their dissertations.

Fourth, differences within disciplines reveal a large variation between the maximum and the minimum number of pages used in the dissertations. The largest variation occurred in the discipline of Information Technology (79%) with the lowest variation in Business Administration (22%). The number of pages is reflecting the number of words and tables.

Fifth, differences between disciplines reveal that the disciplines of Electrical Engineering and Mechanical Engineering produced the highest average number of images per dissertation, which would be related to circuit diagrams and mechanical drawings. This suggests that the FEIT is more visually orientated.

Sixth, differences between disciplines could be considered that the disciplines of Marketing and Mechanical Engineering produced the highest average number of tables per dissertation. This suggests that the students in these disciplines are providing more quantitative data (numbers and values) or qualitative data (direct quotes and statements) that needs to be organised into an accessible form.

Last, different relationships exist between the average number of words, pages, images and tables for all the dissertations. A strong relationship ($r = 0,990$) was found between the number of words and the number of pages. A weak relationship ($r = 0,496$) existed between the number of images and words. A moderate relationship ($r = 0,593$) existed between the number of images and the number of pages. A strong relationship ($r = 0,812$) existed between the number of words and the number of tables. This suggests that all students are using a similar font size; that some students were providing a number of images without describing them; and that some students are explaining their tables very well.

Conclusion and Recommendations

The original research question stated “What differences exist between, and in disciplines, with regard to the length of an acceptable dissertation, which may help future postgraduate students to improve the structure of their dissertations in terms of the number of words, pages, tables and images to use? The results revealed that Management Sciences produced the highest number of average words (40 467), the highest number of average pages (194) and the highest number of average tables (28), while Engineering produced the highest number of average

images (53) per dissertation. Health and Environmental Sciences had the highest average number of supervisors (2.2) per dissertation.

The results of this study may not necessarily help students to improve the quality of their dissertations. However, a possible implication is that it can help postgraduate students to better understand the differences between, and within a close range of disciplines, guiding them to structure their dissertations. This has the potential of removing ambiguity among students on how long their dissertations should be, which is relating to the structure of a dissertation. For example, a postgraduate engineering student should aim for around 175 pages, making liberal use of many images to help conceptualize solutions to real-life problems.

A key recommendation is to include the summarised results of this study in postgraduate brochure guidelines which are often distributed to postgraduate students at the beginning of their programme. This may give them a better idea of the differences between disciplines with regard to the number of supervisors and the length of a standard dissertation. Knowing the length of an acceptable dissertations has the potential to help future postgraduate students to start-off structuring their dissertations in a more manageable and realistic way. It should also be emphasised in the brochure that postgraduate students need to introduce and explain all tables and figures in the text. A few examples of such a discussion may be included in the brochure, which often includes examples of how to structure the reference list.

Gathered information must be processed with regard to what is already known so that it can help to create meaning or improve understanding of specific phenomena. Future research needs to consider the bibliometric analysis of these dissertations, as well as the relationship to the academic achievement of these students. In this way, further meaning and understanding may be fostered by the use of informetric analysis that may contribute to the extension of a basic guideline that students may consult when they start to structure their dissertations.

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Arthur James Swart obtained his DTech in Electrical Engineering from the Vaal University of Technology in 2011, and his Masters in Education in 2008. He is an Associate Professor at the Central University of Technology in South Africa.



