DOCTOR OF PHILOSOPHY

A study of the organisational structure and phraseology of Algerian engineering MSc dissertations with reference to their American counterparts

Rezoug, Fares

Award date:
2020

Awarding institution:
Coventry University

A STUDY OF THE ORGANISATIONAL STRUCTURE AND PHRASEOLOGY OF ALGERIAN ENGINEERING MSC DISSERTATIONS WITH REFERENCE TO THEIR AMERICAN COUNTERPARTS

By
FARES REZOUG

February, 2020

Coventry University

A Thesis Submitted In Partial Fulfilment Of The University's Requirements For The Degree Of Doctorate Of Philosophy

Certificate of Ethical Approval

Applicant:

Fares Rezoug

Project Title:

Compiling a corpus of engineering dissertations

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Low Risk

Date of approval:

14 March 2016

Project Reference Number:

P39308

Certificate of Ethical Approval

Applicant:

Fares Rezoug

Project Title:

Interviewing INELEC teachers

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

22 June 2016

Project Reference Number:

P43319

Dedicated to the memory of my father
(Mr. Abdel Majid Rezoug)

ACKNOWLEDGEMENTS

First of all, I would like to thank the Algerian Ministry of Higher education and Scientific Research for giving me this opportunity to study overseas and fully fund my PhD in the UK. I’m forever, grateful to my country.

Second, I would like to show my greatest attitude to my supervisors Professor Hilary Nesi and Dr Benet Vincent for teaching me so many things throughout the duration of my PhD amongst of which helping me develop a high level of critical thinking and strengthened my analysis skills. Without their constant support and valuable guidance, I would have never successfully made it out of the PhD maze. Similarly, I would also like to thank both of my examiners, Dr Paul Thompson and Professor Sheena Gardner, for making time to read and assess my thesis. Your much-appreciated comments truly strengthened my thesis.

Third, I would like to thank the Algerian lectures and students of the Institute of Electrical and Electronic Engineering for being very welcoming and helpful when asked to be interviewed for this study. I also want to thank the librarians who helped me obtain of the MSc dissertations.

Last but not least, I would like to give a special thanks to the most important women in my life, my mother and my wife, for their unconditional love, indispensable support and patience throughout my PhD journey. I also cannot miss out my parents in law who made it easier for me to feel at home away from home. Finally, I would like to thank everybody who believed in me from previous teachers, neighbours, friends and family.

ABSTRACT

While the world is producing far more dissertations written in English than ever, studies on research-process genres remain heavily focused on research articles. To cast more light on this under-explored genre, this pedagogically-motivated study compares Algerian MSc dissertations in Electrical and Electronic Engineering with their American counterparts, at the structural and phraseological levels.

Two corpora were developed for this study: the Algerian Corpus of Engineering (ACE) which consists of 70 dissertations, and the United States Corpus of Engineering (USCE) which consists of 109 dissertations. As a first step, the context in which the Algerian MSc dissertations were produced was explored through a set of interviews with Algerian English lecturers, MSc supervisors and their supervisees. The knowledge obtained from these interviews is used to inform the background chapter and ascertain the participants' attitudes towards MSc dissertation writing.

A second phase involved using a qualitative research method to analyse all 179 dissertations in their entirety from the abstract to the conclusion to identify their macro and micro-structure, with reference to typical linguistic features of each stage. Neither group of dissertations was found to follow the Introduction, Methodology, Results and Discussion (IMRD) structure. Almost all the Algerian MSc dissertations were found to have the same structure: Abstract,

Introduction, Theory, System Design and Conclusion (AITSC). This is in line with the general responses of the interviewees. Although the American dissertations had more structural variations, most of these were derivative forms of AITSC.

In its third phase, a quantitative research method was used to explore the phraseology of all 179 MSc dissertations with a focus on lexical bundles (LBs) using the structural and functional classification models developed by Biber et al. (1999) and Hyland (2008). LBs were compared across both corpora (ACE and USCE) and across the four sub-disciplines represented in ACE: Power, Control, Computer and Telecommunication. The LB analysis revealed interesting differences in frequency, grammatical structure and function between the two groups of dissertations and the four sub-disciplines. LB differences were also found to be directly related to the structure of MSc dissertations.

It is anticipated that the findings from this thesis will be of value to those interested in developing local materials to teach Engineering dissertation writing in Algeria, thus supporting the spread of English medium higher education in the region.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1
Introduction

1. Introduction

This chapter starts with a brief historical background that focuses on the impact of the French colonial period on Algeria with reference to the linguistic context, followed by pedagogical changes that took place in Algeria after independence. Additionally, the chapter discusses the situation of English in Algeria and links this to the research site that the thesis studies. This chapter also explains the motivation behind conducting this research, and outlines the structure of the entire thesis.

1.1 Brief historical background from a linguistic perspective

1.1.1 French Algeria - *“L'Algérie Française”*

A brief review of the history of Algeria is necessary here to contextualise the current linguistic situation. Algeria is a country that has been affected by multiple conquerors, France being the last and the most influential (1830-1962). The French interest in Algeria was due to the geostrategic location of the country as Europe's gateway to Africa; French colonial attitudes were expressed through the use of terms like ‘French-Algeria’ - ‘L’Algérie Française’, which suggested that Algeria had become a part of France on the other side of the Mediterranean Sea (Aziz, 2015; Maamri, 2009; Prochaska, 1990; Ageron, 1991). French-Algeria meant that France could expand its colonial plans to a number of Algeria's neighbouring countries for the benefit of the French Republic.

Holt (1994:29) states that 'although Algeria is often portrayed as a country where French replaced Arabic, reality was a little more complex; for the native population [Algerians], French suppressed Arabic but left many with neither French nor Arabic education'. France did not tolerate the use of the native languages in official settings, including education (Benjamin, 1954; Benrabah, 2005, 2007a, 2007b) in order to divert Algerians away from Islamic principles often learned through religious texts in Arabic, and thus in theory eliminate any chances of rebellion.

After colonisation, most Algerians in urban areas tended to accept the idea that French was the new language of prestige, prosperity, education and that their mother tongues (Berber with its different dialects such as Chaouia and Kabyle, Averett, 2015) would not be recognized overseas. In rural areas, however, the majority of Algerians chose to protect their identity by abandoning French schools. They remained uneducated and in a state of 'cultural rigidity' (Benrabah, 2004:62) which led to a drastic drop in the Algerian literacy level (Bouazid and Le Roux, 2014:883). Upon independence in 1962 it is estimated that 90% of the population was illiterate (Sharkey, 2012).

Overall, the impact of French colonisation had a far greater effect on Algeria than other French colonised Arab countries such as Tunisia and Morocco. The French colonisation strategy also differed from its counterparts at the time because (as stated earlier) it focused on replacing local language with French. Britain, for example, was not interested to spread English in its colonies at the expense of existing native languages because this meant giving the colonial subjects ambition beyond their status (Pennycook, 2002). Students with English knowledge became ‘invariably unwilling’ to choose manual labour as a means of livelihood leading to ‘discontented classes’ if schooling in English was done on large scale (Pennycook, 2002:98). Unlike the France who supported the spread of French in its colonies, Britain created a limited educated class in its colonies, referred to as ‘a class who may be interpreters between us [the government] and the millions we govern’ (Altbach and Balán, 2007:90). France wanted to strengthen the status of the French language as a global lingua franca by raising the number of French speaking colonial subjects in Africa. This educational policy was at the time only accepted by the minority of Algerians who already had strong links with France. Without a chance for a formal education in a language other than French, the rest of the Algerian population grew up in a multilingual context using a mixture of languages: Berber at home, Arabic in mosques, and French in their interaction with the coloniser.

1.1.2 Arabisation of Algeria - *“L'Algérie Algérienne”*

After independence in 1962, deciding on a national language was an important factor prior to rebuilding the government. As part of doing the latter, Algeria had joined the Arab League - an organization created in Cairo in 1928 with six countries (Egypt, Iraq, Jordan, Lebanon, Saudi Arabia, and Syria) which aimed to recover the status of Arabic across Arab countries. In order to reinforce the Algerian identity, the Algerian government chose Modern Arabic as the national language because it unified all Arab countries and reflected the country’s religious background (Sharkey, 2012:428).

Algeria’s Arabization policy, however, has been widely criticized by many scholars (Benrabah, 2004, 2005, 2007a, 2007b, 2014; Sharkey, 2012) as it meant neglecting other native languages such as Berber (Averett, 2015) and Algerian Arabic (otherwise known as ‘Darja’, spoken by the majority of Algerians) mainly because they are restricted to informal oral communication. The Arab teachers hired from other Arab League countries to teach in Algeria spoken classical Arabic only, while the Algerian students spoke Algerian Arabic (Sharkey, 2012). Also, although most of the hired Arabic teachers had been educated in the medium of Arabic (mostly in religion), they had little or no training in the actual teaching of the language. A further problem was that most of these teachers were influenced by the views of the Muslim Brotherhood, an organization founded by Islamic scholars and schoolteachers in Egypt in 1928 which aimed to spread Islam across Arab countries. The Arabic teachers recruited by the Algerian government were referred to in the literature as ‘religious fanatics’ (Abu-Haidar, 2000:161) who ended up focusing on teaching ‘hard-line Islamism’ rather than language (Sharkey, 2012:438). This led to a political clash between the government and the Front Islamique du Salut (a religious party) and then to a brutal ten-year Civil War (1990-2000).

During the Arabization period Algeria had sent students to qualify in Arab League countries, Europe and the USA, expecting them to contribute to the development of Algeria by passing on their expertise locally to the Algerian students and colleagues or internationally, in international conferences. However, by the end of the Civil War, most of the people with overseas qualifications had died (Sharkey, 2012:439), once again affecting greatly the Algerian bank of qualified educators.

Algeria remains by some measures counted as the largest French-speaking country after France in terms of population (Aitsiselmi and Marley, 2008:211; Sharkey, 2012:430). Competency in French is still important in both the private and the public sectors as well as in education (Benstead & Reif, 2013). There are, however, indications that French is losing status in Algeria. For example, in 2016, SONELGAZ (an energy provider) was sued for sending utility bills in French on the grounds that this went against the Algerian constitution that clearly states that Arabic is the first national language. The court obliged SONELGAZ to switch to issuing utility bills in Arabic, changing their tradition for the first time since independence. Previously, there had been no records of objections to similar traditions towards the use of French, probably because Algerians did not enjoy as much freedom of speech in earlier times. This change of attitude towards French did not only strengthen the status of Arabic as a national language but also opened a gateway for other global languages such as English, which used to be resisted by the dominance of the colonial language. This move away from French has provided a wider range of links and opportunities for the country and the public in both industry and education. The next section will shed light on the place of English in Algeria with a focus on higher education.

1.2 Research background

1.2.1 English in Algeria

At the middle and high school levels Arabic is the sole medium of instruction in all subjects except foreign languages, although a few scientific subjects such as mathematics, natural science, and physics still use some subject-related vocabulary in French. School students soon need to adapt to studying degrees delivered entirely in French at the university level if they opt for hard sciences. At the university level, there is a mixture of languages of instruction. Soft disciplines like religion, human geography and history are taught in Arabic. Scientific and technological disciplines like medicine, mechanics and aerodynamics, on the other hand, are taught entirely in the medium of French (Chaif, 2015). Interestingly, Electrical and Electronics Engineering (EEE) is the only discipline which students can study in French or English in Algeria, according to the institute they attend. However, there is only one institute where it is possible for students to study Engineering in English, in contrast to the high number of French-medium institutes offering degrees in similar disciplines. One institute alone cannot meet the rising demands of students who want to study Engineering in English in Algeria. Due to capacity issues, many students interested in studying Engineering in English end up obliged to study it in institutes where French is the medium of instruction, or postpone their enrolment with the hope of being accepted by the English-medium institute at a later date. However, this situation is expected to change.

Many Algerians (inside and outside the country) have been reacting positively towards the idea of using English as their first foreign language instead of French (Middle East Monitor, 2018). In a poll made on social media with 12,200 participants, 93% voted yes for the use of English. Based on this rising interest in the use of English, some Algerian universities are starting to give the option for students to either submit their dissertations in French or English. The support of the majority of Algerians to the idea of reinforcing the use of English in Algerian higher education has been well received by the

Algerian government. In 2014, the Algerian Ministry of Higher Education and Scientific Research signed a contract with the British Council to send 500 MA students on scholarships to study for PhDs in the UK. This initiative aims to develop 'new relationships and partnerships linking British and Algerian universities to strengthen English language teaching, learning and research' (British Council, 2014). Graduate PhD students of this scheme will then use their research and teaching skills to contribute to the development of English teaching in Algeria. This scheme is expected to boost the teaching of English as a discipline and its use across disciplines in the Algerian educational sectors. One example is supporting the use of English as a medium of instruction in science and technology disciplines which may widen graduates' future career options. Therefore, I believe that the growing preference and support given by the government to the use of English in the Algerian educational system might give rise to a greater use of English in higher education and scientific research. The next section will provide more background details about the only Algerian institute that teaches Engineering in English at present, as an example of how English-medium instruction (EMI) can be successfully implemented in Algeria.

1.2.2 The Institute of Electrical and Electronic Engineering

The Institute of Electrical and Electronic Engineering (IEEE, also known as Ex-INELEC) is one of six institutes that make up the University of M'hamed Bougara Boumerdes (UMBB). As stated earlier, IEEE is the only Algerian institute that uses English as the sole language of instruction, and Electrical and Electronic Engineering is the only discipline in the country that is fully delivered in English. Where physical sciences are taught elsewhere in the country (including Electrical and Electronic Engineering), they are taught in French. IEEE, therefore, suits students who do not want to study technological disciplines in French, and who think that studying in English will increase their employability either locally or globally with foreign companies that use English.

IEEE was created as a result of an agreement between the United States of America (a leading country in the field of Electrical and Electronic Engineering) and Algeria. In 1976, groups of Algerian students were sent to different USA universities to qualify in both English and Engineering, to prepare them to replace the American lecturers that were teaching in IEEE on their return. The contract between Algeria and the USA could not be continued, however, and in 1980 IEEE came under the full responsibility of Algerian lecturers, some of whom had local and others foreign qualifications. In 2013, IEEE added to its undergraduate provision by opening four specialities at its Master of Science (MSc) level: Power Engineering, Computer Engineering, Control Engineering and Telecommunication Engineering.

IEEE is a very strict institute in terms of qualifications when it comes to student enrolment. Students can only enrol on a Bachelor's degree at IEEE if they have top scores in the BAC (National Baccalaureate), a test identical in terms of standards and assessment to the main diploma needed by high school students to pursue university studies in France. The BAC is delivered in Arabic in all fields except foreign languages. However, due to its niche, the institute is obliged by the Ministry of Higher Education and Scientific Research to accept any of its own undergraduates who want to enrol on an MSc course.

IEEE is also strict about undergraduate students' level of English at the enrolment stage. Though most students who intend to study at IEEE have good

BAC grades in English, IEEE provides pre-sessional courses in grammar and English for Academic Purposes (EAP) for all students in their first year. By the end of the pre-sessional programme IEEE students are expected to have acquired the necessary level of English to understand the content of their Engineering lectures and textbooks.

1.2.3 MSc dissertation writing support at IEEE

IEEE does not offer explicit language support classes on how to write dissertations. According to IEEE English teachers, interviewed in this thesis, there are no modules to teach students how to write an MSc dissertation either prior to or during the Masters programme. Students are often encouraged to look at previously submitted dissertations to gain a general idea about how they are most likely to structure their dissertations. They also learn about how to write dissertations from their supervisors in the final years of their BSc and MSc. At BSc level, students learn about writing a dissertation while working on their projects, often by drafting and redrafting chapters in accordance to their supervisors' feedback, and by reading previously submitted dissertations. Because of this, they are expected to know how to write a dissertation by the time they reach their MSc. IEEE, however, offers a module called Communication Skills. As the name suggests, this module is designed to help Masters Engineering students improve their speaking skills and prepare them for their viva presentation. By the time they take this module, the majority of students are in their final phase of dissertation writing. Though this module focusses on oral skills, students can also discuss informally any dissertation-related issues.

The majority of topics at the Masters level are suggested by IEEE supervisors. When interviewed (see Section 3.3 for a description of the interview procedures), professors at IEEE stated that the course leaders at the institute organise annual meetings with members of the industrial sectors to find out what topics they think need to be addressed and improved upon. IEEE professors also attend international events to keep up with the latest topics. On the basis of information gathered from these sources, IEEE professors can identify suitable research projects for staff and Masters' students across the four sub-disciplines. According to the interviews with the supervisors of IEEE, the relevance of their research ensures that IEEE graduates are in high demand by local and international employers and increases their chances of securing a job after graduation.

The next step in a move towards greater use of English as a medium of instruction (EMI) in Algerian higher education would be for the government to establish new institutes with similar characteristics to those of IEEE, or to encourage some of the existing institutes that use French as a medium of instruction to shift to EMI. In order to facilitate the transition from French to English, Algerian universities need a model to emulate - a highly regarded institute that teaches science and technological disciplines in the medium of English. Rather than taking as models universities in countries which do not have much in common with Algeria in terms of resources, language and history, it would be preferable for Algeria to refer to a local model such as IEEE. At IEEE one can identify good practices that can be introduced in other Algerian universities. In this thesis, IEEE is therefore treated as a model to be applied to other scientific institutes in Algeria to meet the increasing need of Algerian students who want to study scientific and technical disciplines in English, as well as the needs of employers and of the government.

1.3 Motivation of the study

Within the scope of this thesis, I have decided to focus on Engineering because it is the only discipline currently taught in English in Algeria, and it is a discipline growing in popularity. According to the [1]QS World Ranking Electrical and Electronic Engineering is ranked amongst the top five distinct disciplines of Engineering and Technology. According to the American Bureau of Labour Statistics, the demand for Electrical and Electronic engineers is projected to grow seven percent from 2016 to 2026. As many countries are planning to gradually depart from fuel consumption towards more environmentally friendly energy such as solar and wind powers to keep up with the rapid growth in population and reduce global warming, the increase in demand for qualified Electrical and Electronic engineers is most likely to be global and not only restricted to leading countries. This means that there will be a rise in the number of students studying EEE in different parts of the world to meet the demands of their respective countries. This is why this thesis takes academic writing practice at the Algerian IEEE as a case study, to be able to better support future students in this regard.

There are many aspects of IEEE that would be worthy of closer examination in order to be better prepared to provide solid academic writing support to the Algerian Engineering students and facilitate the shift towards the

[1] https://www.topuniversities.com/courses/Engineering/guide

spread of EMI in the Algerian higher education. For this thesis, I have decided to examine the MSc dissertation as the most high-stakes assignment IEEE students are asked to produce to qualify as graduate engineers and obtain an MSc degree. The MSc dissertations is the final piece of writing produced by students before they embark on their working lives, and it plays a crucial role in demonstrating students' disciplinary and language proficiencies to supervisors and examiners at IEEE, and to future employers.

The number of institutes offering English-medium programmes are on the increase globally. For example, a study that covered 2,637 institutes of higher education across 28 European countries showed a significant increase in their number, from 725 programmes in 2001 to 8,089 programmes in 2014 (Wächter and Maiworm, 2014:16). The Arab world, on the other hand, is experiencing both positive and negative attitudes towards the spread of English and the idea of shifting to using EMI. The negative attitudes are best described as a struggle between admitting the need to access scientific information through English as a lingua franca and a hope for an Arabized education that supports Arab academia to conduct research in Arabic (BouJaoude and Sayah, 2000). On the other hand, Morocco, for example, is showing positive views towards the use of English in higher education although for historical reasons it is still a country largely dependent on French for the teaching of science and technology (like Algeria). A recent study by Belhiah and Abdelatif (2016) involved interviewing 208 Moroccan students about their perception towards shifting to studying in English, and yielded very positive attitudes (78,8%). Another study by Al-Jarf (2004) showed that 96% of Jordan University students and 82% of King Saud University students believed that EMI is more appropriate for Engineering, medicine and science education. A number of Saudi universities including King Khalid University have already implemented EMI in disciplines such as Engineering, medicine and science (Ryhan 2014, Al-Kahtany, Faruk and Zumor, 2016). Furthermore, the rates of Lebanese learning French have fallen by 10% in Lebanon, although French is still taught as a second language in most schools. The head of the cultural section at the French Embassy in Beirut admitted that it is becoming difficult to promote French in a region where English is 'omnipresent' (Bacha and Bahous, 2011:1323). Two examples of EMI universities in Lebanon are the American University of Beirut (AUB) and the Lebanese American University (LAU).

The reasons for switching to using English vary. In most of the investigated institutes, programme directors for both Masters and Bachelor degrees highlighted the importance of removing language obstacles, and attracting 'top talents'. Other reasons can be also related to the perception that this shift will enhance graduate employability and the internationalisation of higher education (Coleman, 2006).

This global increase in the number of non-native English speakers studying at HE level in EMI institutions, however, poses considerable challenges not only for students adapting to this change but also universities and governments considering the shift to an EMI education. Amongst these challenges, students need to acquire the necessary subject-specific academic language conventions (Hyland and Hamp-Lyons, 2002). These challenges have necessitated the creation of more context-specific English teaching programmes under the umbrella of English for Academic Purposes (EAP), English for Specific purposes (ESP) and English for Science and Technology

(EST). Although many studies (e.g.: Bridgeman and Carlson, 1984; Casanave and Hubbard, 1992; Wallace, 1995; Nesi and Gardner, 2012; Gardner, Nesi and Biber, 2018) show that university students' writing is specific to their discipline and related to their educational level, most EAP courses and textbooks do not use discipline-specific examples, favouring English for General Academic Purposes (EGAP) over English for Specific Academic Purposes (ESAP) (Hyland, 2002; Starfield and Paltridge, 2019). The main reason for this is what Bloor and Bloor (1986) refer to as the 'common core hypothesis' or, in other words, the argument that there are general forms of language shared across a range of disciplines and purposes. Another reason is the fact that EGAP is more economical than ESAP. Regardless of these reasons, however, EAP and ESP practitioners should consider addressing discipline specificity more seriously.

This study undertakes a subject-specific approach to explore writing practices in the discipline of Electrical and Electronic Engineering. This study aims to contribute to the teaching of ESP by providing discipline-specific knowledge about Electrical and Electronic Engineering dissertation writing. Algeria is an important case study in terms of language in North Africa and the Arab world in general.

1.4 Outline of the thesis

This thesis is divided into seven chapters. The second chapter is the Literature Review Chapter. It first starts by explaining disciplinary differences with reference to Biglan's (1973) work. It also discusses the nature of Engineering and regional differences in the teaching of Engineering, and presents the MSc dissertation as a high-stakes assignment. Chapter Two also reviews studies related to genre analysis with a focus on structural analysis studies of MSc dissertations at both micro and macro levels, and studies related to phraseology. Chapter Three addresses points related to ethics and interviews, and explains the creation and compilation process of three different corpora used in the study. It also explains the three research methods used in this study. Chapter Four reports briefly on the interviewees' answers regarding their attitudes on MSc dissertation writing. Chapter Five discusses the overall macro and micro structure of the Algerian MSc dissertations with reference to their American counterparts. This chapter is divided into two sections: the first section explores the structure of the Algerian dissertations and the second looks at the structure of the American dissertations. Chapter Six investigates the level of phraseology in the Algerian MSc dissertations with reference to their American counterparts by looking at the distribution, form and function of the most frequent multi-word sequences. Chapter Seven provides a summary of the research and draws general conclusions from the research findings with reference to research contributions, pedagogical implications, and recommendations for future research.

Chapter 2
Literature Review

2. Introduction

This chapter consists of three sections. The first introductory section explains the concept of a ‘discipline’ and the classification of disciplines with reference to Biglan’s (1973) scheme. These explanations are essential before narrowing down to a definition of Engineering, its different disciplines and subdisciplines, and its two main approaches to Engineering research. This section also talks about the importance of Electrical and Electronic Engineering (EEE) which, as mentioned in Chapter One, is the focus of this thesis. The second section reviews prior studies of the macro- and micro-structure of MSc dissertations, PhD theses and Research Articles (RAs). It starts by briefly reviewing influential structural studies of RAs before focusing on studies of PhD theses and Masters’ dissertations. The last section reviews studies of phraseology with a focus on lexical bundle studies. This section focuses on two key studies, Biber et al. (1999) and Hyland (2008), which present functional and structural models of lexical bundles.

2.1 Disciplinary differences

2.1.1 What is a discipline?

Identifying the contents of a discipline is not ‘straightforward’ (Becher and Trowler, 2001:41). Krishnan (2009:9) explains that disciplines are more than subjects taught in an academic setting, and outlines six criteria that define what a discipline is: 1) a ‘particular object of research’, 2) a ‘body of accumulated specialist knowledge’, 3) ‘theories and concepts’, 4) ‘specific technical language’, 5) ‘specific research methods’, 6) an ‘institutional manifestation’.

The responsible bodies for distinctions between disciplines are ‘leading academic institutes’, which also recognise the emergence of new ‘international communities’ (Becher, 1989:19). Academics working in similar or close disciplinary communities ‘with common sets of practices, at least as far as research practices are concerned’ (Trowler, 2014:1) disseminate their research at international conferences and publish internationally, making themselves part of shared international communities representing their particular disciplines. Different disciplines resemble different ‘tribes’ that operate under their own ‘community culture[s]’ (Becher, 1994:151). However, although international research communities have their own distinct disciplinary cultures, the same discipline may not necessarily be taught and assessed in the same way in different parts of the world. What might vary from one institution to another, or at least in different regions of the world, are approaches to teaching and assessment which are often constrained by countries’ needs, educational infrastructures, the qualifications of professional staff, teaching pedagogies and whether universities prioritise academia and/or links with industry. These constraints influence what is taught or practised in different parts of the world.

Biglan’s (1973) classification scheme is often used as a starting point to understand the nature of disciplines in academia.

2.1.2 Biglan's classification of disciplines

Biglan (1973) interviewed 168 specialists about their perceptions of the nature of their disciplines, in order to create a classification scheme of 35 disciplines. He came up with three continuums: the *hard/soft* continuum indicates the 'degree in which a paradigm[2] exists' in a discipline, the *pure/applied* continuum indicates the 'degree of application', and the *life/non-life* continuum indicates the degree in which a discipline is concerned with 'life systems' (Biglan, 1973:202). Trowler (2014:2), for example, explains that hard disciplines have 'well-developed theory, universal laws, causal propositions, they are cumulative and have generalisable findings', whereas soft disciplines are surrounded by 'unclear boundaries, relatively unspecified theoretical structure, and have loosely defined problems'. While pure disciplines are 'self-regulating' and often indirectly related to problems of the real world, applied disciplines are regulated by external factors of the real world. As its name suggests, life disciplines are concerned with studying live subjects, as is the case in Medicine, Botany and Biology. On the other hand, non-life disciplines are not directly concerned with dealing with living subjects. Disciplines can be described in terms of all three continuums.

The prime function of hard/pure disciplines is 'the search for general laws governing the areas of human understanding with which it is concerned' whereas the prime function of hard/applied disciplines is 'the generation of product-oriented techniques' (Becher, 1989; Becher and Trowler, 2001:177-178). While soft/pure disciplines are seen (at least externally) as 'ambivalent',

[2] A paradigm is the distinct set of knowledge that shapes each discipline including theories, concepts, research methods and facts. The term is popularized by the work of Kuhn (1962, 1970).

dealing largely with inapplicable, theoretical knowledge, involving the study of the particular and the search for 'empathetic understanding' rather than general and causal explanation, soft/applied disciplines are considered 'more heterogeneous', containing disciplines such as Economics and Sociology which aspire to 'generality' and the 'potentiality of application' (Becher, 1989:146).

Biglan's (1973) classification scheme, however, is only useful when applied in the broadest sense. On closer examination several disciplines 'fail to fit comfortably within' these categories (Becher, 1989:16-17). Therefore, it seems that 'neither hardness nor softness, purity nor application, should be seen as absolutes, but as end-points of continua' (Becher, 1989:151).

2.1.3 What is Engineering?

Engineering is an umbrella term for a research area that consists of 'about a dozen different domains of Engineering specialisation' (Gardner and Xu, 2019:6), most of which are largely considered as hard, applied and non-life (Biglan, 1973). However, the four main disciplines of Engineering are Chemical, Civil, Electrical, and Mechanical Engineering (Lande and Jordan, 2015:3). These disciplines are also described by Gardner and Xu (2019:6) as 'the most stable' disciplines according to the Quacquarelli Symonds (QS) World Ranking. Although these disciplines might be loosely related, they exist in their own departments 'as separate estates, with distinctive subcultures' (Becher, 1989:23).

Overall, Parker (2010:206) defines Engineering as 'the application of highly specialized, and technical, knowledge to a practical end that either remedies a problem or represents the "best" solution to a problem, usually within a set of defined constraints'. Combining mathematical and scientific knowledge in a certain way (Lande and Jordan, 2015:2) creates the knowledge required to improve the living conditions of mankind. For centuries 'bringing about change' has remained a key principle in Engineering (Gardner and Xu, 2019). According to Koen (1985:11) 'to identify a situation requiring an engineer, seek first a situation calling for change'. This relationship is also demonstrated in Cropley (2015), as shown in Figure 2.1.

Figure 2.1: The relationship between change, engineers and design (Cropley, 2015:17)

Engineering has an indispensable relationship with design, as shown in Figure 2.1, making Engineering largely design dependent (Cropley, 2015:15). A general definition of design involves 'any activity that results in the synthesis of something that meets a need' (Horenstein, 2002:22), while design Engineering is 'a problem-solving approach which entails a rigorous, systematic study of the deliberate ordering of components in our universe' (Mckay and Marshall, 2005:2). Through design, engineers aim to solve ‘complex technical problem[s]’ (Hagler, Chandler and Fontenot, 2001:3) which involve controlling and/or building artifices ‘for the purpose of manipulating the human environment’ (Pitt, 2001:22). These can be ‘a physical object, a computer program, or a procedure’ (Goetschalckx, 2011:15).

As noted at the beginning of this section, the change that Engineering promotes happens ‘under constraint’ (National Academy of Engineering, 2004:7). Therefore, part of becoming a qualified engineer is learning how to seek ‘the best change within the available resources’ (Koen, 1985:9), which is often achieved through experiments and prototyping. Both apprentice and professional engineers are often restricted in terms of the freedom and the resources that determine the extent to which they can bring about change. Therefore, engineers must learn ‘how to cut out the dross and get to the heart of things’ (Becher, 1989:29) to find ‘new answers to old problems’ (Cropley, 2015:15) without wasting too much time and resources. Overall, there will always be educational, financial, physical and political constraints that not only force engineers to alter their ways of bringing about change but also the ways of teaching Engineering in different parts of the world. In addition, scientific research approaches also differ from one field to another. For the scope of this research, this thesis focuses on the field of Electrical and Electronic Engineering.

2.1.4 Electrical and Electronic Engineering

Of the four stable disciplines of Engineering mentioned in Section 2.1.3, we can accept that Electrical and Electronic Engineering has had the greatest impact on the development of our societies. Since the early steps of the profession in the mid-1800s by big names such as Ohm, Tesla, Faraday and Maxwell, we have become a largely electricity-dependent species (Gindis and Kaebisch, 2017:215) and almost everything we use contains electrical components. As Electrical Engineering is very closely related to Electronic Engineering, they are often combined. While Electrical Engineering deals with the generation and transmission of electricity, Electronic Engineering is more concerned with signal transmission and consumer electronics (Gindis and Kaebisch, 2017:215). Within Electrical and Electronic Engineering (EEE), and especially with the rapid technological development in this field, there is a constant pressure to recognise additional subdisciplines such as precision Engineering, which is concerned with developing laser-cutting and 3D printing machinery (Evans, 2012; Hoffman and Zhang, 2018). Some of the most stable and widely recognised subdisciplines in EEE are Control Engineering, Power Engineering, Telecommunication Engineering, and Computer Engineering. These sub-disciplines use an approach known as Design Science which is specific to the field of Science and Technology.

2.1.5 Design Science in Engineering

What also distinguishes Engineering from other disciplines are the approaches to research taken by engineers. Livari and Venable (2009:1-2) explain that Design Science (DS) is more of a ‘research orientation, within which one can use different research methods’. DS emphasizes a purely ‘construction-oriented view’ (Livari, 2007; Sein et al., 2011:38) to build and test innovative artefacts with often limited or no focus on the human factor. The process ‘entails multiple cycles of design and implementation refinements' (Ford, McNally and Ford, 2017:52), a point which is also mentioned in Edelson (2002:110). Therefore, many engineers spend most of their time refining their 'technical work' (Lande and Jordan, 2015:3). Engineers can also conduct another approach known as Action Research to address the direct impact of certain designs on the individual to eliminate any possible design-related issues.

Many studies (for example Andreessen, 2008; Livari and Venable, 2009; Sein et al., 2011; Maccani, Donnellan and Helfert, 2015) have acknowledged the power of the combination of the two approaches towards improving the efficiency of Engineering designs. The combination of the two approaches is referred to as 'Action Design Research' or ADR (Sein et al., 2011).

Overall, ADR focuses on building, intervention, and evaluation of an artefact that reflects 'the theoretical precursors and intent of the researchers' and also 'the influence of users and ongoing use in context' (Sein et al., 2011:40). Other goals, however, may include 'measuring properties of systems', 'improving system performance', 'developing formal models of application domains', 'improving prior systems', and 'reviewing and synthesizing prior research' (Nunamaker et al., 1991:102). This design-centred nature of Engineering might affect the production of research and its macro-structure.

A typical template for design science research was identified by George (1989) who looked at 40 Engineering students' lab reports and found the following structure: Abstract ('summarise the entire report'), Introduction ('state purpose of experiment; "review" theory; summarize experimental procedure'), Theory ('explain assumption(s)/principle(s) that underlie experiment [explain functions of apparatus, theory behind method being used, method used for determining data]'), Apparatus & Procedure ('describe apparatus used describe experimental procedure'), Results ('present, discuss, analyse results of experiment, compare results with previous (published) work'), and Discussion/Conclusion ('analyse and interpret data'). A similar structure referred to as methodological recount was also found in Nesi and Gardner (2012:185) who analysed students' assignment in a number of disciplines including Engineering. Another structure of design science research in Engineering students' writing described in Nesi and Gardner (2012) is known as design specification. A typical table of contents of the latter is shown in Figure 2.2.

Introduction
Theory
Design specification
- Mechanical system
- Sensing elements
- Output system
- Overall system
Analysis and discussion
Conclusion

Figure 2.2: A typical table of contents of the design specifications genre family (Nesi and Gardner, 2012:185)

Methodological recount and design specification are two distinct genre families in BAWE (Nesi and Gardner, 2012); the Methodology Recounts include lab reports which describe the procedures and results for a single experiment, but Design Specifications describe an iterative design process leading to the specification for a product of some sort, and providing proof that it is fit for purpose. In other words, while the purpose of Methodological Recounts genre family is to demonstrate/develop familiarity with disciplinary procedures, methods, and conventions for recording experimental findings, the purpose of Design Specifications is to demonstrate/develop the ability to design a product or procedure that could be manufactured or implemented in the real world.

It is worth nothing that the table of contents shown in Figure 2.2 is from Engineering students' design specifications produced in the United Kingdom. Whether this structure applies to Engineering texts with a similar purpose produced in different parts of the world is yet to be investigated. The next section will show how regional differences can have an impact on the teaching of Engineering.

2.2 Regional differences in the teaching of Engineering

Although many countries share the goal of preparing highly skilled engineers, it is often argued that 'economic and cultural differences influence the design of these Engineering education systems and the Engineering students within them' (Haase et al., 2013:699). American Engineering faculties are increasingly recognising the importance of soft skills such as 'teamwork, problem solving, and critical thinking' which are expected to widen the range of students' opportunities (Haase et al., 2013:699). These soft skills are often taught during the first two years of the undergraduate degree. For example, Engineering students in the USA are required to complete 'a series of general education courses covering humanities, literature, science, and math courses' before specialising in their desired discipline (Haase et al., 2013:699). Although the Canadian Engineering educational system is similar to that in the USA, this trend is said to be 'more pronounced in the U.S. than in Canada' due to 'earlier development of such programs in the U.S.' (Parker, 2010:213). The USA seems to be focusing on producing what Wheeler and McDonald (2000:484) refer to as the 'new breed of engineer – one that is comfortable and effective in the executive suite as well as the construction site or at the computer'. On the other hand, Denmark has two programs: one is 'academically focused' five years full time resulting in a Masters' degree and the other which is a three-year less academic professional bachelor's degree with six-month internship (Haase et al., 2013:699). It seems that the Danish educational system still separates professional and academic engineers.

In comparison with these two countries, Algeria, although it had strong ties with the USA, does not follow the teaching pedagogy of the USA or distinguish between academically focused and more professional degrees, as in Denmark. As explained in Chapter One, the Algerian Engineering students are not taught soft skills and specialise immediately in Electrical and Electronic Engineering by the end of the second semester after the in-sessional language support. After their Bachler degrees, the large majority of the Algerian Engineering students enrol on two-year MSc degrees which are oriented towards their future professional life as designers of Engineering systems.

While developed countries seem to be moving more towards promoting the diversity and wide knowledge of their new breed of engineers, developing countries, on the other hand, favour applying educational programs that encourage their Engineering students to learn 'high standard' technical skills to provide their industries with well-trained bodies of technicians and professional engineers (Bucciarelli et al., 2009:107). The choice of educational policy is likely to greatly affect both the discipline of Engineering and the kind of knowledge each group of students receives during their studies. Potential differences in the writing of these two groups of students might reflect differences in policies relating to the teaching of Electrical and Electronic Engineering (EEE) in Algerian and other countries such as America. Such differences can only be verified if students writing is analysed from both countries. The next section will explain the importance of focusing on examining MSc dissertations as a high-stakes student assignment.

2.3 The MSc dissertation as a ‘high-stakes’ assignment

Engineering students, like all university students, must produce different high-stakes assignments to progress and eventually obtain their degrees. While low-stakes assignments are important because of ‘the neural changes’ they leave in students’ minds, high-stakes assignments are written to demonstrate high levels of understanding and are graded carefully for ‘soundness of content and clarity of presentation’ (Elbow, 1997:5). This means that while the focus of low-stakes assignments is on the process of writing, high-stakes assignments are more about the final product.

The Masters of Science (MSc) dissertation is the highest-stakes assignment for most Engineering students at the Masters level (Andersson, Najafabadi and Wren, 2016:2). According to the MSc Engineering Handbook (2018-2019) of the University of Dublin, ‘the MSc dissertation is a major undertaking requiring maturity, planning, analysis and a considerable amount of hard work’. The previously discussed regional differences in the teaching of Engineering (Section 2.2) might well be reflected in the way MSc dissertations from different parts of the world are written and presented, alongside the more universal design science nature of Engineering research (Section 2.1.4). Paltridge (2019) argues that ‘even the basic outline of a thesis or dissertation is a complex issue’ because there is not ‘simply one way to write a thesis or dissertation that is acceptable in every area of study’. He adds that the conventions that govern the writing of research genres are often not clear and might differ from one country to another. The next sections will shed light on what we know regarding the organisational structure of MSc dissertations as well as PhD theses and Research Articles (RAs) as two other high-stakes ‘research-process genres’ (Swales, 1990:177).

2.4 Structural studies of research-process genres

> Genre is a socially constructed concept to describe a set of texts that are perceived to perform similar functions. Texts belonging to a genre are conventionalized, to differing degrees, in terms of sequencing, of layout, of phraseology, and there are expectations of, and constraints on, the structure and linguistic expression of such texts. (Thompson, 2001:33)

I chose Thompson’s definition of genre because the reference to ‘layout’ makes it specific to written genres, and it is a good fit with the type of research-process genres covered in this section. This section explores structural studies of three research process genres (Masters’ dissertations, PhD theses and RAs) because they can sometimes overlap in terms of their overall and internal structure. The section starts by reviewing structural models of RAs which have influenced studies of the structure of Masters’ dissertations and PhD theses. The second section reviews studies of the macro and micro structure of PhD theses and Masters’ dissertations.

2.4.1 Research Articles macro and micro-structure studies

2.4.1.1 Macro-structure studies of RAs

A common structure of research writing, in general, divides it into four sections, Introduction, Methods, Results and Discussion, otherwise known as the IMRD structure. What separates these sections from one another are their function within the research paper (Hill et al., 1982:334), which is reflected in the language used in each section. Therefore, early studies such as West (1980) and Heslot (1982) used the IMRD structure as a starting point to understand how each section is written.

Hill et al. (1982:335) examined the structure of a single research paper from Psychology, a discipline which they argued represented a standard rhetorical model in the sciences. Using the traditional non-computational method of manually reading and deciding on the function of each paragraph, they confirmed that the paper they examined had a structure of introduction, procedures and discussion, with the procedure section containing both the method and the results (Hill et al., 1982:334). This, along with that of West (1980) and Heslot (1982), established the notion of the IMRD structure.

The application of the IMRD structure is often explained to apprentice writers with reference to the shape of the 'hour-glass' (Bruce, 2003; Cargill and O'Connor, 2009; Mogull, 2018), starting with a broadly focussed introduction, narrowing down in the middle with the methodology and results, and generalising again in the discussion section. Studies such as Lin and Evans (2012), Posteguillo (1998) and Swales (1990) show that there are other structural forms derived from the original IMRD structure and the IMRD is not strictly a one-size-fits-all model.

Lin and Evans (2012) examined the structure of 433 ‘empirical’ RAs from 39 disciplines in the fields of Engineering, applied sciences, social sciences and the humanities with a range of 1 to 19 RAs from each discipline. These included papers with ambiguous or no headings, which they read to establish their organisational patterns. Stand-alone sections with unique communicative purposes not accounted for in the IMRD model were given an independent status as some sections were identified as having multiple communicative functions. This was shown in their findings by placing the initials of different sections between square brackets; for example, a combined Results and Discussion was referred to as [RD], see Figure 2.3. Lin and Evans (2012) also identified Literature Reviews sections (L).

Figure 2.3: Derivative structural patterns in RAs (Lin and Evans, 2012:154)

As shown in Figure 2.3, the most frequent structure was ILM[RD]C occurring in 21% of the RAs. The IMRD structure was found only in 12.2% of the examined RAs. Overall, however, 80% of the patterns found were derivative forms of the IMRD structure. Lin and Evans’ (2012) did not elaborate on the *‘Others’* category (see Figure 2.3) which is found in 19.7% of RAs.

Table 2.1: Lin and Evans' (2012) Engineering related structural patterns of RAs

Overall, one could say that there is a uniformity in the structure of Engineering RAs examined by Lin and Evans (2012) with many derivative forms of the IMRD structure. The majority of these RAs discuss the results and discussion in the same section. Table 2.1 also shows that almost all Engineering RAs contain a stand-alone literature review separate from the introduction. This is in line with Posteguillo (1998) who found that 30 (75%) of Computer Science RAs collected across different journals had a literature review section separate from the introduction. However, unlike Lin and Evans (2012), 34 (85%) of Posteguillo's RAs had a combined discussion and conclusion (the remaining 15% ended with a results section). Although Swales (1990) treated the Literature review (L) as part of the Introduction (I) section, and the conclusion section as part of the discussion, he acknowledged that a more detailed representation of the IMRD structure could be [IL]MR[DC], where the Literature review is part of the Introduction and the Conclusion is part of the Discussion.

Posteguillo also found that writers of Computer Science RAs avoid one specific section for the methodology. Instead, they make subdivisions in their explanations or add comments comparing their applications and algorithms with those of other fellow researchers. This makes it difficult for linguists to give a clear definition of such sections (Posteguillo, 1998:153), because they do not easily fit into the conventional IMRD structure. This problem of design science research not having a clear typical structure is also expressed by Peffers et al. (2008:53); they argue that the literature is rich of information about how to conduct design science research, yet it lacks in providing clear process models that fit this type of research, a point which is also expressed by Geerts (2011:143). To address this issue with reference to RAs, Peffers et al. (2008) examined seven RAs in Information Systems and identified a six-activity structural model. As shown in Figure 2.4, a clear summary of this model with explanations of each stage is found in Geerts (2011) who also builds on Peffers et al. (2008) to explore the structure of six RAs in Accounting Information Systems (AIS).

Figure 2.4: Design Science Research Methodology (DSRM) in Information Systems (Geerts, 2011:144)

The arrows on the left of Figure 2.4 emphasise ‘the importance of iteration as part of DSRM’ (Greets, 2011:144). Hever et al. (2004:78) refer to this cyclical move as ‘build-and-evaluate loop’ where it is often repeated a number of times before achieving the final desired design/artefact. This cyclical nature of design science is probably what made it difficult for Posteguillo (1998) to identify a one specific section for the methodology in Computer Science RAs.

It is also worth noting that all six RAs in Geerts’ study involved designing an artefact to address a certain issue in the AIS domain (Geerts, 2011:145). This supports the point made in Section 2.1.5 that the design specification genre focusses on designing products or developing procedures that could be manufactured or implemented in the real world. The unconventional sections shown in Figure 2.4 are not often discussed in the literature related to the structure of RAs.

This section has reviewed studies related to the macro structure of RAs and explained some key terminology related to macro-structure analysis studies of RAs. The next section will review studies related to the Micro-structure of RAs.

2.4.1.2 Micro-structure studies of RAs

This section reviews studies that have examined the internal structure of conventional IMRD sections in RAs. Table 2.2 provides a summary of these studies.

Table 2.2: Summary of studies that examined the internal structure of RAs

Introduction	Methodology	Results	Discussion
Swales (1990) Hard Sciences, Social Sciences, Life Sciences (16 each)	Kanoksilapatham (2005) Biochemistry (60 RAs)	Brett (1994) Sociology (20 RAs)	Holmes (1997) History, Political Science and Sociology (30 RAs).
Posteguillo (1998) Computer Research (40RAs)	Kanoksilapatham (2007) Biochemistry (60 RAs)	Posteguillo (1998) Computer Research (40RAs)	Posteguillo (1998) Computer Research (40RAs)
Samraj (2002) Biology and Wildlife Behaviour (24 RAs)	Bruce (2008) Across disciplines (60 RAs)	Kanoksilapatham (2005) Biochemistry (60 RAs)	Kanoksilapatham (2005) Biochemistry (60 RAs)
Swales (2004) Hard Sciences, Social Sciences, Life Sciences (16 each)	Maswana et al. (2015) Engineering (67 RAs)	Kanoksilapatham (2007) Biochemistry (60 RAs)	Kanoksilapatham (2007) Biochemistry (60 RAs)
Kanoksilapatham (2005) Biochemistry (60 RAs)	Khamsi et al. (2015) Engineering (60 RAs)	Bruce (2009) Sociology & Chemistry (40 RAs)	Peacock (2002) Physics, Biology, Environmental Science, Business, Language and Linguistics, Public and Social Administration, and Law. (252 RAs)
Samraj (2005) Biology and Wildlife Behaviour (24 RAs)	Zhang & Wannaruk (2016) Education Research (120 RAs)	Maswana et al. (2015) Engineering (67 RAs)	Basturkmen (2009) Language Teaching Research (10 RAs)
Kanoksilapatham (2007) Biochemistry (60 RAs)	Cotos et al. (2017) Across 30 disciplines (900 RAs)		Basturkmen (2012) Dentistry (10RAs)
Kanoksilapatham (2011) Civil Engineering (60 RAs)			Maswana et al. (2015) Engineering (67 RAs)
Kanoksilapatham (2012) Civil, Software, Biomedical Engineering (180 RAs)			Amnuai (2017) Accounting (20 RAs)
Cortes (2013) One-Million-Word Corpus[3]			Liu and Buckingham (2018) Applied Linguistics (20 RAs)
Kanoksilapatham (2015) Civil, Software, Biomedical Engineering (180 RAs)			
Maswana et al. (2015) Engineering (67 RAs)			

As shown in Table 2.2, all four sections of the IMRD structure have been analysed at the micro-structure level, with more studies of the Introduction and

[3] Cortes (2013) One-Million-Word Corpus: Agronomy (92), Applied Linguistics (87), Animal Science (101), Biology (147), Business (122), Chemistry (94), Civil and Materials Engineering (159), communication Studies (57), Computer Science (144), Economics (92), Physics and astronomy (112), Statistics (91), Urban and Regional Planning (74).

Discussion sections than studies of the Methods and Results sections. The most likely reason for this is that the Methodology and Results sections report on what was done and what was found, which might make them (to a certain extent) less difficult to write than building an argument for the research (in the Introduction section) and discussing the meaning of the findings (in the Discussion section). Another reason for the amount of research done on the introduction section of RAs is related to the impact of Swales' work and his notion of ‘Moves’ and ‘Steps’ as functional units and sub-units for text analysis. Swales created a model known as the Create a Research Space (CARS), as shown in Table 2.3, which breaks down the moves and steps required to write the introduction section of RAs. An important point in the CARS model is the notion of identifying the ‘gap’ the research aims to address. This can be a particular challenge for novice RA writers, and the CARS model has been proved to be helpful in this regard.

The CARS model has been widely used by many researchers to investigate the structure of RA introductions across disciplines, for example by Kanoksilapatham (2004, 2005, 2007, 2011, 2012 and 2015). Despite its initial impact, Swales modified his model in 2004, in response to criticisms regarding its general applicability, and the difficulty of distinguishing between the first three steps in the first move.

Table 2.3: Internal structure of introduction section of research articles cross disciplines

Swales (1990)	Swales (2004)	Kanoksilapatham (2005, 2007)	Kanoksilapatham (2011)	Kanoksilapatham (2012, 2015)
Hard Sciences, Social Sciences, Life Sciences (16 each)	Hard Sciences, Social Sciences, Life Sciences (16 each)	Biochemistry	Civil Engineering	Civil Engineering, Software E, Biomedical E
48 research article introductions	48 research article introductions	60 Research articles	60 Research articles introductions	180 Research articles
M1: Establishing a territory S1: Claiming centrality S2: Making topic generalization(s) S3: *Reviewing items of previous research*	**M1: Establishing a territory** S1: Topic generalisations of increasing specificity	**M1: Announcing the importance of the field** S1: Claiming the centrality of the topic S2: Topic generalizations S3: *Reviewing previous research*	**M1: Establishing a territory** S1: Claiming centrality S2: Making Topic generalisation S3: *Reviewing previous studies*	**M1: Establishing a territory** S1: Claiming centrality S2: Making topic generalization Step 3: *Reviewing previous studies*
M2: Establishing a niche S1: A Counter-claiming or S1: B Indicating gap; S1: C Question-raising; S1: D Continuing a tradition	**M2: Establishing a niche** S1A: Indicating a gap or S1B: adding to what is known S2: Presenting positive justification	**M2: Preparing for the present study** S1: Indicating a gap S2: Raising a question	**M2: Establishing a niche** S1: Indicating a gap	**M2: Establishing a niche** S1: Indicating gaps S2: Adding to what is known S3: Presenting positive justification
M3: Occupying the niche S1: Outlining purposes or S1: Announcing present findings; S2: Announcing principal findings; S3: Indicating RA structure	**M3: Presenting the present work** S1: Announcing present research descriptively and/or purposively. S2: Presenting research questions or hypotheses S3: Definitional clarifications S4: Summarising methods S5: Announcing principle outcomes S6: Stating the values of present research S7: Outlining the structure of the paper	**M3: Introducing the present study** S1: Stating purpose(s) S2: Describing procedures S3: Presenting findings	**M3: Introducing the present work** S1: Announcing present research S2: Summarizing methods S3: announcing principal outcomes S4: Stating research values S5: Outlining the structure of the paper S6: Justifying procedural decisions S7: Describing the study sites	**M3: Presenting the present study** S1: Announcing purposes S2: Summarizing methods S3: Announcing principal outcomes S4: Claiming research values S5: Outlining article structure S6: Offering procedural justification S7: Clarifying terms S8: Describing study sites S9: Suggesting further research

As can be seen in Table 2.3, Swales' initial CARS model consists of three moves: 'Establishing a territory', 'Establishing a niche', and 'Occupying the niche' (Swales, 1990); the third move was renamed as 'Presenting the present work' (Swales 2004). Each move in the CARS model contains multiple Steps with different functional purposes. Although there is a great level of similarity between the models identified in all the studies presented in Table 2.3, there are also some variations, perhaps due to disciplinary differences and the different interpretations of each scholar. The most stable moves across all models are the first two moves: 'Establishing a territory' and 'Establishing a niche' which occur across all studies. However, although the names of these two moves are the same across all studies there are some variations in the number and kinds of steps identified in each move, see Table 2.3. The third move varies at the move and steps levels. It is useful to keep in mind these suggested models when analysing other genres, but at the same time we should be cautious because these models might not necessarily fully apply to introductions in other genres. The next section will examine studies that have investigated the macro and micro-structure of Masters' dissertations and PhD theses.

2.4.2 Theses and dissertations macro and micro-structure studies

2.4.2.1 Macro-structure studies of PhD theses and Masters' dissertations

This section provides a review of major studies that have explored the macro structure of Masters' dissertations and PhD theses. This section will also show the difference in the amount of available research on MSc dissertations as compared to PhD theses and RAs, which is why I have also included studies of PhD theses in this section.

Table 2.4: Five organisational models of PhD theses and Masters' dissertations

Model name	Traditional: Simple	Traditional: Complex	Topic-based: Simple	Topic-based: Complex	Compilation of Research Articles
Studies Found in	(Dong 1998; Bunton, 1998; Dudley-Evans, 1999; Thompson, 1999, 2001; Paltridge, 2002)	(Bunton, 1998; Thompson, 1999, 2001; Paltridge, 2002)	(Bunton, 1998; Paltridge, 2002)	(Dudley-Evans, 1999)	(Dong, 1998; Paltridge, 2002)
Organisation structure	Introduction Literature review	Introduction Background to the study and review of the literature Background; methods (optional)	Introduction Literature review	Introduction	Introduction Background to the study
	Methods		Methods		
	Results	**Study 1** Introduction Methods Results Discussion and conclusions	**Topic 1** Analysis Discussion	**Topic 1** Introduction (Lit) Methodology Results Discussion (conclusion)	**Research article 1** Introduction Literature review Materials and methods Results Discussion Conclusion
	Discussion	**Study 2 etc**. Introduction Methods Results Discussion and conclusions	**Topic 2 etc.** Analysis Discussion	**Topic 2 etc.** Introduction (Lit) Methodology Results Discussion (conclusion)	**Research article 2 etc.** Introduction Literature review Materials and methods Results Discussion Conclusion
		Discussion			Discussion
	Conclusion	Conclusions	General Conclusions	General Conclusions	Conclusions

As can be seen from Table 2.4, the reviewed literature has identified five organisational structures, all of which map onto the conventional IMRD structure of RAs discussed in the previous section: Two are Traditional (Simple and Complex), two Topic-based (Simple and Complex), and one is a Compilation of Research Articles. Bunton (1998) did not label the three types of structures found in his study but they map exactly onto the Traditional Simple, Traditional Complex and Topic-based Simple structures (see Table 2.4). The Traditional Simple and Traditional Complex were suggested by Thompson (1999, 2001) and the Topic-based Simple and Topic-based Complex were suggested by Dudley-Evans (1999). Dong (1998), identified another type of structure which he called Compilation of Research Articles. This consists of 'autonomous journal articles connected on one major theme' (Dong, 1998:371). In fact, all but the Traditional Simple structure report on multiple topics connected to one major theme. The main differences in the organisational structures presented in Table 2.4 are at the level of the 'explanatory' chapters located between the Introduction and Conclusion. In dissertations and theses which are complex or compiled of RAs, the explanatory chapters have a recursive IMRD structure.

Table 2.5: Summary of organisational studies on Masters' dissertations and PhD theses

	Thompson (1999; 2001)	**Bunton (1998)**	**Dudley-Evans (1999)**	**Dong (1998)**	**Paltridge (2002)**
Model	Traditional: simple, Traditional complex.	*[4]Traditional: simple, *Traditional complex, *Topic-based: simple.	Traditional: simple, Topic-based: complex	Traditional: simple, Compilation of Research Articles	Traditional: simple, Traditional complex, Topic-based: simple, Compilation of Research Articles
Data	Interviews (8 supervisors) (8 Agricultural Botany + (8 Agricultural Economics) - PhD level	21 theses (13 PhD & 8 M.Phil.)	Teaching experience - PhD level	25 Interviews, 169 questionnaires (14 of which were Masters students).	15 PhD theses *[5]15 Masters dissertations
Place	UK	China (Hong Kong)	UK	USA	Australia

[4] I used Thompson (1999;2001) and Dudley-Evans (1998) suggested labels to best describe Bunton's (1998: 112) three structures as Traditional: Simple, Traditional complex and Topic-based: Simple.
[5] Paltridge (2002) is the only study that examined the structure of Masters' dissertations.

Table 2.5 shows the type and amount of data used in each study listed in Table 2.4. As shown in Table 2.5, it seems that there are regional variations regarding the structure of PhD theses and Masters' dissertations. For example, in Hong Kong and the UK, PhD theses seem to be Traditional Simple, Traditional Complex, or Topic-based, whereas in the USA they seem to be Traditional Simple or a Compilation of Research Articles. The Australian PhD theses and Masters' dissertations appear to follow all structural variations. The samples were admittedly small, but this suggests that PhD theses and Masters' dissertations do not necessarily follow the same structural practices in different parts of the world, and that different structural practices might be preferred and applied in different countries. It also shows that PhD theses and Masters' dissertations do not necessarily follow the conventional IMRD structure. Next, I will critically review the studies presented in Table 2.5.

Critical review

Before critically reviewing the studies presented in Table 2.5, an explanation of the use of some terms such as 'section', 'chapter' and 'stage' is needed. Studies of the structure of the three research-process genres (MSc dissertations, PhD theses and RAs) use the term 'section' to refer to the different parts that make up these texts, i.e.: Introduction, Literature Review, Methodology, Results, Discussion and Conclusion. This might be a convenient practice when describing the structure of RAs because they consist of sections as the largest units. However, when this practice is applied to PhD theses and Masters' dissertations, it can be confusing as they consist of chapters which are sometimes longer than the sections named above (for example if there is more than one chapter on methods). Therefore, in this thesis, I will use the term ‘stage’ to refer to one or multiple chapters that share the same communicative purpose.

The first study to be critiqued is Dong (1998) who did not explore students’ actual writing. Dong (1998) came up to the ‘Compilation of Research Articles’ structure based on a review of the literature and interviews (see Table 2.4). Dong surveyed 32 professors and 137 students who were in the process of writing a Masters dissertation or a PhD thesis across 74 research areas at two US universities. Though Dong covered both PhD theses and Masters’ dissertations, only 14 out of 137 student participants were Masters’ students. This means that the Compilation of Research Articles structure found by Dong (1998) is more representative of PhD theses than Masters’ dissertations. One reason for this is because of the time it takes for an article to be published, which usually extends beyond the duration of an MSc degree. Another reason is the expertise required to successfully publish research articles, which surpasses the Masters level. Finally, the average length of a research article is usually between 7,000 to 10,000 words. Although some technical and discipline-specific research might be published in short articles, it would be impossible to fit multiple RAs in an MSc dissertation with the normal length restriction of 15,000-20,000 words.

Bunton (1998) examined the structure of 13 PhD and 8 M.Phil. dissertations written by Chinese students from six faculties (Science, Engineering, Medicine, Arts, Social Sciences and Education) at the University of Hong Kong. The number of PhD theses Bunton collected from each faculty was very limited and it did not include Masters' dissertations. Bunton classified the theses by faculties and not by disciplines, grouping them into two broad categories: [6]Science and Technology (ST) - 7 PhD and 3 M.Phil. dissertations, and [7]Humanities and Social Sciences (HSS) - 6 PhD and 5 MPhil dissertations. His approach provides researchers and language instructors with generic structural models instead of detailed discipline-specific findings, a point also made by Hyland (2005) and Paltridge (2002).

Unlike previous studies, Dudley-Evans (1999) was not explicit about the number of theses or dissertations examined. Interestingly, however, he agreed about the need for more research on theses and dissertations as he entitled his article 'Masters' dissertations: case of neglect' and stated that the majority of teaching materials for international undergraduate students in the USA are derived from research on RAs (Dudley-Evans, 1999:29). Perhaps this is due to the availability of RAs compared to other research-process genres. However, there might be some overlap at the level of the lexico-grammar and rhetorical functions. Flowerdew (2015:60) agrees that this justifies the use of RAs to inform materials to help students to write dissertations. Because Flowerdew's students came from different disciplines, she followed a wide-angle orientation in her corpus analysis. This means that she focused on identifying cross-disciplinary language variations rather than focusing on a few (or even a single) discipline. In contrast to Flowerdew (2015), Dudley-Evans (1999:29) argues that materials based on the analysis of RAs are 'only partly successful in helping students who have to write an MSc dissertation rather than articles'. Thus, more

[6] Science and Technology includes the faculty of Science, Engineering and Medicine.
[7] Humanities and Social Sciences includes the faculty of Arts, Social Sciences and Education.

dissertation-driven research is needed to inform our understanding of the writing of this genre to provide better guidance for these students.

Amongst other analyses, Thompson (1999, 2001) examined the structure of 16 PhD theses from two disciplines: Agricultural Botany and Agricultural Economics. Like Dudley-Evans (1999), Thompson (1999; 2001) acknowledges the lack of studies of the rhetorical structure of Masters' dissertations and PhD theses. Both researchers argue that with the rising number of students writing in English, more research is needed to inform the teaching of the genre students are required to write. As most students are obliged to write a dissertation to graduate, it is disappointing that we still know very little especially regarding the structure of MSc dissertations.

Paltridge (2002) is the only study reviewed that included analysis of the structure of Masters' dissertations and PhD theses across different disciplines, see Table 2.5. However, he only looked at 15 Masters' dissertations and 15 PhD theses, which is a very limited number to draw any major conclusions from. Paltridge did not explain what methods he used to arrive at the classifications presented in Table 2.6, but he discussed his findings with reference to four tables of contents (two from Masters' dissertations and two from PhD theses) each of which represented one of the structures shown in Table 2.6. This may indicate that Paltridge only drew on tables of contents and the prior literature to arrive at the classification shown in Table 2.5. Furthermore, he did not draw attention to the existence of two types of Topic-based structure: Simple and Complex, shown in Table 2.4.

Table 2.6: Paltridge's (2002:132) cross disciplinary findings of organisational structures

Some materials have been removed from this thesis due to Third Party Copyright. Pages where material has been removed are clearly marked in the electronic version. The unabridged version of the thesis can be viewed at the Lanchester Library, Coventry University.

As can be seen from Table 2.6, only one PhD thesis was classified by Paltridge (2002) as a Compilation of Research Articles. This strengthens Dong's (1998) claim that this structure is associated with PhD theses rather than Masters' dissertations. All of Paltridge's six MSc Engineering dissertations followed the Traditional: Simple structure presented in Table 2.4, although he did not give further details about what type of Engineering the six dissertations were collected from. This, and the small number of dissertations examined from each discipline, make Paltridge's findings somewhat generic.

This section has reviewed the available organisational structure studies and their suggested structural models based on analyses of Masters' dissertations and PhD theses. It shows that there are more studies about the macrostructure of RAs and PhD theses than studies examining the structure of Masters' dissertations. This suggests that the quest for more discipline and genre-specific structural studies of MSc dissertations has not yet been satisfied. Therefore, this thesis aims to contribute to our existing knowledge by conducting a detailed analysis of the overall structure of MSc dissertations. However, it is difficult to arrive at the overall structure without some knowledge of individual stages that make up MSc dissertations. The next section will review studies that have examined the internal structure of Masters' dissertations and PhD theses.

2.4.2.2 Micro-structure studies of PhD theses and Masters' dissertations

This section reviews studies that have examined the internal structure of individual sections of Masters' dissertations and PhD theses. It is more common for studies to focus on analysing the structure of one stage, rather than covering the entire thesis or dissertation, this is at least partly due to the 'daunting size' of some texts (Swales, 1990:188). Koutsantoni (2003, 2006), for example, argues that 'due to the great length', she chose to analyse students' use of hedging in 'specific sections' of MSc Dissertations, PhD thesis and RAs and not their entirety. Table 2.7 shows a summary of the studies whose main focus is to explore the internal structure of PhD theses and MSc dissertations.

Table 2.7: Summary of micro-structure studies of Masters' dissertations & PhD theses

	Introduction	Literature review	Discussion	Conclusion
PhD Thesis	- Bunton (1998): 13 PhD theses (7 ST & 6 HSS) - Bunton (2002): 45 PhD theses (30 ST & 15 HSS) - Soler-Monreal (2011): 20 computer science PhD theses in English and Spanish	- Kwan (2006): 20 PhD theses applied linguistics written (native speakers). - Soler-Monreal (2015): 30 computer science PhD theses - Abdullah (2018): 3 Applied linguistics PhD theses	- Hewitt and Felices Lago (2010): 16 theses in English studies & 39 theses in Spanish studies. - Abdullah (2018): One PhD thesis (Language Teaching).	- Bunton (1998): 13 PhD theses (7 ST & 6 HSS). - Bunton (2005): 45 PhD theses (30 ST & 15 HSS).

MA\MSc Dissertation	- Dudley-Evans (1986): 7 MSc dissertations (Plant Biology) - Samraj (2008): 24 MSc dissertations (Philosophy, Biology & Linguistics)	- Hsiao (2016): 30 MA dissertations in English teaching written by Taiwanese - Abdullah (2018): 3 Applied linguistics MA dissertations	- Basturkmen (2009): 10 MA dissertations (English language teaching) - Dudley-Evans (1986): 7 MSc dissertations (Plant Biology) - Abdullah (2018): 3 MA dissertations	

The studies reported in Table 2.7 are studies with the main aim to explore the internal structure of either PhD theses and/or MSc dissertations. As shown in Table 2.7, more studies have been conducted with PhD theses than Masters' dissertations, a point also made clear by Samraj (2008). Some studies such as Dudley-Evans (1986) and Bunton (1998) explored multiple stages: introductions and discussions in the former and introductions and conclusions in the latter. According to Dudley-Evans (1986:137), these stages are particularly difficult to write, although the perception of difficulty is likely to differ from one student to another. The next section will briefly critique the studies presented in Table 2.7.

Critical review: The introduction Stage

This section will review studies that examined the introduction stage of Masters' dissertations and PhD theses. Dudley-Evans (1986) explored the structure of seven Masters' dissertation introductions in the field of Plant Biology from the University of Birmingham, UK. The introductions he examined ranged from 320 to 4,640 words (Dudley-Evans, 1986:136). He used Swales' (1981) move and steps method, which was used to create the CARS model (see Table 2.3) and decided on the function of sentences and paragraphs in the introductions. He noticed that the early sections of these introductions focussed on 'placing the study in the context of the literature' and 'justifying the work in terms of previous research' (Dudley-Evans, 1986:135), which according to him covered more ground than Swales' (1981) early moves of 'Establishing the field' and 'Summarising previous research'. At this time Swales' CARS model was in its infancy, and Swales went on to enhance it in 1990 and 2004 to better represent the rhetorical function of each move, see Table 2.3.

Although Dudley-Evans (1986) referred to variation in the length of introductions, he did not mention if the literature review were presented as a section within the introductions or in stand-alone chapters. The 'signs' he used to identify the literature review are 'functional clues' and 'linguistic clues'. The functional clues are the headline (this refers to statements that introduce the topic, and is optional), generalisation, description, and evaluation of previous research (again optional) (Dudley-Evans, 1986:138). What is interesting about these functional clues is that evaluating previous research 'occurs only very occasionally' (Dudley-Evans, 1986:138). In the soft sciences, the literature review is a critique which involves the use of critical and evaluative language, but Dudley-Evans' Plant Biology Masters' dissertations did not make much use of evaluative language in the literature review. This perhaps could be related to the nature of the discipline. A similar case can be assumed for Engineering MSc dissertations as they tend to accept the established paradigms, in contrast to dissertations in the soft sciences.

Another study that examined introduction stages is Bunton (1998). In addition to examining the macro-structure of 13 PhD theses and eight MPhil dissertations, Bunton also examined the structure of the introduction and conclusion stages in the 13 PhD theses. He argues that PhD theses provide ‘more manageable’ data for analyses compared to MPhil dissertations because they are longer texts and more advanced. In his analyses of the 13 PhD introductions, Bunton also started with Swales’ (1990) CARS model. However, he argues that ‘where a move or a step did not appear to fit with descriptions or definitions in the literature a new ‘category’ is proposed’ (Bunton, 1998:151).

Unlike Dudley-Evans (1986), Bunton (1998) counted the number of citations in all chapters. He found that seven theses had the highest percentage of references in their second chapter, which was not what he classified as the introduction chapter. Bunton concluded that ‘the main move of referring to previous research happens elsewhere [not in the first chapter] in nearly all theses’ (Bunton, 1998:154). This means that, unlike RAs where the literature review is often part of the introduction (Swales, 1990; Nwogu, 1997; Bhatia, 1993), the seven PhD theses examined by Bunton did not discuss the literature in the first introductory chapter. This point is investigated further in Bunton’s (2002) analysis of the structure of 45 thesis introductions in Chemistry, Ecology and Biodiversity from a university in Hong Kong, as shown in Figure 2.5.

Figure 2.5: Cross disciplinary reference to the literature in the Introductions of PhD theses (Bunton, 2002:63)

As shown in Figure 2.5, 34/45 introductions contained very few references. Bunton (2002:63) argues that the variation in the number of references means that the literature review plays a smaller role in some introductions than in others. Introductions in Medicine and Arts have more references to the literature, as shown in Figure 2.5. Bunton classified 21/45 theses as containing a stand-alone literature review chapter; ten of these theses used 'Literature Review' as a title, and 11 used titles such as *'Review of ...', 'Theory', 'Approaches', 'Concepts',* or *'Conceptual Framework'*. Bunton depended on the number of references to the literature to determine the overall function of chapters with headings such as these, but in fact they might not have functioned primarily as literature reviews despite containing references to the literature. A detailed analysis of the internal structure of chapters outside the conventional IMRD structure is needed, to determine their rhetorical function.

Bunton (2002:63) also found differences in the length of introductions from different faculties; Medicine, Social Sciences, and Arts theses were 26 to 34 pages long, whereas in Science, Engineering, and Education they averaged only nine to ten pages (Bunton, 2002:63). Although page numbers are not an exact identification of length (as they can be affected by visual data), Bunton's findings show that overall Science, Engineering, and Education theses had considerably shorter introduction stages than Medicine, Social Sciences, and Arts. This indicates a difference between hard disciplines (Science and Engineering) and soft disciplines.

Table 2.8: Moves and steps in Masters' dissertations and PhD theses introductions

Study	Dudley-Evans (1986)	Bunton (1998)	Bunton (2002)	Samraj (2008)
Data	7 MSc dissertations introductions	13 PhD Theses introductions	45 PhD theses introductions	24 MSc dissertations introductions
Discipline	Biology	Science & Technology and Health & Social Sciences	Science & Technology and Health & Social Sciences	Philosophy, Biology, and Linguistics
Moves	Move 1: Introducing the field: Situation(s) Problem Move 2: Introducing the general topic (within the field): Response Evaluation Evaluation Move 3: Introducing the particular topic (within the general topic) Move 4: Defining the score of the particular topic: Introducing research parameters Summarising previous research Move 5: Preparing for present research: Indicating a gap in previous research Indicating potential extension of previous research Move 6: Introducing present research: Stating the aim of research Describing briefly the work carried out Justifying the research	Move 1: Establishing a territory Claiming centrality Making topic generalization and giving background information *Defining terms* Reviewing previous research Move 2: Establishing a Niche Indicating a gap and/or question raising and/or *Indicating a problem* *(Counter claiming and Continuing a tradition)* Move 3: Occupying the Niche Outlining purposes, and/or Taking a theoretical position / Making claims. Announcing present research in general terms. Research Questions / Hypotheses. Method. (Defining terms, Materials /subjects of research, and Parameters of research) Significance / justification of present research. Indicating thesis structure. If in a later chapter: Brief reiteration of Moves 1 and 2 Purpose Method Research Questions / Hypotheses	Move 1: Establishing a Territory Claiming centrality Making topic generalisations and giving background information *Defining terms (Eg, A, So)* Reviewing previous research Move 2: Establishing a Niche Indicating a gap in research *Indicating a problem or need* Question-raising (So, A) Continuing a tradition (M, So) Move 3: Announcing the Present research (Occupying the Niche) Purposes, *aims, or objectives* Work carried out (Eg, Si) *Method* *Materials or Subjects* Findings or Results *Product of research (Eg)/Model proposed (So)* Significance/Justification Thesis structure	Move 1: Establishing a territory Claim centrality *importance in real world* importance in research Review literature or present topic generalizations Move 2: Establishing a Niche *Indicate a gap/question in research* *Indicate problem in the real world* Positive justification Move 3: Occupying the Niche State goals/argument of thesis Background Present hypotheses Present results Preview organization of thesis

Overall, Bunton's findings show that Swales' (1990) classification of the LR as part of the introduction does not necessarily apply to PhD theses, although Table 2.8 shows that the structure of PhD introductions and RA introductions can be very similar.

Samraj (2008) also used Swales' CARS model as a reference when analysing the structure of 24 MSc and MA dissertation introduction chapters from three disciplines: Philosophy, Biology, and Linguistics (eight each). The Philosophy and Biology dissertations did not contain a literature review, but Samraj (2008) found that six out of eight dissertations in the field of linguistics did (three as stand-alone chapters and three as sections within the introduction chapters). This also shows that the importance of the literature review varies from one dissertation to another. Furthermore, only Philosophy and Linguistics introductions ended with a step that shows the organization of the dissertation. Samraj (2008:59) relates this to the absence of an IMRD-like structure in Philosophy and Linguistics dissertations compared to Biology dissertations, a point also made by Swales (2004:23). However, this remains a weak assumption because Samraj did not explore the overall structure of these dissertations and because dissertations with an IMRD-like structure may also contain steps indicating the organisation of the dissertation.

Samraj's model contains one step which had not been mentioned in previous models including Swales (1990, 2004). This step refers to indicating a gap in the 'real world' rather than the 'research world' (see Table 2.8). The distinction between the 'real world' and 'research world' problems is discussed in detail in Xu and Nesi (2017). These two streams of identifying the problem that motivates the research are important as hard-applied disciplines may not position their research as a means of filling a gap in the literature, but rather as a means of solving a problem in the real world. This may lead them to substitute the literature review stage with another stage. Therefore, when applying the CARS model to PhD theses some moves may need to be adapted to account for research practices within the investigated disciplines. Also, regardless of the importance of Swales' CARS model, it was not designed to analyse the introductions to PhD theses and Masters' dissertations because it was derived from a study of RA introductions. Applying Swales' CARS model to the introductions of PhD theses and Masters' dissertations can result in collapsing stages which merit separate move analysis.

Dudley-Evans (1986), Bunton (1998), and Samraj (2008) adapted Swales' 'moves and steps' method of analysis to study the move structure of PhD theses and MSc dissertations introductions, but did not include the literature review stage when it was presented as a stand-alone chapter. Other studies, however, have analysed the literature review chapter as a stand-alone stage (Kwan, 2006; Jian, 2010; Hsiao & Yu, 2012; Soler-Monreal, 2015; Hsiao, 2016). Kwan (2006) looked at 20 PhD theses in Applied Linguistics, and depended on her language specialist doctoral students to determine 'what they considered to be the literature review'. She suggested that the literature review was an 'easily recognizable part' of a thesis, but this may not always be the case, especially for Masters students in the hard sciences who have had little guidance regarding the structure and function of dissertation chapters. In fact, even language students differ from their supervisors in their perceptions of the MA dissertation structure (Bitchener and Basturkmen, 2006).

Critical review: The Discussion Stage

This section reviews studies that examined the move structure of the discussion stage in PhD theses and Masters' dissertations. Dudley-Evans (1986) analysed the moves in the discussion stage of seven Masters' dissertations in Plant Biology. These included a conclusion within the discussion stage in one stand-alone chapter. Basturkmen (2009:247) found that the discussion stage in both dissertations and RAs follows 'a series of Result-Comments Sequences', indicating its cyclical nature. Eight out of the ten dissertation chapters examined by Basturkmen were titled 'Discussion/ Discussion of Results' (Basturkmen, 2009:243). The remaining two dissertations had a merged 'Discussion and Conclusion' chapter with the conclusion marked with statements such as 'in conclusion' (Basturkmen, 2009:243). Basturkmen did not separate the conclusion from the discussion stage in the case of dissertations with a combined Discussion and Conclusion Stage. Analysing the structure of these two stages separately is most likely to generate clearer structural models that better support student writing of these stages.

Basturkmen found that the Discussion stage of RAs and Masters' dissertations share a similar move pattern: 'explaining', 'comparing the result with a result in the literature' and 'evaluating a result'. However, the dissertation discussions contained more detail than RAs when reporting on results (Basturkmen, 2009:248). Students' were also found to give arguments based on the literature whereas authors of RAs gave their own explanations of the findings.

Another study that looked at the discussion sections in PhD theses is Hewitt and Lago (2010). Although they did not conduct move analyses of the discussion stage, they investigated its omission in Spanish students' PhD theses written in English and Spanish in Spain. Hewitt and Lago conducted a comparative study between 16 Spanish PhD students who wrote their theses in English as a second language, 34 Spanish PhD students who wrote their theses in Spanish and four other international students who wrote it in Spanish as a foreign language. For the 16 students writing in English, they collected six theses from Applied Linguistics and ten from Literature. For the rest, they collected 15 theses across disciplines and 24 from Spanish studies. The supervisors of these theses varied in their nationality; 12 supervisors had Spanish nationality, four were English, two were German and one was Venezuelan. Although the majority (50/55) of the PhD students in Hewitt and Lago's corpus were Spanish, their corpus was not well balanced in terms of disciplines, the nationality of supervisors and the language the students used to write their theses.

Hewitt and Lago found that the majority of the PhD theses (13/16 and 35/39) did not include a stand-alone discussion chapter and suggested that this was because of the discipline and the nationality of the supervisors of these theses. The only disciplinary difference highlighted by Hewitt and Lago is that theses in literature did not contain a stand-alone discussion chapter compared to theses in Applied Linguistics. Additionally, they added that German supervisors were found not to favour a stand-alone discussion chapter (Hewitt and Lago, 2010:131). However, Hewitt and Lago (2010) did not clarify if the German supervisors came from Applied Linguistics or Literature. They also did not explain what Literature students write instead of the discussion. Additionally, Hewitt and Lago did not discuss the possibility of the results and discussion being merged into one chapter. What we can take from this study is that there might be regional traditions that can affect the organisation structure of PhD theses. What might be considered as an ideal structure of a PhD thesis or a Masters dissertation in one country may not necessarily be the case in another.

To the best of my knowledge, the study that shed light on the effect of 'specific lingua-cultural contexts in which texts are produced and consumed' within the same discipline and genre of Engineering MSc dissertations is Lee and Casal (2014:39). They examined the linguistic features in a total of 200 Results and Discussion Chapters of MSc dissertations written in English and Spanish (100 each), across five Engineering disciplines 40 of which were in Electrical Engineering (20 each). Apart from using the Chapter headings, Lee and Casal were not clear about how they identified the Results and Discussion chapters of 200 dissertations, same point applies to Koutsantoni (2006), perhaps because both of studies were not interested in investigating the structure of these texts. Nevertheless, Lee and Casal found considerable differences in the use of linguistic features (e.g.: transitions, frame markers, hedges, boosters…etc.) between the results and discussion chapters of MSc dissertations written in English compared to those written in Spanish.

Critical review: The Conclusion Stage

This section will review the moves and steps studies relating to the conclusion section in Masters' dissertations and PhD theses. Bunton (2005) analysed 44 thesis conclusion stages (29 from Science and Technology and 15 from Health and Social Sciences). Before referring to Bunton's suggested moves and steps shown in Table 2.9, it is important to explain the identification process Bunton used, which relied on chapter headings. Out of the 44 conclusions Bunton examined, 38 were realised as single chapters, three were realised in two chapters, and three in the final section of a final or second-to final chapter. In cases where the conclusion was realised as part of a 'Discussion', Bunton (2005) only examined the last section of that chapter, which was often entitled 'Conclusion', 'Summary' or 'General discussion and future direction of study'.

Table 2.9: Bunton's (1998, 2005) cross disciplinary moves analysis of PhD conclusions

Domains	**Science and Technology theses' conclusions**		**Health and Social Science theses' conclusions**	
Study	**Bunton (1998)**	**(Bunton 2005)**	**(Bunton 1998)**	**Bunton (2005)**
Data	**13 Conclusions**	**29 Conclusions**	**13 Conclusions**	**15 Conclusions**
Moves and Steps	**Move 1:** Introductory restatement of: - Territory - Centrality - Work carried out - Method	**Move 1:** Introductory restatement Work carried out	**Move 1:** Introductory restatement of research questions or purposes methods - *Centrality* - *Setting Niche* - *Definition*	**Move 1:** Introductory restatement Purpose, research questions or hypotheses
	Move 2: consolidation of present research usually a few higher-level cycles, on board aspects of the study: - Findings/results - Claims - Method - Product - Evaluation of methods /product - Limitations *(Previous research)* *(Background)* *(Theory)* *(Explanation)* *(Information)* *(Problem/solution)*	**Move 2:** Consolidation of research Space; *(Evaluation of method /product);* Method; *(Explanation); (Significance);* Findings/results; *(Limitations);* Claims; References to previous research Product(s)	**Move 2:** consolidation of present research usually many lower level cycles, and some higher level: - Findings/results - Claims - Previous research (Support/Contrast) - Examination - Information - Evaluation of study - Limitations *(Theory)* *(Method)* *(Product)* *(Evaluation of methods/product)*	**Move 2:** Consolidation of research Space; (*Evaluation)*; Method; (*Explanation)*; Findings/Results; *(Theory);* *(Information)*; Claims; (*Significance)*; *(Limitation)*; References to previous research Evaluation; *(Future research)*
	Move 3: Practical applications / implications	**Move 3:** Practical applications and recommendations Applications or implications; Recommendations	**Move 3:** Practical applications / implications - Caution / warning - Previous research	**Move 3:** Practical implications & recommendations Implications; Recommendations; *(References to previous research*; *Claims)*
	Move 4: recommendations for future research - *(Previous research)*	**Move 4:** Future research Recommendations - *(Previous research)*	**Move 4:** recommendations for future - *(Previous research)*	**Move 4:** Future research *Recommendations* **Move 5:** Concluding restatement Overall claims/findings

As can be seen from Table 2.9, Bunton's (2005) conclusions contain four main moves. They all start with an 'Introductory restatement' including an overview of the purposes of the research, the research questions, the work carried out, and methods. The second move is a 'Consolidation of research' which is expressed with reference to the literature, the main findings, methods and theory. Steps between brackets such as (Background), (Theory), and (Explanation) are less frequent, occurring in 25% of the texts.

Bunton refers to the Theory as a step in the conclusion where 'a writer mentions a theory in support of a method or findings, usually without citing any author or publication' (Bunton, 2005:221). He did not elaborate any further on his definition of a Theory, but found it to occur 'proportionally more in HSS disciplines'. He gave two examples of this step: 'No B assumptions are imposed and CD theory is adopted (ST6)' and 'This is in line with the notion of X (HSS12)'. It seems that what Bunton (1998; 2002; 2005) means by a Theory step is not the same as the Theory stage Nesi and Gardner refer to in their analysis of Design Specification assignments, and what George (1989) refers to in the discussion of design science research, see Section 2.1.4. In Engineering design science writing, the Theory stage explains principles that underlie experiments such as the functions of the apparatus and the theory behind the method being used.

The last two steps found by Bunton are 'Practical applications' and 'Future research and application'. Only HSS conclusions had an additional step: 'Concluding restatement'. Reference to the literature was an optional step in all Bunton's conclusions. Overall, Bunton found that ST conclusions were much shorter than HSS conclusions with an average of 4.9 pages for ST and 17.2 pages for HSS (Bunton, 2005:213). However, Bunton did not elaborate on the reasons for these differences.

This section has reviewed both types of organisation structure studies of PhD theses and Masters' dissertations. This section showed that only a limited number of studies relate to the organisational structure of PhD theses, and there are even fewer studies relating to MSc dissertations. At the macro level, with reference to the literature (Dong, 1998; Bunton, 1998; Dudley-Evans, 1999; Thompson, 1999, 2001; Paltridge, 2002) five structures derived from the IMRD structure were found: two Traditional: Simple/Complex, two Topic-based: Simple/ Complex and one Compilation of Research Articles. Out of the five studies, Paltridge (2002) is the only study that explored the structure of Masters' dissertations across disciplines. The other studies examined PhD theses under the influence of previous conventional models, interview data or reports from teaching experience (see Table 2.5). At the micro-structure level, MSc dissertations are still, as Dudley-Evans (1999) describes: 'a case of neglect'.

Most prior studies have not been very rigorous in the way they decided on the structure of Masters' dissertations, for example depending on students' wording of chapter headings. Depending on chapter headings seems to be the method for identifying the function of chapters in the majority of genre analysis studies of PhD theses and Masters' dissertations (Dudley-Evans, 1986; Bunton, 2002, 2005; Basturkmen, 2009) and RAs (Peacock, 2002; Kanoksilapatham, 2007; Bruce, 2009; Basturkmen, 2009, 2012; Maswana et al., 2015; Zhang & Wannaruk, 2016; Cotos et al., 2017). Alongside this approach, it would be informative to read the entire dissertation and assign functions to each stage. Functions which do not map onto the conventional IMRD structure should be identified as new stages. Although this thesis aims to identify the overall structure of Algerian MSc dissertations, it also joins previous studies by using Swales' notion of Moves and Steps as a starting point to help in identifying the rhetorical function of each chapter.

2.4.3 Conclusion

In summary, Section One of Chapter Two reviewed studies of the macro and micro-structure of the three 'research-process genres' (Swales, 1990:177): Research Articles, PhD theses and Masters' dissertations. Overall, the majority of the reviewed studies seem to largely follow a 'top-down' approach by examining the literature and mapping it to their data. Although this approach might suit RAs where the stages are clearly identifiable, stages in PhD theses and Masters' dissertations are less easy to recognise especially because some stages can be realised in multiple chapters (Bunton, 2005). Therefore, it might be better in the cases of PhD theses and Masters' dissertations, to follow a 'bottom-up' approach and examine the texts in their own right before mirroring them to what is known in the literature.

Additionally, more and more studies of the structure of research-process genres are applying to MSc dissertations organisational structures derived from RAs and PhD theses to MSc dissertations (Paltridge, 2002; Paltridge and Starfield, 2007). Results from studies based on limited texts can be highly influenced by writers' preferences. This also applies to all studies (Dudley-Evans, 1986; Dong, 1998; Bunton, 1998; Thompson, 1999, 2001; Bunton, 2005; Samraj, 2008; Basturkmen, 2009). Studies such as Paltridge (2002), which examined PhD theses from 15 disciplines and MSc dissertations from six disciplines, did not contain enough data to generate generalisable conclusions.

Masters' dissertations are likely to differ from PhD theses and RAs in terms of audience and purpose. Therefore, findings based on PhD theses and RAs should not be directly used to inform the writing of Masters' dissertations. Although genre analysis studies are often small-scale, and do not claim to be representative of all variations of the genre studied, their findings still find their way into teaching materials about the writing of genres such as MSc dissertations (Paltridge, 2002; Paltridge and Starfield, 2007; Paltridge, 2019).

Another issue with the reviewed studies is that they seem to build uncritically on previous organisational structures. Paltridge (2002) and Paltridge and Starfield (2007), for example, provide a brief overview of existing organisational structures without going into detail about how these models were arrived at. For example, when referring to the 'Topic-based' structure (see Table 2.4) identified by Dudley-Evans, they do not mention the amount of the data Dudley-Evans examined. In fact, Dudley-Evans was not clear about his methods which seem to be based on his teaching experience as he based his classification on 'his own impression' (Dudley-Evans, 1999:31).

Other studies show signs of the influence of findings from the analysis of RAs. Dong (1998), for example, refers to the 'five-chapter' structure which seems to be derived from the IMRD structure. Paltridge (2002) discovered that some handbooks and guides on thesis and dissertations writing can be misleading.

Only a few studies, such as Thompson (1999, 2001), address discipline-specific organisational structures by focusing on a few disciplines. The majority of studies follow the approach of analysing a limited number of texts from a range of different disciplines. Such studies provide more generally applicable models but might miss important discipline-specific differences. Furthermore, there is always the possibility of institutional and regional specifications affecting the structure of texts, such as Masters' dissertations. None of the reviewed studies in this section considered this possibility. Examining dissertations from different universities in different parts of the world might reveal structural differences in the writing of Masters' dissertations specific to particular regions.

It is clear from what has been discussed in this section that the macrostructure of MSc dissertations, in particular, is underexplored compared to the other 'research-progress genres' Swales (1990:177). After more than twenty years since the earliest language research cited in this thesis (Dong, 1998; Bunton, 1998) on the structure of PhD theses and Masters' dissertations, Masters' dissertations remain neglected compared to studies of PhD theses and RAs, a point which is also made by Starfield and Paltridge (2019). Given the rising number of students undertaking Masters degrees in countries where English is the first language or in countries where English is the second language (or third language as in the case of Algeria), more studies of Masters' dissertations writing should be conducted, not through using an ‘analogue corpus’ (Flowerdew, 2015:60) but by using ‘tailor-made corpora’ which this thesis aims to do.

This thesis joins the quest to explore the structure of MSc dissertations as a genre separate from PhD theses and RAs. First, based on the reviewed studies in this chapter, I will investigate the overall structure of Algerian MSc dissertations. Second, I will move from micro-structure analysis to the analysis of phraseology. I will analyse the function and structure of multi-word sequences specific to the Algerian MSc dissertations. The next section will review studies on multi-word sequences, in preparation for this aspect of my research.

2.5 Phraseology

This section will provide a brief background to lexical bundle analysis before reviewing the current place of lexical bundle analysis in the literature. It will also show that our phraseology-related knowledge of MSc dissertations is still very limited compared to other genres such as research articles.

Recurrent word combinations have attracted the attention of linguists at least since Palmer (1933) and Firth (1951), who referred to ‘‘collocation’’ and ‘‘collocability’’. However, it was not until the increased availability of computer-readable corpora in the 1980s that it became possible to investigate these combinations in detail. This type of research can be considered under the umbrella of ‘phraseology’, the ‘tendency of words to occur in preferred sequences’ (Hunston, 2002:138). It typically acknowledges Sinclair’s (1991) ‘idiom principle’, which holds that speakers and writers do not select one word at a time but choose pre-constructed phrases to express a particular meaning.

One influential approach to investigating phraseology and thereby finding typical ‘ways of saying things in a particular discourse’ (Gledhill, 2000:1) is lexical bundle analysis (Biber, Johansson, Leech, Conrad, & Finegan, 1999), that is, the identification and classification of the fixed-length strings of items that occur most frequently in particular texts. Lexical bundles are also referred to as n-grams (e.g. Ellis, Simpson-Vlach, & Maynard, 2008), clusters (Schmitt, Grandage & Adolphs, 2004) and recurrent word combinations (Altenberg, 1998; De Cock, 1998).

Since a significant proportion of words are found to occur in recurrent bundles, lexical bundles are ‘useful devices for the comprehension and construction of discourse’ (Biber & Barbieri, 2007:284). Biber et al. (1999:995) for example, find that around 21% of words occur in such bundles in academic prose. Such findings are used to argue that less proficient writers should gain greater awareness of the most common realisations and functions of bundles (Ädel & Erman, 2012; Nesi & Basturkmen, 2006), and also that language teachers should know which bundles are most common in target texts. However, bundles are not usually complete phrases (Biber et al., 1999; Stubbs & Barth, 2003; Biber & Barbieri, 2007), but are more profitably seen as evidence of the phraseological tendency of language, and as one of a number of approaches to investigating conventionalised uses of language (Vincent, 2013).

Wray (2002) and Hyland (2008) point out that different academic disciplines favour different specific word combinations, whether bundles or formulas. Hyland

(2008:5) explains that ‘gaining control of a new language or register requires a sensitivity to expert users’ preferences for certain sequences of words over others that might seem equally possible’. This sensitivity is central to the creation of academic discourse and indicates the importance of investigating cross-disciplinary variations (Hyland, 2008). Such research may usefully inform teaching materials and approaches, especially in fields like ESP and EAP. As pointed out in the previous section, studies of genres such as RAs and PhD theses can inform our knowledge regarding the kind of language some students might aspire to. However, studies of MSc dissertations can inform our knowledge regarding the kind of language Masters’ students are actually expected to produce. The next section will provide a theoretical background relating to studies of recurrent word combinations as part of phraseology.

2.6 Theoretical background of lexical bundle studies

Numerous studies have explored the use of lexical bundles, whether across different language backgrounds (Ädel & Erman, 2012; Chen & Baker, 2010; DeCock, 2000; Römer, 2009), genres (Biber, 2006; Biber, Conrad & Cortes, 2004; Hyland, 2008; Nesi & Basturkmen, 2006; Scott & Tribble, 2006), disciplines (Cortes, 2004; Wood and Appel, 2014; Durrant, 2015) or proficiency levels (Pan, Reppen, & Biber, 2016; Staples et al., 2013). Lewis (2000) and Pang (2010) have also looked at bundles from the perspective of different ways of teaching collocations, and Simpson-Vlach and Ellis (2010) have proposed bundles (their Academic Formulas List) which are most salient, and therefore potentially pedagogically useful in academic registers.

All of these studies base their analyses on the most frequently occurring lexical bundles, or ‘target bundles’ (Cortes, 2004, 2006). As Biber et al. (2004:376), point out, such frequency data is not explanatory, but ‘identifies patterns that must be explained’. Since bundles are ubiquitous in all types of text, this explanation tends to be based on classifications of bundles in terms of the structures they typically fall into and functions they serve. It is of some interest to compare the structural types of bundles found in different text types and disciplines, not least since there are associations between structural types and the communicative functions they perform (Hyland, 2008). However, the chief area of interest in the investigation of lexical bundles is in terms of their functional classification.

One common way of approaching the classification of bundles for the purposes of comparison is to consider their main structural realisations. Drawing on the Longman grammar of Spoken and Written English (LSWE), Biber et al. (1999) list 11 structural realisations of lexical bundles and one ‘other’ category for less frequent expressions, as shown in Table 2.10. Studies commonly follow Biber et al. (1999) in recognising that typical structural realisations of bundles vary considerably according to register. For example, drawing on the TOEFL 2000 Spoken and Written Academic Language corpus [T2K-SWAL], Biber et al. (2004b) explored many linguistic features, one of which was lexical bundles and used the same structural model shown in Table 2.10. They found that classroom teaching relies much more heavily on lexical bundles than conversation, while textbooks and academic prose contain relatively few different lexical bundles. It is worth noting, however, that at the writing level, T2K-SWAL does not contain dissertations or any other student produced genres.

Table 2.10: Biber et al.'s (1999:1014-1024) structural classification of lexical bundles

Biber et al. (1999) structural categories are also used by Hyland (2008), although, Hyland only found that seven of these (highlighted in bold, as shown in Table 2.10) occurred sufficiently frequently to be worth mentioning in his almost 3.5 million words of cross-disciplinary corpora of RAs, PhD theses and MSc dissertations.

Another common way of approaching the classification of bundles for the purposes of comparison is to consider the function they serve. The functional framework for analysing bundles applied in this study is from Hyland (2008), as shown in Table 2.11. Although only a small proportion of Hyland's (2008:8) corpus was made up of MSc dissertations in Electrical Engineering (190,000 words), it is worth noting that these are from the same discipline and texts analysed in this thesis; making Hyland's functional classification model more suitable for this study than that from Biber et al.'s (1999) mixed corpus of spoken and written academic English.

Table 2.11: Functional classification of lexical bundles (Hyland, 2008:13-14)

The 'Research-Oriented' (RO) category includes bundles that 'help writers to structure their activities and experience of the real world' (Hyland, 2008:13). 'Text-Oriented' (TO) bundles, meanwhile, are those 'concerned with the organization of the text and its meaning as a message or argument' (Hyland, 2008:13). Finally, 'Participant-Oriented' (PO) bundles include both those that refer to 'Stance' and a further subcategory of 'Engagement' bundles, which 'focus on the writer or the reader of the text' (Hyland, 2008:14). This framework, like Biber's, is clearly inspired by Halliday's (1985) three-way functional analysis of language: 'Participant-Oriented' relates to Halliday's 'interpersonal' meanings; 'Text-Oriented' to 'textual' meanings; and 'Research-Oriented' to 'ideational' meanings. This section reviewed a number of studies related to lexical bundles analysis. The two major frameworks which will be used in this thesis are those of Biber et al. (1999) and Hyland (2008). The next section will sum up what has been discussed so far before presenting the three research questions arising from the literature reviewed in this chapter.

2.7 Research questions

So far, very few studies have provided a detailed analysis of the micro and macro-structure of MSc dissertations in Engineering. Although Engineering features in some of the studies cited in this chapter, it remains under-explored, a point which is also referred to in Koutsantoni (2006:22). To the best of my knowledge, although Electrical Engineering has featured in studies of RAs (Koutsantoni, 2006; Hyland, 2008; Lin and Evans, 2012), PhD theses (Koutsantoni, 2006; Hyland, 2008) and MSc dissertations (Koutsantoni, 2006; Hyland, 2008), it was not featured in any detailed macro and micro analysis of Electrical and Electronic Engineering MSc dissertations as an entirety.

Also, the majority of studies that have examined phraseology in terms of form and function are based on RAs, and very few (Hyland, 2008), have included MSc dissertations. This chapter indicates how much more we know about the structure of the other research-process genres (PhD theses and RAs) compared to MSc dissertations, and argues that findings from the study of PhD theses and RAs- are not always applicable when teaching students how to write MSc dissertations. Although studies of PhD theses and research articles might be useful to inform our understanding of MSc dissertations, they remain different genres in terms of their aims, audiences and levels. Only limited conclusions can be derived from the analysis of these genres to support our understanding of MSc dissertation writing.

The nature of Engineering, which is largely a hard-applied discipline using design to solve real-life problems (see section 2.1.3), might affect the way Engineering research is structured, especially when compared to research in the pure disciplines. For example, Engineering students might pay less attention to identifying a gap in the prior literature, thus affecting the focus of the literature review. It might shift it from what we know in the social sciences as a compulsory extensive critical review of prior studies to an optional review or summary of previous solutions to issues that still prove problematic.

Engineering students, especially undergraduate and MSc students' writing their MSc dissertations in a foreign language with limited language support, are likely to focus more on the technical side of their research giving less attention to soft skills such as critical thinking, important in the humanities and social sciences. The straightforward nature of Engineering research, which is based on the need for change (see Section 2.1.3) might also cause Engineering Masters students (especially those who are more professionally oriented) to concentrate on the design element of their dissertations.

However, Engineering MSc dissertations might contain a ‘Theory’ stage, reported in Engineering students’ assignments (George, 1989; Nesi and Gardner, 2012). George states that the Theory stage explains principles that underlie the experiment, including functions of apparatus, the theory behind the method being used, and the method used for determining data. It seems to contain elements from both of the Literature Review and the Methodology stages, by reviewing previous studies to explain the working principles of the experiment and the different available methods. It is possible that students who are professionally oriented will be more likely to write a Theory chapter in their dissertations, while those who are more academically oriented will be likely to write a literature review, or both a literature review and a Theory chapter.

The cyclical nature and the importance of the ‘build-and-evaluate loop’ in design science research, discussed in Section 2.4.1.1, appear to have an impact on the writing of both of RAs and students’ assignments. This may be what makes it difficult for design science research to fit in the more conventional IMRD structure, as noted by Posteguillo (1998). In addition to these discipline-specific characteristics of design science research, coupled with the regional differences in the teaching of Engineering depending on the county’s needs, discussed in Section 2.2, might affect the way Engineering students structure their MSc dissertations to meet the requirements of their respective institutes.

Therefore, in this thesis, I aim to contribute to our knowledge by analysing features specific to the Algerian MSc dissertations in comparison with their American counterparts. The design and creation of all corpora used in this thesis are explained in Chapter Three.

Research Question One:

- What is the organisational structure of the Engineering MSc dissertations produced in the medium of English in Algeria compared to their American counterparts?

Research Question Two:

- What are the grammatical structures realised by the most frequent lexical bundles in the MSc dissertations produced in the medium of English in Algeria compared to their American counterparts?

Research Question Three:

- What are the rhetorical functions expressed by the most frequent lexical bundles in the MSc dissertations produced in the medium of English in Algeria compared to their American counterparts?

Chapter 3
Research Methodology

3. Introduction

This chapter presents the methodology of the study including ethics, interviews and corpus compilation. The research methods are both quantitative and qualitative. Quantitative methods result primarily in numerical data analysed using statistical methods, whereas qualitative methods investigate open-ended, non-numerical data using non-statistical methods (Dörnyei, 2007:24). Both methods are 'different ways of observing the same world' (Richards, 2005:36). By using more than one research method, I hope to provide greater insight regarding the writing of Algerian MSc dissertations, as what might be missed using one research method can be obtained by utilising another. Therefore, this research uses a mixed-method approach; qualitative method which consist of a manual analysis of texts in their original format, and quantitative method which involve computational analysis technique (lexical bundle analysis).

The interviews in this study are not used as a research method to answer any of the research questions mentioned above, but rather to support this thesis by providing background information about the research site in Algeria, i.e. The Institute of Electrical and Electronic Engineering (IEEE). The data collected from the interviews were used to inform the content of Chapter One and will be referred to again when discussing the pedagogical implications of this research in

Conclusion Chapter Seven. Any another additional information from the interviews can be found in Chapter Four. Computational analysis and the manual examination of the MSc dissertations in their original PDF format are the main research methods of this thesis.

The creation of the two corpora used in this thesis is explained in Section 3.3., and a detailed account of all the analytical methods I used can be found in Section 3.4. A mixed method (qualitative and quantitative) analysis of 70 Algerian MSc dissertations and 109 American MSc dissertations is used to address all three research questions. The first research question (RQ) aims to identify the overall organisational structure in the Algerian MSc dissertations compared to their American counterparts. The methodology used to address this RQ is explained in Section 3.4.1. The method that will address research questions two and three is lexical bundle analysis in which I explore the formulaicity and phraseology in the Algerian MSc dissertations compared to their American counterparts. The methodology used to address this RQ is explained in Section 3.4.2.

The reason why I chose to compare Algerian MSc dissertations with American MSc dissertations is because IEEE was founded with American backing, as discussed in Chapter One, and was at least initially heavily influenced by Engineering education practices in the USA. Differences in learning environments and educational policies are likely to affect Engineering writing conventions and practices in different parts of the world, however, and this might be reflected in the findings from my structural analysis of Algerian and American MSc dissertations.

3.1 Ethics

To ensure that studies will not risk causing any pain or indignity to participants, researchers are required to go through an ethics approval process to discuss research aims, ownership of data, permission to pass it from the participant to the researcher, and conditions over the use and dissemination of the results (Cohen et al., 2011). Ethics is defined as 'a matter of principled sensitivity to the rights of others' (Cavan, 1977:810). Cohen, Manion and Morrison (2011:84) explain that regardless of the nature of the project, researchers must consider the possible effects of the research on the participants, and make sure to protect their dignity as human beings.

Participants are often asked to sign informed consent forms as part of the ethical process of data collection required for the research project. Signing an informed consent is the process by which individuals choose 'to participate in an investigation after being informed of facts that would be likely to influence their decisions' (Diener and Crandall, 1978:57). The principle of informed consent 'arises from the subjects' right to freedom and self-determination' (Cohen et al., 2011:77). The consent form aims to obtain written evidence from participants that shows that the data has been collected based on a mutual agreement between the researcher and participants. This allows the participants to evaluate the risks and benefits of their involvement in the research project and make the final decision about whether or not to participate (Howe and Moses, 1999:24).

For this research, ethical procedures were followed when conducting the interviews and collecting the dissertations. Regarding the dissertations collected online, the data was already in the public domain and are downloaded directly. For the Algerian dissertations, which are not in the public domain, I was offered access to the institute of Electrical and Electronic Engineering (IEEE) based on a letter (see Appendix One), which authorised me to collect electronic copies of MSc dissertations and to interview participants (lecturers and students). IEEE lecturers and students were given consent forms that contained a brief explanation of the project to be signed, voluntarily, as proof that they had agreed to be interviewed for the research project (see Appendices One and Two). The next section will explain the interviews conducted for this thesis.

3.2 Interviews

In a research context, an interview can be described as:

> ‘A two-person conversation initiated by the interviewer for the specific purpose of obtaining research-relevant information, and focused by him on content specified by the research objectives of systematic descriptions, predictions or examinations' (Cannell and Kahn 1968 as cited in Cohen et al., 2015:411).

Gray (2014:396) makes it clear that 'an interview is not a normal conversation and therefore the usual norms of human interaction do not necessarily apply'. This is because interviews demand a far greater degree of 'attentiveness', and unlike ordinary everyday conversations, they are purposeful, one-way (often asked by the interviewer) and question-based (Dyer, 1995). They might be considered as a research method in which researchers convince participants that they are participating in what seems like a conversation, but which extract from interviewees very specific information within a limited space of time. This section covers two elements related to the research: the rationale behind conducting interviews and the interview procedures.

3.2.1 Rationale for interviews

Interviews can provide in-depth information around the researched topic (McNamara, 1999), in this case factual information for Chapter One. In contrast to online surveys or traditional paper questionnaires, semi-structured interviewer has the opportunity to probe by asking follow-up questions.

The interviews with the lecturers provided details about the background of the research site and also their perceptions regarding dissertation writing. The students' interviews, on the other hand, revealed what they knew about dissertation writing and what chapter they perceived to be most difficult to write. Although answering interviews can be easier for participants than answering open-ended questionnaires, because no writing is required, the time had to be monitored carefully to avoid taking up too much of the participants' time. This was especially important in the case of the supervisors because they have been interviewed based on their availability between their working hours.

3.2.2 Interview procedures

Using the cover pages of the 70 dissertations I collected for this study, I identified the names of 30 subject lecturers at IEEE that supervised MSc dissertations in 2014/2015. Eight out of these 30 supervisors were chosen based on years of teaching experience (at least 10 years). In addition to the eight supervisors, I also interviewed two English module leaders, as they have the highest teaching experience in the institute. The majority of the staff have PhD degrees and long teaching experience with foreign qualifications from the USA (mainly) and Europe (see Table 3.1). I also interviewed 10 students who were in the process of writing their MSc dissertations. Students were interviewed from the four Engineering sub-disciplines. All participants were randomly selected, based on their availability.

Table 3.1: Interviews participants' information sheet

Participants	Discipline	Degree	Teaching Experience
Supervisor 1	Electrical Engineering	PhD (foreign degree)	35 years
Supervisor 2	Electrical Engineering	PhD (foreign degree)	33 years
Supervisor 3	Electronic Engineering	PhD (foreign degree)	30 years
Supervisor 4	Electronic Engineering	PhD (foreign degree)	24 years
Supervisor 5	Electrical Engineering	MSc (foreign degree)	18 years
Supervisor 6	Electronic Engineering	PhD (foreign degree)	15 years
Supervisor 7	Electronic Engineering	MSc (local degree)	12 years
Supervisor 8	Electrical Engineering	PhD (foreign degree)	11 years
Lecturer 1	English Teacher	PhD (foreign degree)	34 years
Lecturer 2	English Teacher	MA (foreign degree)	34 years
Student 1	Telecommunication Eng.	Master of Science	/
Student 2	Telecommunication Eng.	Master of Science	/
Student 3	Telecommunication Eng.	Master of Science	/
Student 4	Computer Eng.	Master of Science	/
Student 5	Computer Eng.	Master of Science	/
Student 6	Computer Eng.	Master of Science	/
Student 7	Control Eng.	Master of Science	/
Student 8	Control Eng.	Master of Science	/
Student 9	Power Eng.	Master of Science	/
Student10	Power Eng.	Master of Science	/

The language in which the interview was conducted was also an important consideration because of the complicated linguistic situation in Algeria, as discussed in Chapter One. I prepared copies of the interview questions in both English and Arabic, but all the interviewees opted to use English. This was probably because, as an English-medium institute, IEEE encourages the use of English among teachers and students. Communicating in English is in keeping with the norms of professional communication within the institute.

Every participant was informed about the rationale for the study, given a consent form, and then interviewed using the semi-structured interview schedule provided in Appendix Four. Each interview lasted between 15 to 20 minutes and can be best described as semi-structured. When participants revealed interesting information that was relevant to my study their answers were probed further, in order to develop new directions. The interviews were recorded using a digital recording device which had microphones on both sides to ensure high quality voice recording.

I was particularly careful to allow for individual differences during the interview process, in accordance with the advice given in most interview guides and handbooks regarding the way interviewers should deal with different kind of participants who might vary considerably depending on their personality (Krueger and Casey, 2000). All participants were very friendly and showed great willingness to participate in the research. I had the impression that all students perceived me like a peer rather than a visiting researcher and therefore did not feel the need to be guarded about what they revealed to me. All lecturers were also supportive as they saw me as a reflection of their younger selves, as most of them had studied overseas in their youth. It was probably for this reason that they were very understanding and tried to support me as much as possible.

3.3 The corpora

This section explains my reasons for using a corpus approach and points to general issues in corpus design. It also covers the creation and content of the three corpora used for this study. Briefly, The Algerian Corpus of Engineering (ACE) was created as the main corpus to answer the research questions listed at the end of Chapter Two. As shown in Chapter Two, the majority of studies that have explored the structure of PhD theses and MSc dissertations base their findings on interview data, teaching experience and intuition, or a limited number of texts (Dong, 1998; Bunton, 1998; Thompson, 1999, 2001; Paltridge, 2002; Samraj, 2008). The structural model, suggested by Dong (1998), for example, was not based on empirical analysis of any PhD theses or dissertations, but on interviews with students and their supervisors.

To start with, Section 3.3.1 will explain the need for the Algerian Corpus of Engineering (ACE) and its creation process. This is followed by an account of the creation of the comparative corpus entitled the United States Corpus of Engineering (USCE).

3.3.1 The need for specific corpora

There are a number of reasons why a corpus of MSc dissertations had to be compiled for this study. These are explained below: As discussed in great detail in the literature review chapter the genre of MSc dissertations still remains a ‘case of neglect’ (Dudley-Evans, 1999:28). In this research, I am interested in exploring the academic language used in MSc dissertations in the context of Middle East and North Africa, and specifically Algeria. Details regarding the creation of the Algerian Corpus of Engineering (ACE) are presented in Section 3.3.2.

An analysis of ACE cannot reveal its distinctive features unless it is compared to a ‘reference corpus’. Therefore, a secondary corpus in the same field of Electrical and Electronic Engineering was created. Details regarding the creation of this corpus is presented in Section 3.3.3. A corpus of MSc dissertations produced in a different country, under different teaching/learning circumstances might reveal regional differences regarding writing conventions in the same genre. The next section discusses the design and contents of the main corpus of this study, ACE.

3.3.2 The Algerian Corpus of Engineering

The Algerian Corpus of Engineering (ACE) consists of all Masters’ dissertations submitted to IEEE in the academic year 2014/2015. It is worth noting that all 70 dissertations are a joint work, mostly of two students. Only four dissertations were written by three students. IEEE consists of two departments each with two sub-disciplines, as shown in Table 3.2. Both departments share the same library where all dissertations are stored in both hard and electronic copies. Table 3.2 shows the total number of dissertations collected from both departments and the total word count in ACE (596,817 words); tables and figures were not included in the word count. Word count calculations were made using AntConc version number 3.4.4 (Anthony, 2011); other corpus tools can yield slightly different results as they tokenise using different algorithms.

Table 3.2: Distribution of Masters' dissertations in the Algerian Corpus of Engineering

Disciplines	Dissertations	Word Count
Computer Engineering	17	145,975
Telecommunication Engineering	15	136,975
Control Engineering	15	131,161
Power Engineering	23	182,706
	70	596,817

It is clear from Table 3.2 that amounts across the four sub-disciplines are not balanced in terms of either the number of dissertations or the word count. Power Engineering had the highest number of submitted dissertations in the year of collection, 2014/2015, with the highest word count of 182,706 words. Computer Engineering is the second largest sub-discipline with 145,975 words and a total of 17 dissertations. Though there were similar numbers of dissertations in Telecommunication Engineering and Control Engineering (15), Control Engineering had the smallest word count of 131,161 words. The differences in the length of dissertations across the sub-disciplines may be attributed to the fact that Telecommunication Engineering and Control Engineering make greater use of visual data such as programming scripts and diagrams. Differences in the number of dissertations are because I chose to collect all the dissertations that were submitted in 2014/2015. An alternative approach would have been to reject some dissertations from Power and Computer Engineering to achieve a balance of 15 dissertations from each discipline, but this approach was rejected in favour of achieving a complete representation of the 2014/2015 output.

The following steps were taken in the compilation of ACE. Texts were collected in electronic form. First, the ‘print specific page numbers’ option in Adobe Reader was used to extract the main content-related sections, from the abstract to the general conclusion chapter. These were then converted to plain text files using AntFileConverter version number 1.2.0 (Anthony, 2015). The acknowledgement, dedication, table of contents, lists of figures and tables, lists of abbreviations, table, figures, reference lists and appendices were all excluded from the conversion and compilation process. These sections are less important from the perspective of supervisors and dissertation examiners, and their inclusion would have affected the results of search queries for terms and expressions used in the main body of the dissertations. For example, students usually write acknowledgements and dedications to their families, close friends and sometimes even their unborn children. The language of such sections is quite distinct from the language of research, which I am more interested in exploring in this thesis. Copies of the dissertations were also saved in their original PDF format so that I was able to refer to tables of contents, figures, and tables during my manual analyses of the internal structure of the dissertations to determine their overall organisation.

The selected chapters were subjected to different types of necessary editing, although this did not include correcting the language of the authors when occasional typographical errors were spotted in the conversion process. Mathematical language cannot be represented by the American Standard Code for Information Interchange (ASCII). Coding of characters outside this set would require the use of Standard Generalized Mark-up Language (SGML) where every character is represented by a sequence of three numbers and two symbols ‘&’ and ‘#’. I did not consider it necessary to convert characters in this way for my study, as my research questions did not focus on mathematical data. Visual and mathematical data were removed and replaced with tags. Equations and matrices were replaced by the tag <Formula>, and visual data were replaced with the tags <FIGURE> and <TABLE>. Similar examples of these tags can be found in the British Academic Written English (BAWE) corpus.

Documents were given unique identification codes to make it possible to trace them back to their original format and explore them individually. The coding of the documents followed two stages: the macro and micro. The macro coding stage gave each dissertation a reference number. This stage did not require deep reading of the content of the dissertations apart from the cover page. The codes indicated the field and the dissertation number. Dissertations from the field of Power Engineering are coded PE01 to PE23, where PE stands for Power Engineering. Similarly, dissertations from Telecommunication Engineering are coded TE01 to TE15, and dissertations from Control Engineering are coded CE01 to CE15. To avoid confusion with Control Engineering, Computer Engineering dissertations are coded OE01 to OE17, where ‘O’ references the French term *‘Ordinateur’* (meaning *Computer*).

In addition to the codification of files, angle brackets (<>) tags were used to indicate the internal structure of chapters, identifying divisions, headings and sub-headings as well as the beginnings and endings of paragraphs (see Table 3.3). The use of these tags helps in identifying the structure of chapters which is lost otherwise in the conversion process to plain text files. The authors of the dissertations were not always consistent in their use of headings which is a further reason why I used my level tags rather than repeating the numberings used by the authors of the dissertations. The tags that show how the chapters are divided are summarized below.

Table 3.3: Organisational tags added to the Algerian Corpus of Engineering

Tag	Use
…	The enclosed text is a new chapter.
…	The enclosed text is a header at the first level.
…	The enclosed text is a header at the second level.
…	The enclosed text is a header at the third level.
…	The enclosed text is a header at the fourth level.
<list> … </list>	The enclosed text is a list.
…	The enclosed text is a paragraph.

It is important to make clear that the heading tags refer to level numbers and not the actual heading numbers assigned by the authors of the collected texts. Chapter One is tagged using <div1> and </div1> to indicate the start and end of the chapter. The first heading in a chapter is tagged <h1> and </h1>, indicating that this is the first section in the chapter. This type of tagging helps in the identification of the rhetorical function of the entire chapter, as will be explained when describing the micro coding stage. Further subheadings in sections are tagged using <h2> and </h2> and so on. In the case of another main subheading, the tagging starts all over again. The coding is further illustrated in Figure 3.1 below.

```
<div1> Chapter One
(level 1) <h1> 1.1. Introduction </h1>
      (level 2) <h2> 1.1.2. ………. </h2>
      (level 2) <h2> 1.1.3. ……….. </h2>
(level 1) <h1> 1.2. ………… </h1>
(level 1) <h1> 1.3. ………… </h1>
      (level 2) <h2> 1.3.1 ………… </h2>
          (level 3) <h3> 1.3.1.1. ………… </h3>
          (level 3) <h3> 1.3.1.2. ………… </h3>
                   (Level 4) <h4> 1.3.1.2.1. ………….. </h4>
                   (Level 4) <h4> 1.3.1.2.2. ………….. </h4>
(level 1) <h1> 1.4. Conclusion </h1>
</div1>
```

Figure 3.1: Tags of heading and sub-headings in ACE

Based on this tagging system, and because I am interested in investigating potential cross-sub-disciplinary language variations between and within the dissertations, I decided to create three versions of ACE that differ in their format. The three versions are 1) ACE as one block of plain text in a single document. This file was used when exploring the academic language used at IEEE generally and comparing it with the use of academic language in other corpora; 2) ACE divided by sub-disciplines (four sub-corpora) to explore the language within and across the four sub-disciplines; 3) ACE divided by the rhetorical function of chapters, as explained in Section 3.3.2. The dissertations in their original PDF format were also retained for manual analysis of their organisational structure.

The micro coding stage, on the other hand, involved applying functional codes to each chapter according to their rhetorical function based on titles and content; for example, either following the conventional *Introduction, Methodology, Results and Discussion (IMRD)* structure or the *Introduction, Theory, System Design, and Conclusion* structure of the Design Specification genre identified by Nesi and Gardner (2012) and George (1989), as shown in Section 2.1.4.

The classification of chapters according to their rhetorical function followed an elimination process starting with the stages that could be most easily identified. These were the Abstract, Introduction and Conclusion. The coding of these three stages was a straightforward process as they have well-established functions and are expected to occur in most dissertations. The chapters situated between the general introduction and the general conclusion, however, were more difficult to classify as multiple chapters sometimes fulfilled the functions of a single stage. For this reason, I carefully examined the remaining chapters to see whether they followed the structure of the Design Specification or the typical IMRD structure and its derivative forms, as discussed in Chapter Two.

The identified general structure of a Design Specification consists of three broad sections: introductory, central and final (Nesi and Gardner, 2012:185). The introductory section explains the purpose of the report. The central section reports on the research activity, often with calculations using statistical programmes. The final section reviews the procedures previously described and states the success of the final specifications. It is helpful to note the order of the main stages presented in the structural model suggested by Nesi and Gardner (2012). According to this model, the Theory comes immediately after the Introduction stage. In other words, in a Design Specification genre, we would normally expect the first chapter that comes after the Introduction to serve the rhetorical function of a Theory, or a System Design if a Theory stage is absent.

I also took into consideration the titles of chapters when deciding on the rhetorical stage of every chapter. Chapter headings (if used correctly) can help to identify the functions of each chapter as they can act as 'macrothemes', and 'establish expectations for the sections that follow and facilitate focused comparisons of Engineering registers across disciplines' (Gardner and Xu, 2019:14). To establish whether this was the case, I carefully read each chapter and considered its relation to the title given by the student.

The chapter titles did not always reflect the expected content of the chapters. For example, 'Literature review' was a common chapter heading, but close reading revealed that IEEE students did not review the literature critically; instead, they referred to theories, concepts, and models presented in the literature as a starting point before presenting the design process of the study. These chapters might better be described as "Theory" chapters, rather than "Literature Reviews", and were therefore classified as belonging to the Theory stage. The students' use of "literature review" as a heading for sections where the prior literature was not critically reviewed might be due to the influence of practices in research publications.

Table 3.4 gives the titles of chapters categorized as belonging to the Theory and System Design Stages. These titles are also classified either as generic headings (Introduction, Theory, Discussion …) or subject-specific headings such as 'Array Hybridization', 'Generic Algorithms'; this classification is also used in Bunton (1998:156).

Table 3.4: Theory and System Design stages and their chapter titles

Function	Theory		Design Specification	
Type	Generic Headings	Subject Specific Headings	Generic Headings	Subject Specific Headings
CE	Theoretical background Introduction to motion planning	Motion planning approaches Diffusion MRI Mobile robot navigation Robot kinematics	Simulation and results	Implementation and experimental validation Optimal Feedback motion planning System Automation Software Design & Simulation
PE	Theoretical background Theory	DC Chopper Boiler description Brushless DC motor	Simulation and discussion of results	Genetic algorithms Case Study Distance relay design model
OE	Theoretical background Mathematical background Stereo vision theory	Gabor filters Basics of cryptography	Results Simulation & implementation results	Hardware System Design Software System Design Experimental results
TE	Literature review of RF theory	Microstrip antenna overview Generalities on Microstrip Patch Antennas Optimization Techniques Line Coding	Classification result Simulation and Discussion	Array Hybridization Implementation using HTK OFDM in an LTE System

After the Theory stage, we might expect a chapter devoted to Methodology as is the case with the IMRD structure. However, I could not find any stand-alone chapter entirely devoted to Methodology. Nesi and Gardner (2012) distinguish between ‘Design Specification’ and ‘Analysis and Discussion’ sections in student assignments. However, in the case of ACE, I found that there is generally no clear distinction between what might be considered a System Design Stage and an Analysis and Discussion Stage. While reading the chapters located between the Theory and Conclusion stages, I noticed that they contained the greatest use of equations, formulae and diagrams and also explained how the system ‘is’ and how it ‘should be’, in the way described by Nesi and Gardner with reference to Design Specification assignments (2012:186). In fact, these chapters tend to represent a cycle of hardware and software design and implementation before concluding that the device works successfully. In cases where there is a discussion section within the System Design Stage, it is usually very short and reports whether the project is working successfully (see examples 1 and 2), and/or what its limitations are (see example 3).

1- ‘The generated path is *executed successfully* in the real robot using point to point technique where the waypoints are sent serially through the serial port to the Arduino. Between two waypoints; a time delay (Td) is selected experimentally to get a smooth path and avoiding the discontinuous motion’. (CE09 – Chapter03)

2- ‘Clearly seen that starting from the 5th heartbeat *the accuracy identification rate* or resolutions or recognition percentage *is very significant*’. (OE07 – chapter 04)

3- After the implementing and analyzing the results, the following *limitations* of the system set are gotten.
- The servos are limited to 180 degrees each.
- Good lighting is required.
- The system cannot function properly when the detected face is moving too fast.
- The system can detect more than one face Figure 4.34 but it tracks only one, the one that is detected first. (OE17 – Chapter4)

These short discussion sections show the importance of providing evidence that the system is working successfully enough to validate the research.

In brief, I have included in what I have categorised as a System Design stage, all chapters located between what I classified as the Theory and Conclusion stages. It is also worth noting that there were no cases where a stage was interrupted by another stage (e.g.: Theory – Design Specification – Theory). However, stages contained recurring smaller units. For example, the System Design stage had a reoccurring sequence of *system design, simulation and implementation*.

Section 3.3.2 provided a detailed explanation of the compilation process of the Algerian Corpus of Engineering (ACE) including tagging and file coding. The next section explains the process of compiling my comparative corpus. As stated earlier, comparing MSc dissertations from IEEE with dissertations written in the US can allow us to investigate the extent to which IEEE is still complying with American MSc dissertation conventions.

3.3.3 The United States Corpus of Engineering

The United States Corpus of Engineering (USCE) consists of 109 MSc dissertations which were downloaded from the open access online American database, Ohio-Link (https://etd.ohiolink.edu/pg_1?0). The database contains dissertations submitted to different US universities across different points in time since 1900. Unlike ACE dissertations which are team project (mostly of two students), all 109 dissertations in the USCE are written by individual students.

To create a comparable corpus to ACE, I focused on collecting dissertations that were submitted between 2012 and 2016, at around the same time ACE dissertations were submitted (2015). I used the ‘advanced search category’ to search the database for sub-disciplines similar to Electrical and Electronic Engineering, and also read keywords and titles of dissertations to help me identify dissertations that matched ACE dissertations. For example, through reading cover pages and abstracts, I concluded that Electrical Engineering was a match for the Algerian sub-discipline of Power Engineering. The three sub-disciplines which were similar to the sub-disciplines in ACE were: Electrical Engineering, Control Engineering, and Computer Engineering. Unfortunately, only one dissertation was found to match the field of Telecommunication Engineering, and for this reason, this sub-discipline is not represented in USCE. Table 3.5 shows the overall number of dissertations across the three sub-disciplines and universities in USCE. A total of 109 dissertations from seven universities were collected.

Table 3.5: USCE dissertation dispersion across sub-disciplines and universities

Universities	**Electrical Engineering**	**Computer Engineering**	**System and Control Engineering**
Case West Reserve University	10	10	10
Dayton University	10		
Akron University	10	09	
Wright State University	10	10	
Toledo University	10		
Ohio State University		10	
Cincinnati University		10	
Total	50	49	10

USCE was not created to compare practice across the seven universities. The reason why USCE has more universities than ACE is because there is only one Algerian institute where Electrical and Electronic Engineering dissertations written in English are produced (as stated in Chapter One, Section 1.3.2). The existence of multiple American university Masters courses in Electrical and Electronic Engineering and the availability of some of their MSc dissertations online meant that more data could be collected from multiple univariates for USCE.

To facilitate the compilation process for USCE, the 109 PDF files were edited using the ‘print as PDF file’ option, to create new copies which contained only the main parts of each dissertation (from the abstract to the conclusion). All the 109 edited files were then uploaded to AntConverter version 1.2.0 (Anthony, 2015) and converted to plain text automatically to form a corpus of 1,094,737 words.

In the case of dissertations where the abstract was separated from the other chapters by other parts such as acknowledgements or lists of figures and tables, the PDF was reprinted using the ‘print as PDF’ option, starting from the introduction chapter. The abstract was then added manually to the converted text file. Likewise, if the conclusion chapter and parts of the list of references were on the same page, the list of references was manually removed from the converted text file.

All the converted text files were then examined individually to remove any nonsense text resulting from the conversion of tables, figures or formulae. This kind of text can easily be removed because AntConverter does not present it as a block paragraph. Instead, AntConverter represents it as a long list of words that ends with the title of the table or figure and leaves a noticeable space between this list and the surrounding paragraphs of the dissertation.

As with ACE, USCE was retained in different formats: each dissertation was stored in its original and edited PDF files, as plain text and as a series of rhetorical stages in plain text files. Codes were added to each USCE dissertation to mark formal and functional features. USCE is numbered from one to 109 without explicit reference to university provenance.

To sum up, Section 3.4 explained the need for the creation of the Algerian Corpus of Engineering (ACE) which is the main corpus used in this thesis. Due to the absence of suitable comparable corpora, USCE was created. Dissertations from the United States were chosen because of the original connection between the Algerian IEEE and the US; it was founded in 1976 with American backing. After explaining the corpus compilation processes, the next sections will explain the research methods used to address the three research questions.

3.4 Research methods

This section explains the research methods used in this thesis. The first research method was a qualitative exploration of the organisational structure of the MSc dissertations as explained in Section 3.4.1. The second was a lexical bundles analysis across both corpora, with a focus on ACE, as explained in Section 3.4.2.

3.4.1 Dissertation structure analysis

To answer to RQ1, I conducted a qualitative analysis to identify the overall structure of all 179 MSc dissertation in their entirety. In this analysis, I used the term ‘stage’ to refer to a bigger functional unit than a ‘move’; this was either a chapter or multiple chapters. For example, in the case of the IMRD structure, the Introduction, Methodology, Results and Discussion were considered to be stages. In the case of the Design Specification structure, the Introduction, Theory, System Design and Conclusion were considered to be stages. The use of the term ‘stage’ suits the structural study explored in this thesis better than the term ‘section’, used in the structural studies of RAs (reviewed in Chapter Two), because these sub-parts did not necessarily correspond to chapters or headed sections.

In order to identify the overall structure of the Algerian and American MSc dissertations, I considered what the literature discussed in Chapter Two offered in terms of structure, moves and steps. I also read all the dissertations and paid attention to structural clues found across different parts of the dissertations such as tables of contents and chapter headings. While reading the chapters for content, I started with the introduction and conclusion of each chapter to have a better understanding of its communicative purpose.

For example, when identifying the Conclusion stage in all 179 MSc dissertations, I took into consideration previous studies that have examined the structure of conclusions in Masters' dissertations (Samraj, 2005), PhD theses (Bunton 1999, 2005; Thompson, 2005). However, although many studies have investigated the structure of individual or multiple sections of RAs (Kanoksilapatham 2005, 2007, 2012, 2013, 2015; Milagros del Saz Rubio, 2011; Sheldon, 2011; Swales, 1990; 2004), very few have looked at the Conclusion as a stand-alone stage and not as part of the Discussion stage. One possible reason for this is that the Conclusion in the IMRD structure is part of the Discussion section. In this thesis, the Conclusion is analysed as a rhetorical stage on its own, and in cases where it was presented as part of the final Discussion chapter, it was extracted and analysed separately for its internal structure, following Bunton (2005:211). The sections entitled 'Discussion of future work' were also classified as part of the Conclusion Stage and not the Discussion stage.

The identification of the overall structure of the dissertations initially followed a 'bottom up' approach; i.e.: carefully reading the dissertations and then comparing their structure with the structural models discussed in Chapter Two. After several readings, I decided whether the structure of the Algerian and American MSc dissertations followed the conventional IMRD structure (and its derivative forms). Having decided which structural model best described each group of dissertations, I narrowed my focus to identify the stages specific to that structure. Chapter Five shows the results of the structural classification process as well as definitions of the identified stages with examples from both corpora.

It is worth noting that I noticed some surface errors in USCE. These occurred across all stages and especially in the stage where students explained the working principles of the components and approaches used in their project *(e.g.: 'However, again this theory <u>does not considers</u> the diffusion of free radicals, which has been covered in theory proposed by Tanford and Pease [6]', USCET47).* These errors were not corrected.

3.4.2 Lexical bundle analysis

As stated in Chapter Two, lexical bundles (LBs) can be defined as the most frequent fixed-length word sequences in a corpus. LBs are also known in the literature by other names, such as N-grams (Ellis, Simpson-Vlach, and Maynard, 2008), Clusters (Schmitt, Grandage & Adolphs, 2004), Recurrent word combinations (Altenberg, 1998; De Cock, 1998), and Formulaic sequences (Staples, Egbert, Biber and McClair, 2013). In this thesis, I have decided to use the term lexical bundles in line with the two major studies I refer to, Biber et al (1999) and Hyland (2008).

To extract LBs from both ACE and USCE and across ACE four sub-disciplines, i.e.: Power Engineering, Telecommunication Engineering, Control Engineering and Computer Engineering, as shown in Table 3.2, I used AntConc software (Anthony, 2015), taking into consideration three criteria: length, frequency, and dispersion/range. The first selection criterion was LB length. LBs can theoretically be of any length, but usually studies focus on lengths from two words to six words. For this study four-word lexical bundles were chosen because they are more common than five and six-word lexical bundles and more structurally complete than three and two-word lexical bundles (Biber et al., 1999; Biber and Barbieri, 2007; Hyland, 2008). We can see an illustration of this in Figure 3.2, which shows how a six-word bundle can be broken down to multiple shorter LBs which overlap with each other. This process is referred to as 'nesting' (Biber et al., 1999:993). The highlighted four-word LBs in Figure 3.2 are the focus of this study. All bundles that passed the strict thresholds set for this study, including all forms of four-word bundles that might belong to a longer bundle, were included in the analysis. It is worth noting that setting low thresholds can lead to over counting small bundles that belong to longer bundles. However, as the thresholds set for the four-word bundles in this study are higher than those reviewed in the literature, only enough numbers of bundles were retrieved for analysis. Investigating longer bundles, on the other hand, would have reduced the number of bundles to a level that might have affected the analysis.

Possible 2-wordbundles: Do you; You want; Want me; Me to; To do →

Possible 3-word bundles: Do you want; You want me; want me to; me to do →

Possible 4-wordbundles: Do you want me; you want me to; want me to do →

Possible 5-word bundles: Do you want me to; you want me to do →

Possible 6-word bundles: Do you want me to do.

Figure 3.2: The nesting of lexical bundles of increasing lengths (Biber et al., 1999:993)

The second criterion related to LB frequency. LB studies typically set a minimum frequency threshold to avoid having an excess of data to analyse and to reduce the possibility of including bundles which are unusual and therefore not representative of the discourse in question. Frequency criteria are sometimes acknowledged to be 'somewhat arbitrary' (Biber & Barbieri, 2007:267; Hyland, 2008:8) since there may not be a clear reason for choosing stricter or more generous thresholds, apart from the amount of data that can be reported. A range of different thresholds have been used – sometimes the same scholar has applied different ones. Biber et al. (1999) included bundles that occurred 10 times per million words (pmw). Hyland (2008) and Cortes (2004, 2006) applied a stricter cut-off of 20 times pmw. The strictest threshold of 40 occurrences pmw were applied by Biber et al. (2004) and Biber and Barbieri (2007).

This study applied the strictest of these thresholds; LBs had to occur at least 40 times per million words. This strict figure was chosen due to the relatively small size of the sub-corpora of ACE (from around 130,000 to 180,000 words – see Table 3.2). Figures were calculated separately for each sub-discipline by dividing the corpus size by one million and multiplying the result by 40. For example, in the case of Power Engineering, the pmw figure was calculated thus: 181352/1000000 x 40 ≈ 7 (6.9). All results were rounded to the closest figure, meaning that bundles had to occur a minimum of five times in Control Engineering and Telecommunications Engineering, and six times in Computer Engineering. Setting a low frequency threshold would have resulted in the retrieval of bundles with very low raw frequencies, and over-represent relatively idiosyncratic and unusual instances. This relates to Bestgen's (2019) point that due to Zipf's law, rarer phenomena will tend to be retrieved in smaller corpora compared to larger corpora when the same thresholds are applied. Applying this frequency cut-off meant that bundles had to occur at least five times in the smallest sub-corpus, which is TE (131,161words) as show in Table 3.2.

The third criterion relates to the dispersion of bundles, also referred to as 'range'. Biber et al. (2004:375) set a cut-off of occurrence in around 2% of texts, while Biber and Barbieri (2007:267) set this at around 5% of their texts; Hyland (2008), only considered bundles occurring in at least 10% of his texts. Setting a range cut-off point is important to minimise the likelihood of a particular writer's preferences skewing the findings (Pan et al., 2016). In other words, without applying a high range threshold and collecting texts produced by different people, an individual writer's preference for certain bundles might give the impression that they are very frequent when in fact they are rarely used by most other writers.

In terms of range, only bundles that occurred across at least 20% of the total number of dissertations in ACE and USCE were analysed. The same range was applied to the dissertations in each sub-discipline of ACE. In the case of Power Engineering, this meant that a bundle had to occur in at least 20% of the 23 dissertations, or 4.6, which was rounded up to 5; the counterpart figure for the other sub-disciplines was a range of at least four texts. This rather strict range threshold was used since, like the strict frequency threshold, it can help to reduce differences which can be created when bundles taken from corpora of different sizes are compared (Bestgen 2019).

As shown in Chapter Two Section 2.6, many previous studies have compared different groups of genres and many of these have used corpora of different sizes. Such studies relied on normalisation alone and the assumption that, all else being equal, bundles would be distributed equally across corpora of different sizes. According to this logic, if 40 instances of a bundle were found in a corpus of 1 million words then around 10 instances should be found in a corpus of 250,000 words (Bestgen 2019). Bestgen shows that comparing LB findings across corpora of very different sizes can be problematic even when the results are normalised. In any corpus, 'a few words occur with very high frequency while many words occur but rarely' (Bestgen, 2019:12). This is known as the Zipfian effect (Zipf, 1935/1965). The result of this effect, as Bestgen (2019) shows for a range of corpora, is that if the corpora compared are of 'relatively different sizes', this will have a significant impact on the number of bundles identified; more bundles will pass normalised frequency thresholds in smaller corpora than in larger corpora (Bestgen, 2019:15). There are ways to counter this effect. Bestgen (2019:15) suggests that 'the simplest and most correct way to avoid unfairness in the comparison is to analyse corpora of sizes as similar as possible'. This is the case when comparing the sub-corpora of ACE, which are between around 130,000 and 180,000 words.

In summary, the thresholds I applied when retrieving 4-word LBs in this study were a minimum frequency 40 pmw and a minimum range of 20%. The selection criteria were applied to each corpus (ACE and USCE) to generate two lists of bundles. The same selection criteria were also applied across the four sub-disciplines of ACE for a more detailed cross sub-disciplinary analysis of bundles within the Algerian context.

The lists of lexical bundles generated were analysed at three levels: distribution, structure and function. The analysis of bundles followed the model presented in Biber et al. (1999) and later used by Hyland (2008), see Tables 2.10 in Section 2.6. These are essentially the same model but the different corpora used in the two studies resulted in certain structures being found in greater numbers. Hyland's study applied the model to a more specific corpus of PhD theses, Masters' dissertations and RAs in a variety of disciplines including Electrical Engineering; he also conflated structures which did not occur frequently enough to be worth reporting into an 'Other' category. The original structural model suggested by Biber et al (1999) was generated from registers of spoken and written English. It was therefore more completely representative of the English language, and was used to make a more detailed classification of the bundles which Hyland placed in the 'Other' category.

There are some small differences in how Biber et al. and Hyland interpreted some of the LB structures. For example, Biber et al. (1999) classed *'can be used to'* as *'(Verb phrase) + to-clause'*, while Hyland (2008:11) appears to have classified it as *'passive verb + prepositional phrase fragment'*. However, most of the time the classifications are in agreement and in this study too. The bundles were classified by me and one of my supervisors; both raters did not have difficulty agreeing on bundle classification.

For the functional classification of bundles, two closely-related models have been proposed, one by Biber et al. (2004) which was developed further in Biber (2006), and another by Hyland (2008), which is presented in Table 2.11, Section 2.6. Biber et al. (2004) introduced a 'preliminary' three-way functional taxonomy: 'Referential Bundles' such as *'as shown in figure/table'* refer to information inside or outside the text, 'Discourse Bundles' are used to create cohesion within the discourse and include bundles such as *'as well as the'*, and *'on the other hand'*; and 'Stance Bundles' refer to the writer's own evaluation and attitudes and include bundles such as *'the fact that the'* and *'it is unsatisfactory that'*. This framework, like Hyland's, was clearly inspired by Halliday's (1985) three-way functional analysis of language; 'stance' relates to Halliday's interpersonal metafunction, 'discourse' to the textual metafunction and 'referential' to the ideational metafunction. However, it is not clear whether this framework was intended to cover all possible bundles. Certainly, Biber (2006) indicates that some bundles fall into a fourth, 'Other', category, or 'special functions', although this may apply more to spoken language than written.

In this thesis, I followed Hyland's (2008) functional taxonomy. As noted in Section 2.6, Hyland's corpus consisted of Masters' dissertations, research articles, and PhD theses from a range of disciplines. As stated earlier, Biber et al.'s (2004) functional taxonomy emerged from a corpus of a range of registers including casual conversations, service encounters and textbooks, with the result that their framework is based on 'far more personal, referential, and directive bundles' than Hyland's corpus of 'more research-focused genres' (Hyland, 2008:13). The present study focuses on texts from the disciplines of Electrical Engineering, which were also included in Hyland's corpus. This made Hyland's functional classification of lexical bundles more applicable than Biber's.

Table 2.11 in Section 2.6 illustrates the framework and also the examples Hyland provided for each overall category, and indicates how each category is divided into sub-categories. Broadly speaking, the 'Research-oriented' (RO) category, which includes bundles that 'help writers to structure their activities and experience of the real world' (Hyland, 2008:13) equates to Biber's 'Referential' type. 'Text-oriented' (TO) bundles are 'concerned with the organization of the text and its meaning as a message or argument' (Hyland, 2008:13), like Biber's 'Discourse' bundles. Finally, 'Participant-oriented' (PO) bundles include both 'Stance' bundles and a further subcategory of 'Engagement' bundles, which 'focus on the writer or the reader of the text' (Hyland, 2008:14), a distinction that draws on Hyland's work in metadiscourse (e.g. Hyland, 2005).

There are, however, considerable challenges for any researcher who seeks to apply Hyland's framework, in that not enough detail is provided either in terms of descriptions of sub-categories or in terms of their extensions, i.e. the items included in each one. One might ask why, for example, *the magnitude of the* and *the size of the*, which seem broadly synonymous, find themselves in different categories: the former is provided as an example of 'Quantification', while the latter is in the 'Description' category (Hyland, 2008:13). This sort of problem necessitated a minor adaptation of Hyland's (2008) framework where these two categories were merged.

Unlike the structures of lexical bundles which are relatively straightforward to identify, the functions of lexical bundles are sometimes less obvious, due to the fact that bundles are often structurally incomplete. Two main issues that can occur in this respect.

Firstly, lexical bundles may have different functions in different contexts. A good example of this is the lexical bundle *at the same time*. In academic discourse, this bundle commonly has a contrastive sense similar to *on the other hand*, and therefore falls within the Text-oriented (TO) category as a ‘Transition signal’. However, it can also be found in descriptions of procedural steps in the methodology meaning ‘simultaneously’, where it fulfils a Research-oriented ‘Location’ function, as in this example: *‘We start the control at t=2s to ensure that we work in that speed line and at the same time we try first to set our desired value to approximately to the compressor flow just below the start of the controller’* (ACE-CE07).

Secondly, lexical bundles may have different functions within the same context. In other words, the entire bundle can have more than one meaning at the same time and therefore belong in more than one category. An example of the former is the lexical bundle *can be written as*, which might be interpreted as having a structural function (pointing to an equation) or as having a stance function (PO) in that it refers to a possible or agreed-upon way of writing an equation. Another example of this phenomenon is *can be used to*. The first part ‘can be’ is associated with the expression of ‘stance’ (Biber, 2006). The second part, which is in the passive form *'used to'*, is associated with the description of procedures (Hyland, 2008).

Hyland (2008) was not explicit regarding how he dealt with these issues, and perhaps there is no totally satisfactory means of doing so. However, a consistent approach is necessary. The approach used here with the first issue was to categorise bundles according to the function found in the majority of cases; with *at the same time*, this was found to be the RO 'Location' function. With the second type of issue, the decision was to categorise LBs according to their main function. In the case of *'can be used to'*, I can argue that the 'procedure' meaning is more salient than the 'stance' meaning. This categorisation, like the others in this study, is based on analysing the bundle in its co-text, i.e. by looking at concordance lines, an easily accessible option with the software used. After multiple one to one analysis sessions on the function and structure of bundle in its co-text, both raters (Fares Rezoug and Benet Vincent) were 100% in agreement on the classification of these bundles.

3.5 Conclusion

In this chapter, I explained the initial ethical procedures required for data collection and use in this thesis. I also explained briefly the ethical process and the ethical clearance granted to carry out this research. The purpose and process of the interviews with both students, supervisors and English teachers in Algeria were also explained. The first main part of this chapter explained in detail the content and compilation process of The Algerian Corpus of Engineering (ACE) of 70

Masters' dissertations, and the United States Corpus of Engineering (USCE) of 109 Masters' dissertations. The second part of this chapter explained in detail the research methods used which are the organisation structure analysis to respond to RQ1 and the lexical bundle analysis to respond to RQs 2 and 3. Chapter Four will report briefly on the answers of the interviewees regarding their attitudes towards Electrical and Electronic Engineering MSc dissertation writing. Chapter Five will provide detailed analyses of the organisation structure of ACE and USCE. Chapter Six will report on the lexical bundles found in ACE and USCE and across the four sub-disciplines of ACE.

Chapter 4
Interview Findings

4. Introduction

This chapter presents a synopsis of the interviews conducted in this study. The questions addressed in this chapter were asked to eight supervisors and ten MSc students (see Section 3.2.2 for a full recount of the interview procedure and participants).

As previously stated in Chapter Three, the first main reason for the interviews was to obtain the factual information reported in Chapter One, Section 1.2.2 regarding the years of experience and qualifications of IEEE lecturers, the types of degrees taught in the institute, the background of the institute, and the kind of English language support students received (if any). I obtained this information through interviews because it was difficult to obtain it otherwise. Interviewee responses reported in Section 1.2.2 are not restated in this chapter.

The second reason for the interviews, which I will focus on in this chapter, was to ascertain the participants' attitudes regarding the style and structure of a good MSc dissertation. The questions that I will focus on here are as follows:

Q1. What makes a good MSc dissertation, in your view?

Q2. Is there a conventional structure to an MSc dissertation in your field of study?

Q3. (for supervisors) – Based on your experience, what are the problems students usually face when writing an MSc dissertation?

Q4. (for students) – Based on your experience, what are the problems you have faced so far in writing your MSc dissertation?

Q5. Have you any other comments about teaching/studying at IEEE?

4.1 Q1 – What makes a good MSc dissertation, in your view?

The first question asked respondents to give their opinion on important components of a good dissertation. Overall, there was a general agreement amongst the supervisors on what makes a good dissertation. According to Supervisor 1, 'the best MSc dissertation is the one that will have some direct implications in industry and solve a real-life problem'. As shown in Table 3.1 in the Methodology Chapter, Supervisor 1 was one of the most experienced supervisors, with 35 years' experience. His opinion on what made a good MSc dissertation was also shared in one way or another by all the other supervisor interviewees. Supervisor 2, who had 33 years' experience, also perceived a good MSc dissertation to be one that 'can use existing knowledge to propose new solutions to real-world problems'. According to Supervisor 3, who had 30 years' experience, a good MSc dissertation should not only suggest a solution to a problem, but should also suggest a solution that can be implemented using the available resources of the institute. The same point is expressed differently by supervisor 5, who had 18 years' experience, as follows: 'a dissertation that contains the implementation part is better than one with just simulation or theoretical things alone'. Both supervisors 3 and 5 were voicing a generally held opinion when they agreed that suggesting a solution that could not be implemented would affect the quality of an MSc dissertation. The four remaining supervisors agreed that good MSc dissertations addressed topics brought from industry to answer real problems in the industrial field. They explained that this raised the students' chances of being hired by companies upon graduation. The four supervisors also made the point that a good dissertation should be 'well written' and 'well structured', although they did not go into detail about what they considered to be good writing and structuring.

In terms of student responses, these were similar to those expressed by the supervisors. Three students stressed the importance of the practical part. The main ideas mentioned are shown in the extracts below.

- 'Good results, as in the theoretical part we do not bring any new ideas' (student 9).
- 'It must be complete with a working simulation and implementation' (student 1).
- 'A good project is based on the implementation' (student 4).

Two students stressed the importance of making an original contribution, as indicated in the extracts that follow.

- 'It must have some sort of new contribution in the real world' (student 7).
- 'Need to have some originality' (student 6).

Two of the students referred to the need to address industry-related real-life problems. The relevant extracts are shown below.

- ‘A real project for a real problem in the real-life’ (student 8).
- ‘It needs to serve a purpose in the industry’ (student 5).

Additionally, three students stressed the importance of good writing and organisation, as well as the need for a snappy title. Their comments can be seen below.

- ‘Title should be short/interesting’ (student 10).
- ‘Research should be well done and well organised’ (student 2).
- ‘The topic and language … you need to show a good command of language and choose the right topic’ (student 3).

It is interesting that students did not just mention issues of content and how they carried out the research but also referred to the importance of organisational issues, which are covered in more detail in the next section.

4.2 Q2 – Is there a conventional structure to an MSc dissertation in your field of study?

The eight supervisors were asked if they wanted students to follow the conventional structure in dissertations in their field of study. Four supervisors were specialised in Electrical Engineering and four were specialised in Electronic Engineering, as shown in Table 3.1. Two supervisors (one from each discipline – supervisors 7 and 8) did not elaborate on this question, saying that the structure chosen would depend on the supervisors. However, there was unanimity amongst the other six supervisors in terms of what they thought was an acceptable structure. Very broadly, they named the following sections: Abstract, Introduction, Theory, Experimental/Practical part – 'student work' - and Conclusion. According to supervisor 1, this structure was suggested by the American teachers who set up the institute and has been applied in the institute since 1976. All six of these supervisors agreed that the Abstract should indicate the problem, how it was solved and the main results. They also said that the introduction should state the problem (briefly and clearly).

These supervisors were also in agreement that the part of the dissertation that they called the 'Theory' chapter should include 'the state of the art' of the theories relevant to the students' topics. As supervisor 1 explained, after reviewing relevant theories, students should then decide on the most suitable theory or theories as a basis for their experiments. To this supervisor, the Theory chapter was important as it reflected the student's theoretical knowledge and confidence prior to starting the experimental description. He also made the point that generally there were two types of projects in Electrical and Electronic Engineering: software projects, which were concerned with software design and simulation, and software and hardware projects, which were concerned with manufacturing and implementing projects in real-life conditions. He added that 'we appreciate the ability to prove that both systems work in the way the student has stated'. This shows the importance of the third stage, the Experimental/Practical part, to the supervisors.

The Experimental part was described by the supervisors as 'the student's actual hard work and contribution' (supervisor 2). It was considered to be where 'the students say what they have done' (supervisor 3), and where they 'test, simulate and implement the software/hardware' (supervisor 5).

The Conclusion was most clearly explained by supervisor 4 as a brief chapter where students stated how successful they had been in solving the problem set out in the problem statement.

Unlike the supervisors, the students did not elaborate much on the structure of MSc dissertations in their field. As all students were at different stages of their MSc dissertations, they may have had limited awareness about this aspect. Student answers to question two claimed that 'we are free to choose our own structure of the project' or that 'it depends on the supervisors'. According to the students, some supervisors were happy to accept the structure suggested by their student, while other supervisors suggested their own structure. One student added that it was easier when 'the structure is suggested by the supervisor because it helps a lot with writing the project'. The students' answers to this question therefore contradicted the answers given by the supervisors, the majority of whom identified a structure that was conventional for dissertations in their field. It is worth restating that the students had not been taught anything regarding MSc dissertation writing prior to their MSc degree. It is therefore most likely that the supervisors did in fact influence the students' choice of structure in more or less overt ways by guiding students towards a certain preferred structure without imposing it directly from the beginning. In fact, according to the results that will be shown next in Chapter Five, the structure of IEEE MSc dissertations was very consistent.

4.3 Q3 – Based on your experience, what are the problems students usually face in writing an MSc dissertation?

When asked about student's MSc dissertation writing problems, all eight supervisors agreed that the chapters prior to the Experimental part were relatively less difficult to write. The majority thought that the Experimental part of the dissertation, also known as the practical part, was the most difficult, as students struggled to explain clearly the procedures they had followed. This point is in line with the students' responses to the same question as shown in the next section (Section 4.4).

Supervisor 1 added that 'students struggle to apply theory to practice in the experimental part'. This answer relates to the difficulties students face when working on complex topics that might be difficult to implement in real life. Two supervisors (5 and 6) agreed that they always had to provide extra support for their students when working on the Experimental part. The only dissenting voice, however, was supervisor 8, who thought that her students struggled most with the Conclusion chapter. She commented that 'sometimes we find many difficulties to push our students to conclude their projects'.

4.4 Q4 – Based on your experience, what are the problems you have faced so far in writing your MSc dissertation?

When students' were asked about potential problems faced when writing an MSc dissertation, six of the ten students said that they had difficulty writing the Experimental part. As one student explained, the Experimental part is 'the chapter where you explain all of your experimental work which makes it the most difficult part of the dissertation'. This is in line with the supervisors' point reported in Section 4.3. The difficulties students spoke about relating to this chapter included commenting on the results, linking the results to the expecting knowledge, and explaining the steps of the research. One student added that because they often had to adapt their design multiple times to obtain accurate results, it was difficult to describe the process clearly.

Three students, however, made it clear that they did not think that they had problems with writing, but instead focused on difficulties they had with the technical implementation of the projects, especially the lack of equipment.

4.5 Q5. – Have you any other comments about teaching / studying at IEEE?

Out of the ten supervisors, only one, supervisor 8, added a further comment. This supervisor had taken all her Engineering degrees in French (BSc and MSc in Algeria and PhD in Paris), and for this reason, she said, it would have been easier for her to teach Engineering in French. However, she had chosen to learn English and work in an English medium institute because most of the relevant literature was published in English and it was difficult for her to conduct research in French.

This point supports the point raised in Chapter One regarding the anticipated switch from French to EMI in science and technology disciplines in Algerian higher education.

None of the students added any other additional points apart from one or two remarks relating to the lack of equipment.

4.6 Conclusion

Overall, the supervisors generally agreed about what makes a good MSc dissertation, and unsurprisingly had more knowledge in this regard compared to their supervisees. The interviews with the supervisors regarding what constituted a good dissertation can be summarised as follows:

- It should describe a project that aims at improving the design or performance of a particular system.
- It should contain an implementation of the project in the real world.
- It should address real-life problems relevant to industry, to raise students' chances of finding suitable employment.
- It should address a feasible topic in terms of the available equipment in the institute and the expertise of the supervisors.

In terms of dissertation structure, there was broad agreement that it should consist of five stages: Abstract, Introduction, Theory, Experimental Part and Conclusion. According to the supervisors, this structure was established by the American scholars who ran IEEE in Algeria in 1976. Whether this remained applicable to MSc dissertations submitted to IEEE in 2015 will be explored in the next chapter.

Supervisors and students agreed on the main challenge in writing the MSc dissertation, the writing up of the Experimental part. The supervisors found that their students struggled to simplify and provide a clear version of their Experimental procedure even though they had completed the experiments successfully. Other problems included difficulties linking theory to practice and writing the Conclusion. According to the interview findings, the Algerian MSc Engineering students struggled mainly in the last two stages: The Experimental part and Conclusion. This is an interesting finding because previous studies of Masters' dissertations (Dudley-Evans, 1986; Samraj, 2008), PhD theses (Bunton, 1998, 2002) and RAs (Swales, 1990, 2004; Kanoksilapatham, 2005, 2007, 2011, 2012, 2015) have identified the Introduction as the stage where most writers struggle. Reasons for these differences are discussed further in the next chapter. The next chapter will investigate the macro- and micro-structure of all 179 MSc dissertations in their entirety.

Chapter 5
Structural Analysis of
MSc Dissertations
in ACE and USCE

5. Introduction

This chapter explores the overall structure of the Algerian and American Electrical and Electronic Engineering dissertations. It describes the identification of their communicative purposes, realised in single or multiple chapters referred to in this thesis as stages. This identification is essential to arrive at the overall structure of dissertations in the two corpora (ACE and USCE). This chapter also briefly examines differences in word count between the Algerian and American dissertations to give a general idea of the required length of MSc dissertations in both countries. Although it is true that the word count alone will not reveal anything about the kind of language used, this measure is used in this thesis as a starting point because differences in the length of the Algerian and the American dissertations might be due to the absence or existence of some stages in one corpus and not the other. Unlike Bunton (1998:96) who reported on the size of PhD theses based on their page numbers, in this chapter I report on word count of MSc dissertations, which is a more accurate measure.

This chapter is divided into two sections. The first section reports on the structure of the Algerian dissertations, and the second section reports on the structure of the American dissertations.

5.1 Organisation structure analysis of MSc Dissertations in ACE

Figure 5.1 shows the word count of all dissertations in ACE (counting the Abstract, Introduction, central chapters and Conclusion) across the four disciplines: Power Engineering (PE), Control Engineering (CE), Computer Engineering (OE), and Telecommunication Engineering (TE). Before looking at the length of Algerian dissertations, perhaps it is useful to keep in mind that ACE dissertations are team work projects written by at least two students (as explained in Section 3.3.2), whereas USCE dissertations are projects produced by individual students (see Section 3.3.3).

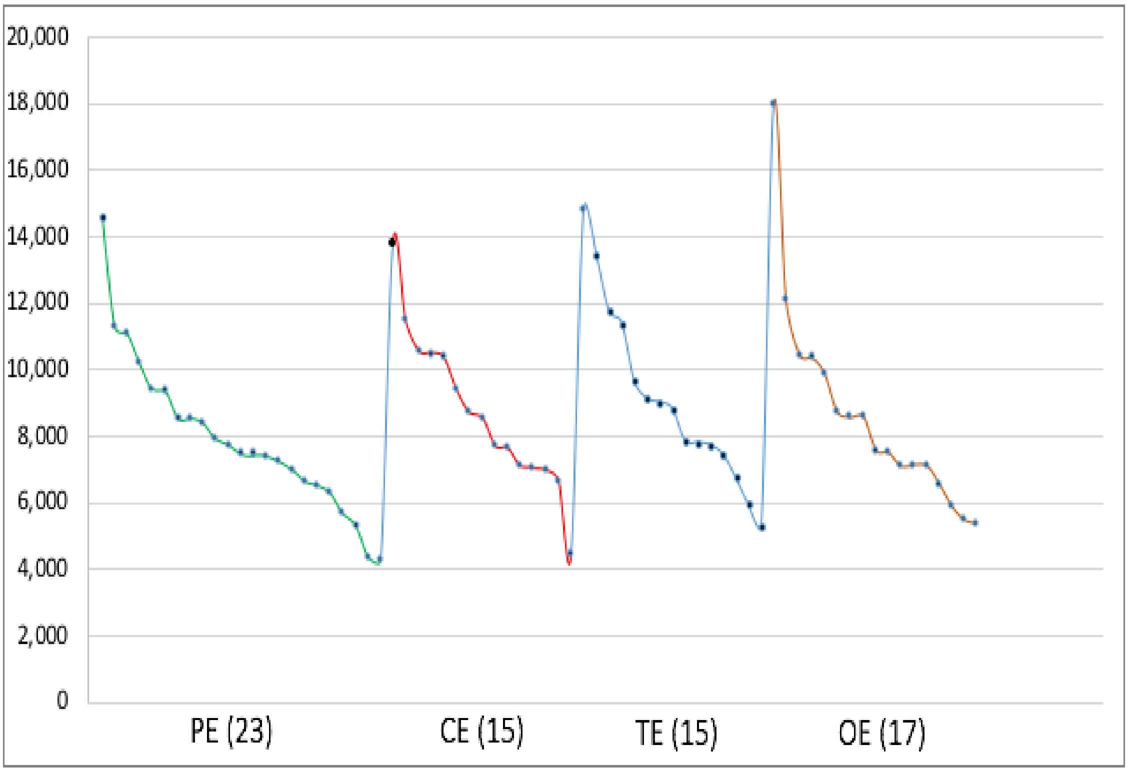


Figure 5.1: Word count distribution of every dissertation in ACE

As shown in Figure 5.1, while there is a wide range of word counts, more than half of all dissertations in every sub-discipline are between 6,000 and 10,000 words in length. In the interviews, the Algerian lecturers stated that they did not set a fixed word count for their students and only advised them not to exceed 40 pages. It is clear that the produced dissertations are longer than this, despite the Algerian lecturers' advice. CE dissertations have the highest average number of pages (52 pages) compared to TE (49 pages), PE (45 pages) and OE (44 pages). The reason for these differences is related to the high use of visual data in CE and TE. The average number of figures in CE is 42 per dissertation, and in TE it is 40. OE and PE have lower average figures of 37 and 36 respectively. Differences in the word count will be presented when analysing each stage.

Differences between the Algerian and the American dissertations might be due to the existence of some stages in one corpus and not the other. The next section will investigate the overall function of each dissertation chapter to arrive at a sense of how the dissertations are divided into multiple rhetorical stages.

5.1.1 Identification of rhetorical stages and their internal structure in ACE

This section explores the rhetorical function of every chapter in ACE. As stated in Section 3.4.2., I identified the most common stages first, the Abstract, Introduction, and Conclusion, and I will describe these before examining the remaining chapters and the rhetorical functions they serve.

5.1.1.1 Abstract stage

In the identification of the Abstract stage, I followed a straightforward approach using the title and the conventional initial location before the first chapter of each dissertation. I also read all abstracts to confirm their rhetorical function.

The Abstract stage is found in all 70 dissertations in ACE. The Abstract stages were of a similar length in TE, PE and CE; half of them were in the range of 100 to 200 words. OE had slightly longer Abstracts, with half ranging from 140 to 240 words, as shown in [8]Figure 5.2. A few dissertations across the four sub-disciplines had very short abstracts ranging from 61 to 100 words. When we compare these findings with those from studies of PhD thesis abstracts (Bunton, 1998:124), we can see that the Algerian dissertation abstracts were only about half the length.

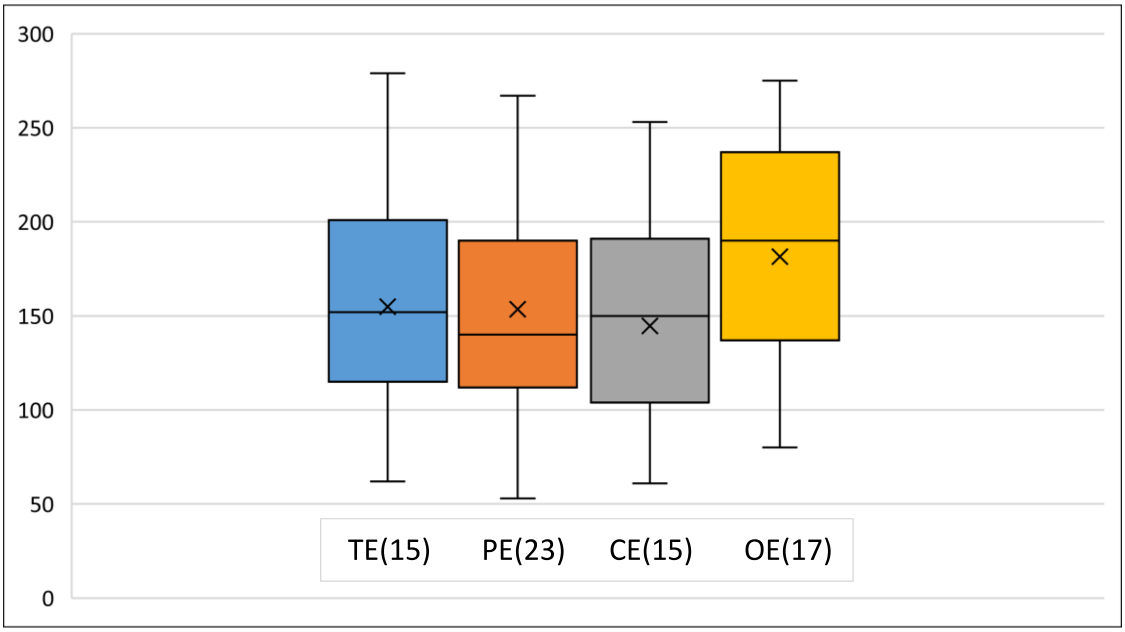


Figure 5.2: Word count distribution of the Abstract stage across the four sub-discipline of ACE

Abstracts are summaries located at the very beginning of a piece of research (Swales, 2004), with the aim of giving a general idea of the kind of research carried out, the methods used, and the main findings. Hyland refers to this pattern in the abstracts of RAs as 'purpose, method, product' (Hyland, 2000:68); this reflects the typical IMRD structure of RAs. However, as shown in Table 5.1,

---

[8] I chose to present my data in a box plot because it gives us an idea about the distribution of abstracts by word length, as each quartile represents 25% of the overall date

the Algerian abstracts only focus on what is to be done (the aim of the project) and how it is achieved (the methods), with an optional evaluation of results at the end. This is in line with the supervisors' opinion of the structure of the abstract 'problem, methods and results', see Section 4.2. This suggests that these MSc dissertations might not have an IMRD structure. Examples of each move and the Abstract it was taken from are presented in Table 5.1.

Table 5.1: Moves and steps in the Abstract stage of ACE

Nº	Move	Example
Example 1 (OE3)	Aim	The aim of this report is to describe the design and the implementation of a Field Programmable Gate Array (FPGA)-Based autonomous obstacle avoidance robot.
	Methods	The rotating sonar system mounted on a servo motor performs the obstacle detection by reading obstacle distances at known angles, with respect to the center of the robot. The digital controller is designed using a heterogeneous computer platform, this platform consists of the System on Programmable Chip (SoPC) that reads data from the sensor, and a custom hardware developed in both Very high-speed integrated circuit Hardware Description Language (VHDL) and Library of Parallel Modules (LPMs). After processing data and taking decisions, the obstacle avoidance task is performed by generating Pulse Width Modulation (PWM) signals to actuate the direction of the wheels. The system is developed using the Altera Quartus II software web edition version 9.1 and realized on a Cyclone-II EP2C35F672 low-cost FPGA platform to verify its feasibility and functionality.
Example 2 (OE1)	Aim	The main purpose of this work is to design and realize a mobile robot tricycle-platform.
	Methods	This robot is controlled remotely through a network by a graphical user interface. The robot sends its position to the graphical user interface for localization purposes. The robot motion is based on differential drive concept.
Example 3 (PE4)	Aim	The steam generator at the Algiers refinery is provided with several regulators, and the targeted objective is maintaining the level of water inside one of its boiler drums at a desired set point in order to reach the maximum point of efficiency and avoid getting droplets of water in the produced steam.
Example 4 (CE3)	Evaluation of results (Optional)	The simulation results show that self-tuning Fuzzy PID controller system achieves real-time precise control of temperature, improves the control performances and has a profound practical significance.

As shown in Table 5.1, the Algerian abstracts were written in the present tense. The aim was an obligatory move identified in all 70 Abstracts. This move was typified by statements such as '*the aim of the/this* common noun *(e.g.: project, report, research) is to X'*, where X is an action verb (e.g.: *design, build, create, teste*). Due to the relationship of Engineering with design the action verb *design* is very common in this pattern. Less typical statements which served the same function were *'the main purpose of this project is to X'* and *'the targeted objective of this research is X'*.

The abstract of PE4 is reproduced in its entirety in Table 5.1. It is only one sentence long, and the sole focus is on the aim, which is to maximise the efficiency of a steam generator at one oil and gas refinery in Algiers. The abstract does not provide any explanation of how this was achieved or whether it was achieved. In the interviews, the lecturers at the Algerian Institute of Electrical and Electronic Engineering (IEEE) explained that they considered the expression of the aim of the research to be a very important part of their students' MSc dissertations.

As discussed in Chapter Two, a large part of Engineering is about bringing about change through design. This relation is made clear in the great majority of the Algerian abstracts, which address real world challenges such as the design of a 'mobile robot', 'remote control of a differential steering robot', or the construction of 'an Android application to help people extracting text from images'. The Algerian abstracts also address real-world problems such as parking in overpopulated cities, improving the performance of antennas, and overheating issues. When the aim is not design-driven it is about testing an artefact or maintaining its performance at a certain level. The aim move in the abstracts is one to two sentences long.

The Methods move was found in 61 of the 70 Algerian Abstracts. The amount of detail in this move depended on the nature and the number of methods involved in the project. Example OE3 in Table 5.1 gives details regarding the software programs used in the project. Passive constructions were used in all 61 Abstracts with the method steps (e.g.: *The digital controller is designed' and 'This robot is controlled').* The active voice is used to describe the actions of inanimate objects – the system performs, the robot sends. So, the focus is not on the human designers, but on the object or system that is designed or tested.

The final move, which I have named 'Evaluation of results', was only found in nine out of the 70 Abstracts. In this move, students highlight the success of the design/project using statements containing abstract nouns with positive connotations, such as 'accuracy' or 'effectiveness', and adjectives to intensify a claim such as 'practical', 'precise' or 'profound'. In example CE3 in Table 5.1, the students claimed that their projects achieved real-time precise control of temperature, improved control performances, and had a profound practical significance.

Thus, the Abstract stage in ACE follows a pattern of two main moves: the aim (100%) and methods (87%), and a third optional move of evaluation of results (13%) in which students make claims about the success of their projects. ACE abstracts do not contain an introductory statement and do not completely map onto Hyland's (2000:68) 'purpose, method, product' model of RA abstracts which largely mimics the IMRD-like structure. The 'Product' is entirely missing from all the Algerian Abstracts probably because it is the part of RAs which summarises the results. The test-and-evaluate loop nature of Engineering generates series of tests which are not regarded as the outcome or the actual product of the study – the outcome of research in Engineering is usually whether a design or a system works or not.

5.1.1.2 Introduction stage

The Introduction stage was found in all 70 dissertations. As shown in Figure 5.3, while there was a wide range of lengths, around 50% of all the introductions from every sub-discipline were between 300 to 1000 words. The shortest introductions were found in CE and the longest were found in TE. One potential reason why the Algerian introductions are of this length may be because the majority of the students were preparing to be practising engineers rather than academics and were therefore preparing to write in the succinct style required of Engineering professionals. The Algerian lecturers confirmed that they advised their students to keep their introductions short and place more emphasis on later sections where they could display the development of their technical skills.

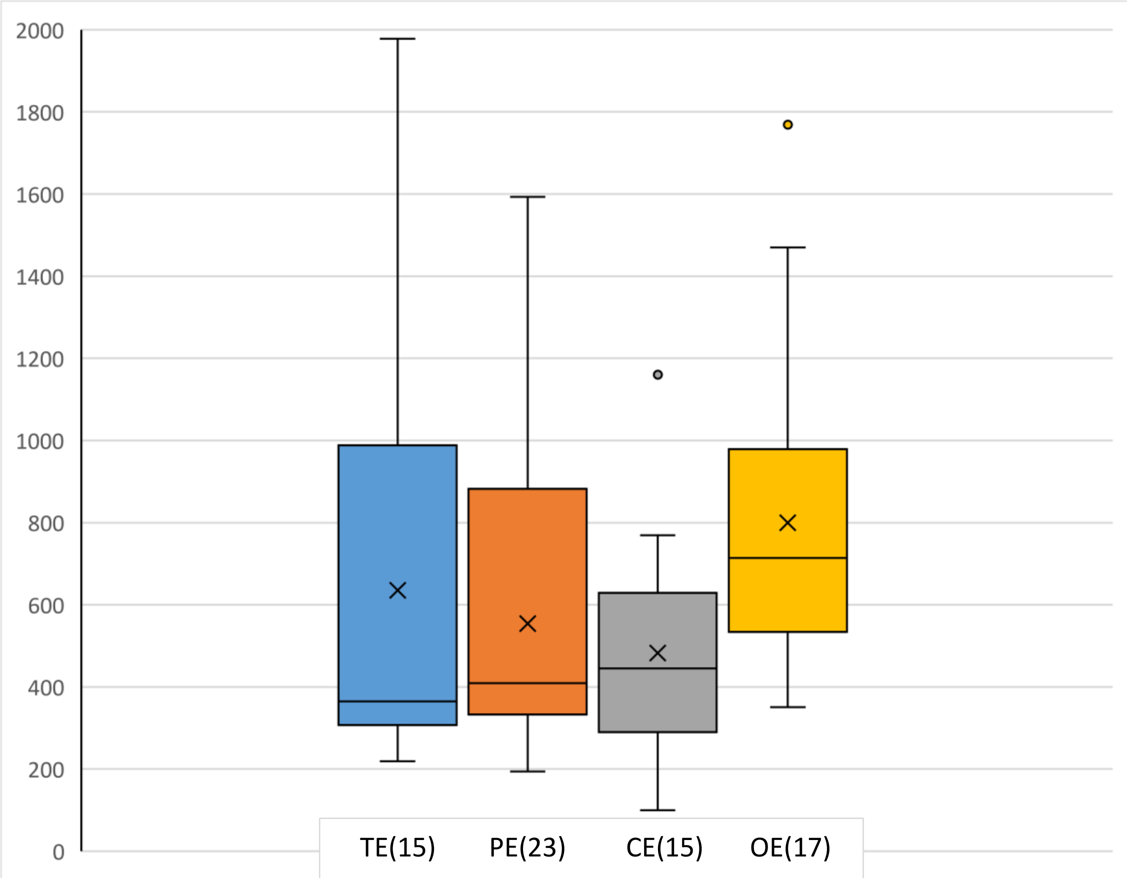


Figure 5.3: Word count distribution of the Introduction stage across the four sub-discipline of ACE

All 70 introductions used the title ‘Introduction’ as the main section header. Of these, 62 ranged between 60 and 800 words and were written in the form of one block paragraph without any other sub-headings. The remaining eight introductions, however, ranged from 971 to 1,819 words and contained clearly labelled sub-sections, perhaps because they were longer and needed to provide more guidance for the readers. The section headings used in the eight longer introductions are shown in Table 5.2.

Table 5.2: Sections headings in the eight introductions with multiple sections in ACE

Section heading	Total
'Overview' (5) / 'Introduction' (2) / 'Quick overview' (1)	8/8
'Literature review' / 'Related work'	2/8
'Problem statement'	2/8
'Motivation'	5/8
'Project objectives'	4/8
'Organisation of the report' (5) / 'Summary' (1)	6/8

For my moves and steps analysis, I read all 70 introductions carefully, taking section headings into account where they were present. It is worth noting that the overwhelming majority (68/70) of the ACE dissertations did not contain a sub-section entitled literature review, which suggests that they did not follow the typical IMRD structure. The two 'Literature review' / 'Related work' sub-sections in the eight introductions shown in Table 5.2 did not review previous research in the way described in RA studies, where "the writer critically shows that there are aspects of the research field that still require further investigation". Instead, the section entitled 'Literature review', contained only one reference, used to support a claim about system popularity: 'most popular systems are UV and IR solid state sensors used alone or in various combinations to combat false alarms [5]' (OE5). The other section entitled 'Related work' contained three references to previous methods that had been used to address a particular issue.

- ‘In [5] the problem is solved using X’,
- ‘In [7] the author solves the problem by X’,
- ‘Among the earliest works, [6] has approached the problem in a similar way as in [5] by X’.

From the examples above, we can deduce that this section entitled ‘Related work’ is a preparation for the next sub-section which will identify the gap to be addressed in the dissertation. This becomes clear in the following line from the same section *‘In some situations this approach may fail to identify that X [6]’*. We also note the use of the Vancouver reference style with numbers to refer to studies instead of author names and years of publication. The Vancouver reference style is usually used in hard applied disciplines that place more emphasis on experimental methods and results than on who conducted the study.

The most common moves and steps of the Algerian Introductions are somewhat similar to those described in Swales’ CARS model (1990, 2004), presented in Section 2.4.1.2. However, I found that the 1990 model was better suited to describe their structure, as the 2004 model does not have the step for ‘Claiming centrality’. The most frequent steps that make up the internal structure of the Algerian Introduction stages are *Claiming centrality, Indicating a gap, Outlining purposes* and *Indicating research structure*. These steps are discussed with examples as shown in Tables 5.3, 5.4, 5.5 and 5.6. In what follows, I will explain the lexico-grammatical features typical of the identified steps, starting with ‘Claiming centrality’.

Claiming centrality

Claiming centrality was identified in 90% of the 70 Introductions, see Table 5.3. In this step, writers raised awareness of the importance of the topic through claiming that interest in it was growing, or that its use was becoming widespread.

Table 5.3: Examples of claiming centrality in the Introduction stage of ACE

Move	Step 1	Examples
M1: Establishing a Territory	Claiming Centrality (63/70)	‘For industrial mobile robots, navigation is essential’ (CE5). ‘Communication is an important part of our daily life. Every day, we are using different types of communication services, such as voice, video, images, and data communication’ (TE15). ‘During the last few decades, there has been a huge increase in energy demand which has accelerated the depletion of world fossil fuel supplies. Thus, the development of suitable isolated power generators by utilizing the renewable sources has become of great importance’ (PE1). ‘Robotics is a field that is becoming widespread; […] Due to the recent technological growth, this field has seen a large beneficiary of these advancements especially in Mobile robotics’ (OE1). ‘In Oil and Gas Industry, centrifugal compressors are widely used. They constitute a main part of process machinery at the topside of oil and gas exploitation’ (CE1). ‘Nowadays vehicles are an important tool in our life’ (CE3). ‘Industrial parameters are considered as critical ones for almost every process in daily life’ (CE4) ‘The microstrip antennas and arrays have been widely used in recent years because of their good characteristics; they are electrically thin, lightweight, low cost, and conformable’ (TE2).

Another lexico-grammatical feature of Claiming Centrality is the use of adjectives and adverbs such as *huge* and *widely* to boost claims (e.g.: 'have been/are *widely* used to/in', and 'has been a *huge* increase in'). Students also expressed this step through reference to rising need or demand e.g. 'In this *increasingly* industrial world, *we need to improve* our production\performance continually', and '*as energy demand continues to increase'*. Another means of claiming centrality was by indicating a continuation from the past to the present (e.g.: *'X have attracted great attention due to…', 'X has always been one of the most important needs of mankind').* The topic for which centrality is claimed can either be a general real-world problem, such as parking spaces in overpopulated cities, or a discipline-specific problem such as improving the preference of '*Multi-band radio frequency (RF)/microwave filters'.*

The most common evaluative adjective is '*important'*, which is used to modify nouns followed by a preposition *in* or *of* (e.g.: 'X *plays an important role in…'* or 'X is an important part of …'). Although the evaluative adjective *'important'* is the most common (occurring in 42 introductions), other the evaluative adjectives were used instead such as *'crucial, major, significant, vital'.*

A summary of some of the lexico-grammatical features that help in highlighting the importance of the topic and students' interest in a particular research project are shown in Figure 5.4.

There has	+	*<u>been a huge increase in</u> …*
X have	+	<u>been widely used</u> in …
X	+	*<u>attracted great attention</u>* due to … / and is …
	+	*<u>limited</u> because …*
X are/is	+	*<u>considered</u> as critical for …*
	+	*<u>widely used</u> to/in …*
X play(s)	+	*<u>an important</u> role in/part of*
The *<u>need for X is</u>*	+	in the rise / rising + due to …
Dependent Clause	+	Independent Clause
(e.g.: As X *<u>demand</u> continues to increase,)*	+	*(e.g.:* we *<u>need</u>* to + *improve, enhance, develop)*

Figure 5.4: Summary of the frequent lexico-grammatical features expressing claiming centrality

Indicating a gap

This step is found in 83% of the 70 Introductions in the Algerian Engineering dissertations. According to the IEEE lecturers interviewed for this study, the majority of IEEE students work on topics suggested by their supervisors, addressing real-word problems. This confirms the participants' attitudes towards what makes a good MSc dissertation, as discussed in Chapter Four, Section 4.1. Some examples of real-world problems and the language used to convey the step of *indicating a gap* across the four sub-disciplines of ACE are presented in Table 5.4.

Table 5.4: Examples of indicating a gap in the Introduction stage of ACE

Move 2	Step 2	Examples
Establishing a Niche	Indicating a Gap (58/70)	'However, the electrical performance of the basic microstrip antenna or array suffers from a number of serious drawbacks, including narrow bandwidth, high feed network losses, high cross polarization, and low

		power handling capacity' (TE2). 'The main problem with commercial manipulators solutions is that they require (or come with) proprietary (Black-Box) and expensive Control hardware (modules) and programming environments (CE09). 'Even though many control algorithms were discovered, tested and simulated, these simulations do not reflect the actual behavior of the real system' (PE13). 'The modern grid, however, is not designed for modern electrical loads, distributed energy sources, or optimal efficiency' (PE3).

This step is marked by the noticeable use of contrastive connectors (e.g.: *however*, *despite*, *although*, *but*, and *yet*). An example of this is *'Different types of voltage regulators can be employed. However, they are quite expensive and quite complex' (PE1).* '*However'* occurs in this step in 50 of the introductions. We can see from this example that the students are using *however* to mark a contrast between the point made in the previous sentence with the point made in the next sentence. In other words, the two sentences can be rewritten as *although 'different types of voltage regulators can be employed', they remain quite expensive and out of research for the scope of this project, which means they cannot be employed in this case.* We also note the use of words with negative meaning (e.g.: *complex, expensive, poor*) and intensifiers (e.g.: *quite, very, extremely*).

Contrast was also expressed through the use of *although* and *despite* (e.g.: '*Despite* advancement in X, Y efficiency *still remains poor and system cost is very high',* '*although* X attracted the attention of many Z, *many of them* *do not focus on …*’). ‘*But’* was also a popular contrastive connector used in 25 introductions to indicate the gap (e.g.: ‘*These methods do not contribute to any boost in the achievable data rates, but rather make the communications link more robust’,* TE14). In example TE14, the project was about boosting *‘achievable data rates’* and was not about making a robust communications link

Another feature used to indicate the gap is negation. This can be achieved through the use of quantification devices such as *little, no, few;* as in *‘a battery holds relatively little power which limits the running time of a given robot’* (CE06). It can also be achieved through the use of verbs (e.g. *fail, lack, restrict, limit*). An example from this category is *‘The efficiency of a solar cell is limited by …’, This approach may fail to identify …’.* The most common type of negation to indicate a gap is the use of simple negation *‘not’*, often following a modal verb, *(e.g.: ‘X are extremely effective at Z, but they generally cannot provide Y’, ‘Priori knowledge of X may not always be available’, ‘This means that X will not be very accurate and will be susceptible to disturbances’, ‘X* cannot *operate properly in cold regions’, ‘X is not convenient in harsh environments’).* Figure 5.5 provides a summary of the pattern that expresses indicating a gap using the negation ‘not’.

X +	is/are	+	not	+ evaluative adjective (*e.g.: convenient*) + in				
	modal verbs (*e.g.: may/can*)	+	not	+	be	+ amplifier (*e.g.: very*)	+	evaluative adjective (*e.g.: accurate, susceptible, Efficient, economical, safe*)

Figure 5.5: Summary of the pattern that expresses indicating a gap through ‘not’

By using the lexico-grammatical features shown above, the engineers are trying to identify an unsatisfactory situation in the real world. The Algerian introductions do not critically review the literature to identify a gap in the prior research, as is a common practice in pure disciplines. Overall, reference to the literature in the introduction stage is very limited and only used to briefly mention previous techniques (e.g.: *'Hybrid systems combining the two previous mentioned tracking methods are also reported in literature [5]'* - OE13). In the Algerian dissertations, the next step after identifying the gap is to explain the purpose of the research or 'Outline purposes' Swales (1990).

Outlining purposes

The '*Outlining purposes'* step belongs to *'Move 3: Occupying the niche'* in Swales' CARS model and is the only move where two steps were identified in the Algerian introductions.

Outlining purposes was identified in 86% of the 70 Introductions. While the previously discussed steps provide a context for their work, in this step students identify their own work. Some examples of this step are shown in Table 5.5.

Table 5.5: Examples of outlining purposes in the Introduction stage of ACE

Move 3	Step 3	Examples
Occupying the Niche	Outlining Purposes (60/70)	'Our goal is to design a robot manipulator system and demonstrate an easy to use graphical task programming interface' (CE09). The aim of our project is to design a suitable PLC based control system for a machine that includes a punching press and a conveyor system, which can achieve these three

		steps. (CE13) The goal of this paper is to explain the building process of LabVIEW model for distance relay. (PE22) The main goal of this work is to design, analyze and optimize compact microstrip tri-band BPFs for modern wireless communication systems. (TE05)

As shown in Table 5.5, students in this step explicitly state the objectives of their study. A common pattern is '*the X of this Y is to Z'.* The subject of the clause, X, is a cognitive noun (e.g. '*purpose, aim, goal, objective')* and Y refers to the dissertation task (e.g. '*project, paper, work, thesis'). Z* can be any action verb which in one way or another is related to construction or design (e.g.: *design, build, achieve, create, detect, control).* Due to the nature of Engineering and its relationship with design, the word *'design'* is dominant in this step. This step is also marked by the use of deictic references to the text (both the determiner *'the'* and demonstrative adjective *'this'*).

A summary of the common lexico-grammatical features and patterns identified in this step is shown in Figure 5.6.

The	+	cognitive noun (e.g.: *purpose, aim, goal, objective'*)	+	of this	+	academic genre nouns (e.g.: 'project, report, study, *thesis/dissertation*)	+ is to +	action verb *(e.g.: design, build* create, test)
This	+	academic genre nouns (e.g.: '*project,* report, *study, thesis/dissertation*)	+	promissory verbs (*e.g.: tends, aims*, *attempts, will*)	+	to	+	action verb *(e.g.: design, build create, test*)

Figure 5.6: Summary of the frequent lexico-grammatical features expressing outlining purposes.

Indicating research structure

Indicating research structure is the last step identified in the Algerian introductions. It tells the readers what to expect in the dissertation and where to find specific information. This step is identified in 77% of the Introductions. A typical example of this step is shown in Table 5.6 and a breakdown of the lexico-grammatical features that make this step is shown in Figure 5.7.

Table 5.6: Examples of indicating research structure in the Introduction stage of ACE

Move 3	Step 3	Examples
Occupying the Niche	Indicating research Structure (54/70)	'<u>This report includes three main chapters and it is organized as follows</u>: - '<u>Chapter one presents the</u> general theory about microstrip patch antennas …' - '<u>Chapter two deals with the</u> analysis and design of a rectangular microstrip patch antenna.' - '<u>In chapter three</u>, M and N shaped defects and size reduction have been successively performed on the former rectangular microstrip patch antenna to obtain a new reduced size structure'. - '<u>Finally, a general conclusion is presented at the end of the report</u>'.

As shown in Table 5.6, in this step students explicitly state the organisational structure of their dissertation. A common structure used to convey this step can be summed up in the pattern *'this X is Y'* or *'the Y of this X* is *as follows';* with X being any of the following research genre nouns *'report, study, thesis, work, project, research'* and Y being any of the following structure-related verbs/nouns '*organized/organization, divided/structure, outlined/outline*'. The pattern can also be preceded by a preposition *in* which necessitates the use of the deictic elements '*this/the*' followed by a brief explanation of the content of each chapter (e.g.: '*In this report, chapter one will…*').

Another lexico-grammatical feature that marks this step is the use of sequential connectors (e.g. *chapter one, two, three, and first/ly, second/ly third/ly*) which allow students to explain the structure of their research and the content of each chapter of their dissertation. A summary of the common lexico-grammatical features and patterns identified in this step is shown in Figure 5.7.

This + academic genre nouns + is + past participle + as follows:
(e.g.: project, report, study, thesis/dissertation)
(e.g.: organized, divided, structured)

The + nouns/nominalisation + of this + academic genre nouns + is *+ as follows:*
(e.g.: organization, structure, outline)
(e.g.: project, report, study, thesis/dissertation)

Followed by sequencing connectors:

Sequential connectors (e.g.: the first, Firstly) or Chapters (e.g.: ch1,2,3) + reporting verb + X
(e.g.: introduces, presents, highlights shows, covers)

Figure 5.7: Summary of the frequent lexico-grammatical features expressing outlining purposes.

Overall, the most common steps in the Introductions of the Algerian MSc dissertations are *Claiming centrality* (90%), *Indicating a real-world gap* (83%), *Outlining purposes/objectives* (86%) and *Indicating research structure* (77%). The next section will present the analysis of the Conclusion stage in the Algerian dissertations.

5.1.1.3 Conclusion stage

The Conclusion stage was identified in all 70 MSc dissertations as a single chapter entitled 'Conclusion'. In order to identify the Conclusion stage, I read the final chapters of all the dissertations to identify the lexico-grammatical features that realized this stage, keeping in mind the generally accepted view that the main aim of the conclusion in PhD theses and Masters dissertations is to restate what has been done in the research and explain its significance (Paltridge and Starfield, 2007:154). The conclusions in ACE varied in size with an overall range of 100 to 723 words, as shown in Figure 5.8.

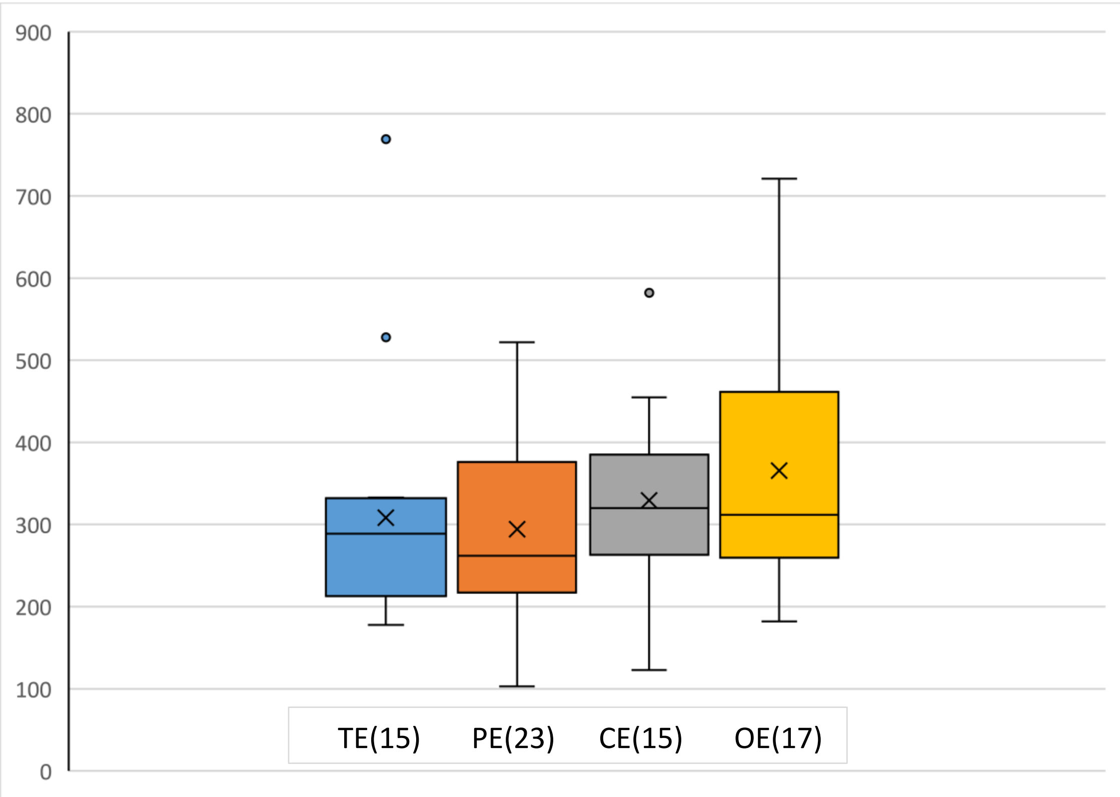


Figure 5.8: Word count distribution of the Conclusion stage across the four sub-discipline of ACE

Although the conclusions ranged in length from 116 to 723 words, around 50% were between 200 and 450 words (one page). None of these conclusions contained multiple sections. Conclusions of dissertations and theses in the hard, applied and none-life disciplines are usually shorter than conclusions of dissertations and theses in the soft and pure disciplines. For example, Bunton (1998:191) found that conclusions of PhD theses in Science and Technology were five times shorter than those in Health and Social Sciences. A possible reason for this might be because findings can be proved conclusively in the hard disciplines, through quantification, whereas in the soft disciplines, findings are open to interpretation and writers have to present arguments to support their conclusions. This disciplinary difference not only affects the length, but also the internal structure of the conclusion chapter.

A summary of the internal structure of the 70 conclusions in ACE is shown in Table 5.7.

Table 5.7: Steps in the Conclusion stage in ACE

Steps	%
Restatement of the work carried out	100
Restatement of the methods	100
Evaluation of main findings	100
Practical implications	41
Limitations	38
Future research	21

Bunton (1998, 2002) and Samraj (2008) placed the first two steps shown in Table 5.7 in Move 1: ‘Introductory restatement’, and the third step in Move 2 ‘Consolidation of present research’. In Table 5.7 the structure is described at the step level only and the steps are not grouped into moves, so that my findings can be compared with those of previous studies.

As shown in Table 5.7, the steps that occurred in all 70 Conclusion stages were: ‘Restatement of the work carried out’, ‘Restatement of the methods’, and ‘Evaluation of the findings’. The remaining three steps were not identified in all conclusions and varied from one conclusion to the other. This means that the first three steps are obligatory steps in the conclusions of Algerian MSc dissertations.

In the ‘Restatement of the work carried out’ step, also identified by Bunton (1998, 2002), students briefly restated the aim of the research, for example as follows: ‘<u>*this project was designed to*</u> *detect fire sources, aim at the flames position and extinguish them’* (OE05). The step is a restatement of the *Outlining purposes* step in the introduction, also known as *Announcing present research* in Swales (2004). In this step the tense usually changed from the present tense, dominating the previous steps, to the past tense. The most common lexico-grammatical pattern to starts this step was *‘In this X, we Y’,* where X is a common noun referring to the dissertation task (e.g. *project, work, research, thesis)* and Y is a past tense action verb (e.g. *tried, presented, explored, designed, tested, studied*). Alternatively, this step could start with deictic references *‘the/this’* and present perfect, as in the following pattern: ‘*the current / this report has presented and discussed the design of the …’.*

The second step, ‘Restatement of the methods’ has also been identified in previous studies of PhD thesis conclusions (Bunton, 1998, 2002; Samraj, 2008). In this step, students restated the methods used in the research. Thus, this step was marked by references to the software programs used. For example: ’In this project, we used X (e.g. LABVIEW, MatLab, Power System Protection, HSS control) and/or Y (e.g. Kinect sensor, DC motor) + To verb (e.g.: to test) / preposition + nominalisation (e.g. for image processing). An example of this step is *'In this project, we used MatLab for image processing and a PIC microcontroller to drive stepper motors, aim at the targeted flames with a water cannon and shoot them until extinction' (OE05).* The length of this step depended on the nature of the project. In projects that involved multiple research methods and hardware, this step was repeated for every method and component

In the third step, 'Evaluation of the study/findings', the Algerian students commented on how successful they were in their project. Some examples of this step are '*We finally succeeded and got the desired results*. *Errors were insignificant with regard to the loss of precision'* (OE05), and *'Different tests were carried out, and the parking system operated according the designed control strategy'* (CE3). This step was marked by perfect aspect, which refers to actions or circumstances occurred earlier than the time under consideration (e.g.: *'we have succeeded, confirmed, obtained, reached').* Alternatively, the writers did not self-refer, but used the passive with anticipatory it and a that-clause (e.g. *'It was confirmed that PLC could be integrated with').* This step was also marked by the use of evaluative adjectives such as *'the desired' or 'the required'* followed by an abstract noun such as '*results, structure, number, pattern, specifications, target, value'.* This step was always expressed in positive terms. Students did not say that they had failed to meet their objectives, although they might acknowledge some limitations which would be discussed separately. It is worth noting that the positive language used in this step is the opposite of that used to indicate a gap in the Introduction stage discussed in Section 5.1.2.

This step was also marked by the use of the adverb *successfully* which occurred in 25 conclusions in the following pattern *'X was successfully* + action verb (e.g. completed, designed, fulfilled, implemented, produced, obtained). Through these examples we see that the focus of these students was on proving that their design procedure was fit for purpose. The step did not include any restatement of the methods, and ended after stating that the aims of the project had been achieved. It seems that the students did not devote much space to discussing the findings or attempting to convince the reader of the significance of the findings.

The fourth step, 'Practical implications', was found in 29/70 conclusions, see Table 5.7. It was considered as a move in its own right by Bunton (1998, 2005), see Section 2.4.2, but in the Algerian dissertations it was often no longer than one sentence. In this step, students stated the possible impact of the designed product in the real world. An example of typical language used to state impact was as follows *'Such dual frequency structure finds wide applications area in personal mobile handsets combining GSM and Bluetooth' (TE02).* The underlined part of the example *'finds wide application area in'* expresses the practical implication of the project, especially the use of the intensifier '*wide',* highlighting the importance of the research.

Students also showed the implications of their research in relation to their learning outcome, for example '*we have learned a certified practical way of testing the various protective devices in our country'* (PE14). The use of *'we'* here does not refer to the whole Engineering community but it is exclusive to the speaker (i.e.: the students). Mentioning the study's contribution to the field is a more 'academic' approach – professional engineers focus more on making the design work, but academics want to establish new theoretical knowledge. This step, however, appears in only 29 conclusions and the majority of students jump directly to *Limitations* and/or *Recommendations for future research*.

The 'Limitation' of the study was found in 19/70 dissertations, either as a final step or before *Recommendations for future research*. In this step contrastive connectors (e.g. *however, despite, but, yet*) were often used to downplay the limitations of their project. Some examples that show this concession/claim pattern are *'Although the robot did not exert human like motion, it is considered as a good building block for further work'* (OE8), *'we did not use X, but we successfully designed Y using …'* (OE1).

I also noticed that sometimes students attempted to present the limitation in a positive manner. For example, *'The disadvantage of our design is using X which is slow compared to Y. Although it is difficult to implement, Y ensures a higher speed transfer rate to Z'* (OE11). In this way the students could express their awareness of existing better options, but at the same time t make it clear that these were '*difficult to implement'*, which meant that they would have needed more time (and possible resources) to implement them. One writer made this explicit: *'We think that if we had more time we could have troubleshoot the design successfully*' (OE11). This is known as 'positive spin'. Overall, students did not elaborate on this step, which was no longer than two sentences in any of the 19 conclusions.

The last step identified in ACE conclusions was *'Recommendation for future research'*. This step was marked by the general use of the following phrase '*For future + task-related noun (e.g.: research, work, study, project), we …*' in the initial position of the sentence. An example of this pattern is *'For future* *work, we expect developing the fire detection algorithm to be able to distinguish between different fire classes and shoot with the most suitable extinguishing agent to manage all fire threats' (OE05).* Less common is the pattern *'Other improvement such as X could be added to Y',* or *Y can be further accomplished' (OE9).* The *Recommendation for future research* is the least frequent step in the Algerian dissertations, occurring only in 15/70 conclusions. This could be because the ACE writers were more oriented towards employment than towards further research.

So far, I presented the internal structure of three stages commonly described with reference to MSc dissertations, PhD theses and Research Articles. Even at this level of analysis we can see that the Algerian dissertations do not follow the conventional IMRD structure of RAs. This will also be confirmed in the analysis of the remaining chapters presented next.

5.1.1.4 Theory Stage

In this and next section, I will present and discuss the results of the structural analysis of the remaining chapters in ACE. As speculated from the analysis of the previous stages, they do not fit the conventional IMRD structure because they do not include a chapter or a section that critically reviews the literature, as show in Section 5.1.2. Instead, what makes the Algerian dissertations distinctive is that they include stages known as *Theory* and *System Design* which are typical of the Design Specification genre identified by Nesi and Gardner (2012) in students' assignments. The Theory and the System Design stages did not receive much attention in the studies reviewed in Chapter Two. The reason for this is probably because the majority of these studies focussed on texts that followed the IMRD structure, on the basis that this is thought to be the most typical structure of dissertations, theses and RAs.

The Theory stage was found in all 70 dissertations in ACE, immediately following the Introduction chapter. As shown in Figure 5.9, the wordcount of the Theory stage varied across the four sub-disciplines. The average length in OE (3,144 words) and CE (3,166 words) was much less than in PE (4,068 words) and TE (4,729 words). As the length of Theory stages is not reported in the prior literature, these figures cannot be discussed with reference to other studies. However, they can be compared with those for the Theory stages identified in USCE, see Section 5.2.1.3.

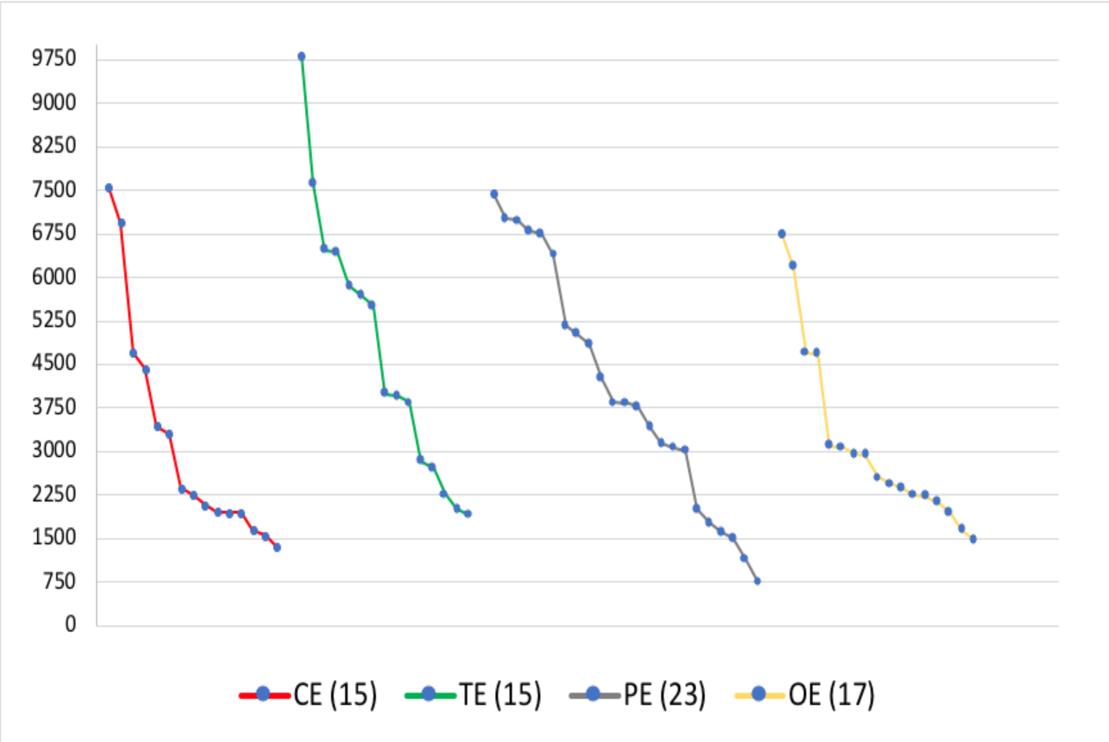


Figure 5.9: Word count distribution of Theory stage across ACE four sub-disciplines

It is worth noting that ACE chapters entitled *'Background'* and *'Literature Review'* were considered to form part of the Theory stage. The titles given to these chapters was misleading as they did not reflect the true function of the chapters. The use of these chapter headings might reflect either the influence of RAs on MSc dissertation writing, and/or a lack of awareness of the function of these chapters.

When I read the main chapters of ACE located between the Introduction and the Conclusion Stage, I found that students took up to three chapters to cover the Theory stage. Figure 5.10 shows the percentage of dissertations using one, two or three chapters to present the Theory.

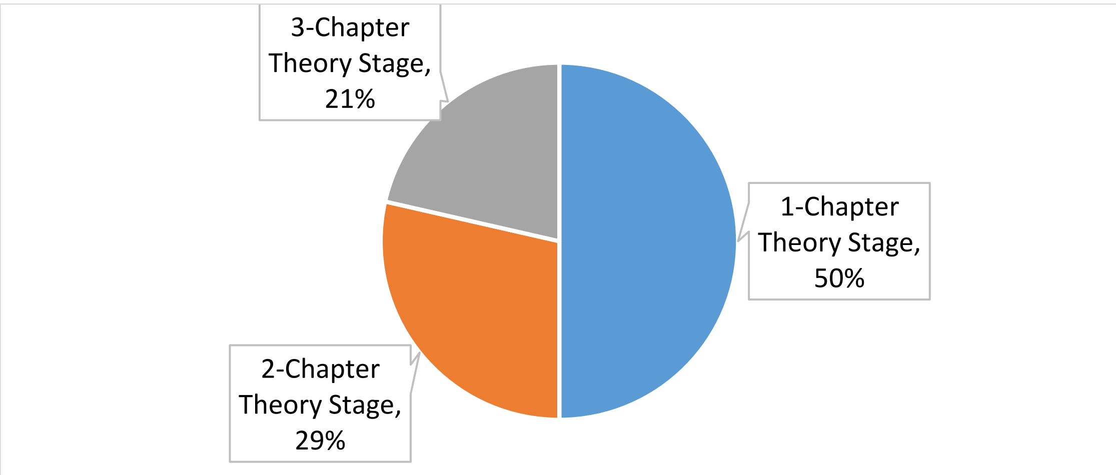


Figure 5.10: Number of chapters that have been classified as Theory stage

As shown in Figure 5.10, half of the dissertations in ACE presented the Theory in one chapter; this was particularly the case in CE and OE dissertations. TE and PE dissertations were more likely to present the Theory in more than one chapter. It is worth noting from Figure 5.1 that the average length of dissertations in TE (4,729 words) and PE (4,729 words) was higher than those of CE (3,166 words) and OE (3,144 words). This might be related to the fact that TE and PE had longer Theory stages.

Although there is not a direct relationship with the number of chapters and the word count, spreading the theory across multiple chapters suggested that the students had different Theory-related points that had to be covered separately. This might mean that PE and TE students focus more on expressing their awareness of Theory compared to OE and CE students. Possible reasons for these differences will be discussed after the analysis of the System Design stage in Section 5.1.1.5.

A key feature that differentiated the Theory stage from the Abstract, Introduction and Conclusion stages in the ACE dissertations is that it was written using ‘expert to expert’ technical language typical of Science and Technology disciplines (also noted by Thompson, 2001:170). An example of ‘expert to expert’ communication is presented in Figure 5.11.

$E_1 = \hat{a}_\theta j\eta \; lkI_0 e^{-jkr} \{ e^{+j \frac{1}{2}[kdcos\theta+\beta]} \} \cos\theta \; 4\pi r$

$E_2 = \hat{a}_\theta j\eta \; lkI_0 e^{-jkr} \{ e^{-j \frac{1}{2}[kdcos\theta+\beta]} \} \cos\theta \; 4\pi r$

The total electric field is $E_t = E_1 + E_2$ and is given by: $lkI_0 \, e^{-jkr} \; +j^1 [kdcos\theta+\beta]$

$-j^1 [kdcos\theta+\beta]$

$E_t = E_1 + E_2 = \hat{a}_\theta j\eta \; 4\pi r \; \{e2 + e2$

$= \hat{a}_\theta j \, \eta \; lkI_0 e^{-jkr} \cos\theta \, \{2cos\, [^1 \, (kd\, cos\theta + \beta)]\} \, 4\pi r \, 2$

It is apparent from (I.12) that the total field of the array is equal to the field of a single element positioned at the origin multiplied by a factor which is widely referred to as the array factor. Thus, for the two-element array of constant amplitude, the array factor is given by:

$AF = 2cos\, [\frac{1}{2}(kd\, cos\theta + \beta)]$ (1.13)

So: E (total) = [E (single element at reference point)] × [array factor]

This is referred to as pattern multiplication for arrays of identical elements [1].

Figure 5.11: Example of expert to expert language of the Theory stage.

In fact, the Theory stage was marked by heavy use of mathematical language and equations, interspersed with only brief explanations. The function of the Theory stage is to provide information regarding ‘the purpose of the system [or device] and its basic design rather than referring to methodological issues’ (Nesi and Gardner, 2012:185). In fact, in the Electrical and Electronic Engineering field, it is very important to first explain the main components of an artefact as well as its working principle before moving to the design process.

Overall, the aim of a Theory stage was to familiarise the reader with essential technical knowledge. Chapters representing the Theory in ACE typically started with *‘We are going to introduce X’,* where X was a list of components (e.g. *programmable logic controller)* and other abstract points *(e.g. its general function, hardware form and the programming languages used to program it’, CE3)*. The entire Theory stage ended with a statement of the aim of the project, which almost always involved designing and implementing a combination of software and hardware, as in the following example: *‘In this Project we are going to design and implement a multilevel circulation type car parking system Using Siemens S7 300 PLC as a controller, SIMATIC Step7 as a software development tool and SIMATIC Wincc as an HMI development software’.* Unlike dissertations with the IMRD structure discussed in Chapter Two, ACE dissertations did not list research questions; this statement of purpose was used instead.

Whereas Methodology stages made use of sequential connectors (e.g. the first, second, third …) to indicate steps in the design process, the Theory stage used these connectors refer to sequences of information within the text such as *‘the first equation is…’, ‘the first half cycle is known as …’, ‘the second* *class, case, type, method'.* The Theory stage made almost no use of the adverb form of these sequential connectors (i.e.: firstly, secondly, thirdly …) which were typical of the Methodology stage where the information was reported chronologically. Instead, they used numbers when explaining the working principle of different component of an artefact, as shown in Figure 5.12.

Figure 5.12: Example of expert to expert language of the Theory stage (ACE-CE10).

Another characteristic of the Theory stage is lists of research-related devices, or analytical techniques, marked by devices such as bullet points and sub-sections. The reason for this is because this stage can cover multiple sub-components of machinery, or multiple approaches. An example of this is a sequence of three 'optimization techniques' with detailed descriptions of every technique (TE7). Other information presented in list form includes different types of defects, coding techniques, classifications of filters, terms and their definitions, and advantages and disadvantages of different techniques.

As shown in Figure 5.12, students write the Theory stage to show their examiners that they are familiar with the hardware and its working principle. This was the type of information the writer of this excerpt considered to be essential before going on to discuss work on the design of a centrifugal compressor in the next stage. In this excerpt the writer explained the working principle of a ‘centrifugal compressor’ using the simple present tense and without any reference to the research conducted for the dissertation. We also notice that chronological sequence is marked using numerals except of the word *‘finally’* at the end of the process. The students distanced themselves from this process because this was not a recount of what they had done but merely a statement of it’s the working principle. In other words, it demonstrates discipline- and topic-related knowledge which is a typical feature of the Theory stage.

The Theory stage contained a large amount of visual information (*equations, tables and figures*) compared to the previously discussed three stages (Abstract, Introduction, and Conclusion), which have none. Due to the nature of the field, Engineering students are obliged to include many visual data to demonstrate their detailed understanding of the Theory part of their work. For example, the Algerian students provided pictures and diagrams of individual components as part of a larger device to give a better picture of the machinery to be studied. An example of this is the ‘impeller and diffuser’ which are key parts of a centrifugal compressor, as shown in Figure 5.13.

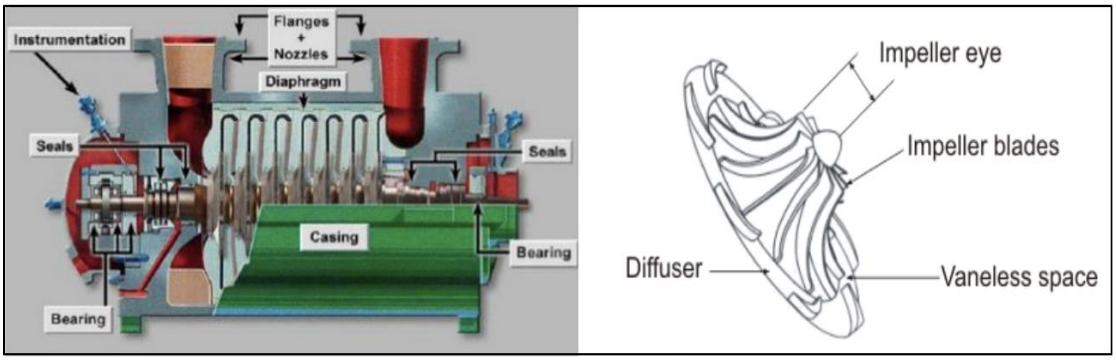


Figure 5.13: Centrifugal compressor, and impeller and diffuser

The type of information shown in Figure 5.13 was always coupled with an explanation of these devices in patterns such as *'The impeller consists mainly of …, and the diffuser consists of a'* (CE10).

In the next section, I will discuss the System design stage.

5.1.1.5 System Design stage

The System Design stage was found in all 70 dissertations across one or multiple chapters. I included in the System Design stage all the remaining chapters excluding the conclusion. As stated in Section 5.1.1.4, ACE dissertations do not contain a stand-alone Methodology Stage because it is difficult to separate the methods from the testing and retesting, given the cyclical nature of Engineering. Instead, the System Design stage explains the process of designing the system and/or mechanism and shows how the system or mechanism was tested and implemented under real-life conditions. The stage can be broken down into the cyclical Moves of *design, simulation and implementation*. Figure 5.14 shows the number of words in this stage in dissertations across the four ACE sub-disciplines. One dissertation in TE did not include any System Design chapters. This seems to be a mistake made by the student, perhaps due to problems at the submission stage. Therefore, TE in Figure 5.14 shows only 14 System Design stages.

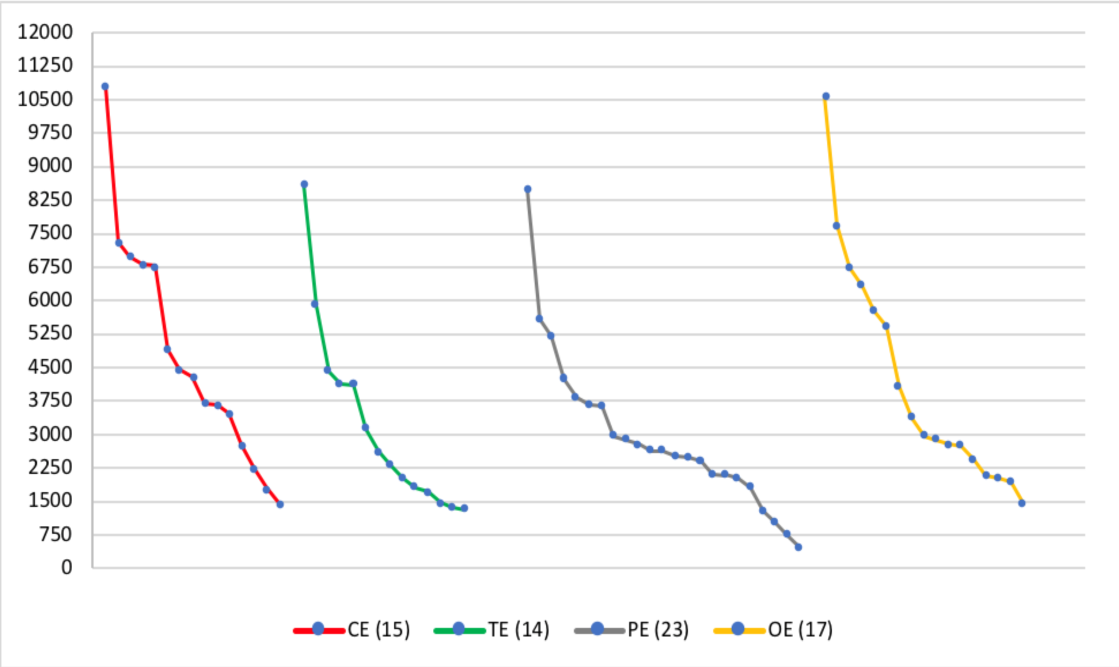


Figure 5.14: Word count distribution of the System Design stage across ACE four sub-disciplines

The average word length of the System Design stage in CE (4,761 words) and OE (4,192 words) is greater than in TE (3,211 words) and PE (2,934 words). This shows that CE and OE write longer system design stages compared to PE and TE students. Like the Theory stage, the System Design stage was identified in single or multiple chapters. In the case of OE dissertations, the System Design stage was realised in two separate chapters before the general conclusion ('Chapter 3: Hardware system design' and 'Chapter 4: Software system design'). The sum of both chapters represented the design, simulation and implementation of the study. This point is illustrated in Figure 5.15 which shows the table of contents for the two System Design stage chapters within one dissertation.

Chapter III: Hardware System Design
Introduction
Universal Asynchronous Receiver/Transmitter UART
The Pulse Width Modulation (PWM)
Description of The System
  Arduino Mega and GPS (Pmod GPS)
  Arduino Mega and Wi-Fi module (ESP8266)
  Arduino Mega and DC Motors
The Overall System Design
Chapter IV: Software System Design
Programming Language and Environment
  Arduino Programming Languages
  Visual C# (C Sharp) Programming Language
  Arduino Interface Development Environment
  Microsoft Visual Studio Express 2013
Mapping
  Google Maps JavaScript API v3
Arduino Programming Development
  PmodGPS
  Wi-Fi Module ESP8266
  Control DC Motors (Move Robot)
  Arduino Overall Program
Visual C# (C Sharp) Programming Development
  Set PC as Client
  PC Robot Control
  Client Parsing GPS Data
  PC Overall Program
Final GUI

Figure 5.15: Table of contents of a two-chapter System Design stage (OE01)

The spread of the number of chapters that were identified as expressing the System Design stage in ACE is shown in Figure 5.16.

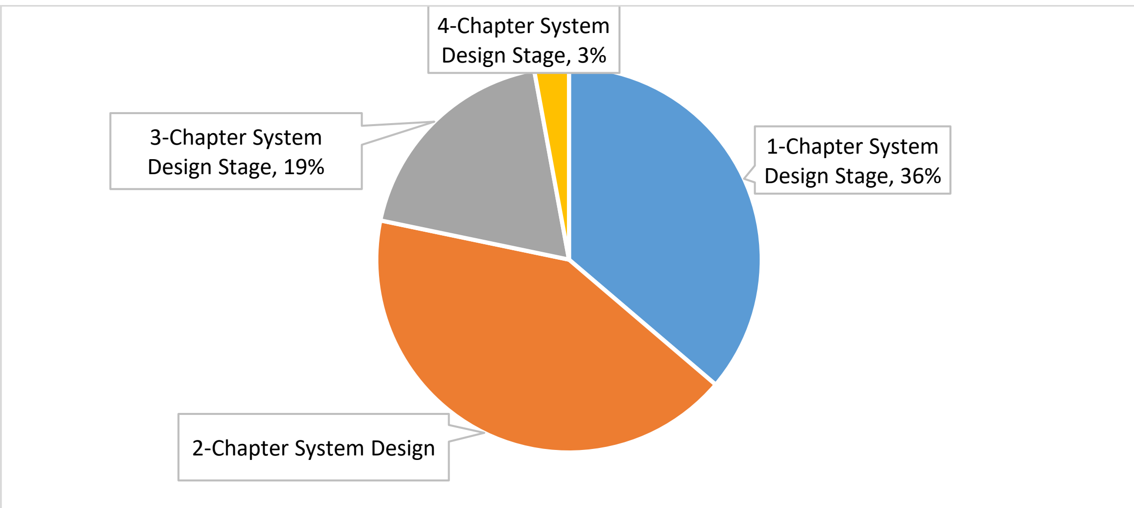


Figure 5.16: Number of chapters classified as System Design in ACE

As shown in Figure 5.16, 64% of dissertations presented the System Design stage in multiple chapters, the 2-chapter system being the most common (42%). To understand why 50% of the Theory stages were presented in one chapter and 42% of the System Design stages were presented in two chapters, a summary of chapter distribution across the four sub-disciplines is presented in Figure 5.17.

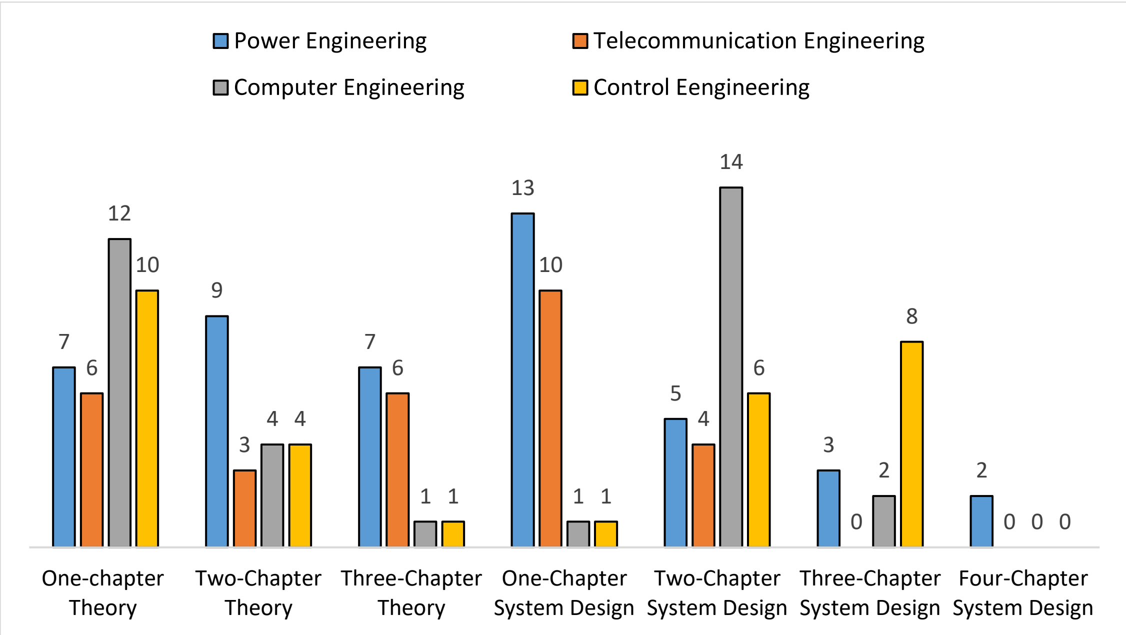


Figure 5.17: Distribution of Theory and System Design stages by number of chapters in ACE

There seems to be a relationship between the length and number of chapters expressing the Theory and System Design stages in ACE. PE and TE students wrote longer Theory stages spread over multiple chapters, whereas OE and CE students wrote longer System Design stages spread over multiple chapters. The average length of the Theory stage was 3,144 words in OE, 3,166 words in CE, 4,068 words in PE and 4,729 words in TE. A summary of the average word length of the System Design stage was 4,761 words in CE, 4,192 words in OE, 3,211 words in TE and 2,934 words in PE.

A possible reason why CE and TE wrote more single-chapter Theory stages than PE and TE might be related to the nature of the projects in these disciplines. Differences in the number of chapters at each stage was due to the number of techniques and/or various components involved in the research. The Theory stage was mostly presented in one chapter in CE and OE because research in these disciplines involves focusing on small software-driven projects. Overall, these disciplines seem to follow a software-driven approach, and some CE and OE research topics simply did not offer the possibility of field construction as they were purely computational. If a piece of research is about finding out what method works best for the classification of a 'hyperspective image', for example, no construction takes place, but only multiple testing and simulation techniques with various mathematical data. This type of research requires a detailed explanation of the theory part, but the actual design, simulation and implementation is relatively straightforward, using computer skills.

For example, a one-chapter Theory stage taken from CE14 was about 'Diffusion Magnetic Resonance Imaging[9]'. This chapter talked about how to calculate diffusion, types of diffusion and the limitations of the theory; only one topic was covered and this could be explained in one chapter. Other examples of this type covered topics such as stereo vision theory and motion planning approaches.

The Theory stage was also presented in one chapter when the students took a single methodological approach. An example of this is the Theory stage in OE15 which started as follows *'This chapter covers the theory related to field-*

[9] Diffusion MRI is a 'magnetic resonance imaging (MRI) method that produces in vivo images of biological tissues non-invasively and weighted with the local microstructural characteristics water diffusion' (ACE-CE14:3).

programmable gate array (FPGA) and the relevant hardware components as well as their working principle'. In this chapter, the students introduced the FPGA (e.g.: '*FPGA is an integrated circuit designed to …'*) and explained its usage (e.g.: *'Technically, an FPGA can be used to solve any problem which is computable'*). The chapter continued to provide FPGA-related information and then moved on to explain the relevant hardware components (e.g.: *robot, sensor*) relevant to the research project used later to design and simulate the hard and/or software system.

As shown in Figure 5.17, some Theory stages were realised over multiple chapters. The three-chapter Theory stage from dissertation number 12 in OE is an example; it was about creating software to help with language processing, referred to as a 'Compiler'[10]. The first three chapters provided the reader with theoretical knowledge about the component required to better understand the function and design of the compiler. To start with, the first chapter of the Theory stage introduced the compiler by giving a definition, the structure and the working principles (see example 1):

> (1)
> Computer science now depends on programming languages because all software running in the computer are written in some programming languages. Generally, these programming languages are high level languages so that they cannot be executed directly by the processor. They need to be translated to an equivalent language understood by the processor. This is the job of a compiler. (OE12-CH1:1)

One of the key phrases in Example 1, repeated three times, is 'programming languages', mapping the territory of the project to computer Engineering. In this brief introduction to the first Theory chapter, we can also see that there is a

[10] A compiler is a program or a software tool that reads a source program written in one language and translates it into an equivalent program in another language called the target program. During the process of the translation, the compiler reports any error in the source program (OE12:1).

reference to a real-world problem, the difficulty of the processor to execute programming languages without a translator. This chapter went on to explain complex working principles of the compiler, in discipline-specific mathematical language.

The second chapter of the Theory stage of the same dissertation explained another component which is referred to as the 'lexical analyzer[11]'. This chapter started as follows: 'In this chapter, we will see the structure of a lexical analyzer and its implementation using pseudocode' (OE12-CH2:8). In this chapter, the lexical analyser was explained with reference to its structure. The explanation of the implementation of the analyser only briefly described how it could be realised through a specific method of coding, so the chapter only functioned as a Theory stage. This is also confirmed in the conclusion section of this chapter: 'In this chapter, we have introduced the theory behind lexical analysis and we have seen that a lexical analyzer records lexemes from the source code and interacts with the parser by returning a Token object each time it is called from the parser' (OE12-CH:13).

The third chapter in the Theory stage of OE12 explained concepts and the working principles of another process related to the creation of the compiler, 'Syntax analysis'. Example 2 is the introductory section of the chapter.

(2)
Every programming language has a set of rules that describes the syntactic structure of programs written in this programming language. These rules are represented by what is called a context free grammar (CFG). In this chapter we will introduce the concept of CFG, syntax directed translation and the different types of parsing. (OE12-CH3:14)

11 A 'lexical analyzer' is the first phase in the compilation process. It reads characters from the source program, group them into lexemes and returns a token object for each lexeme (OE12:8).

As shown in example 2, the chapter clearly stated that it would introduce concepts essential to the project such as CFG, syntax translation and types of language parsing. All three chapters were classified as a Theory stage.

Table 5.8 shows the table of contents for OE12 and the classification of all its chapters in terms of stages. This is the only dissertation in OE with a three-chapter Theory stage and three-chapter System Design. As stated in Chapter Three, not all chapter headings reflect the function of the chapter. For example, the main aim of Chapter 2 and Chapter 3 was not to conduct any research-related analyses but to demonstrate understanding of the working principles of computational methods.

Table 5.8: Three-chapter Theory and System Design dissertation (OE12)

Table of contents	Rhetorical function
Abstract	Abstract
Introduction	Introduction
Chapter 1: Compiler structure Chapter 2: Lexical analysis Chapter 3: Syntax analysis	Theory
Chapter 4: The source programming language and the target programming language Chapter 5: Front end Design using UML Chapter 6: Implementation using java	System Design
General Conclusion	Conclusion

Other examples of chapter titles for the Theory stage were ‘Stereo vision theory’, ‘Concepts and theory of filters’, ‘Antenna array concepts’, ‘Theoretical background’ and ‘Theory’. The Three-chapter Theory stage was more common in PE and TE than in CE and OE, as shown in Figure 5.17. Table 5.9 shows the contents of a TE dissertation with a two-chapter Theory stage and a one-chapter System Design.

Table 5.9: Table of content for a single-chapter System Design (TE12)

Table of contents	Rhetorical function
Abstract	Abstract
Introduction	Introduction
Chapter 1: Hyperspectral Data Chapter 2: Wavelets and Grey Model	Theory
Chapter 3: Data classification using Grey model and SVM	System Design
Conclusion	Conclusion

The tendency to have two or three Theory chapters in TE and PE results in technically dense System Design stages, using discipline-specific terminology which has been introduced in the Theory stage. The System Design stages in these disciplines contain less explanation and more visual data, used to present and discuss results. For this reason, fewer chapters are needed for this stage than for the Theory stage. This type of structure is what supervisor 1 described as software-based project when answering question two of the interviews, see Section 4.2.

An example of a single-chapter System Design is ‘Chapter 3: Data classification using Grey model and SVM’ from ACE-TE12. This chapter makes it clear that it builds on information discussed previously, as is shown in this sentence: ‘In this chapter, we use the theoretical background obtained from the previous chapters to perform the classification of the hyperspectral data using grey model with SVM classifier’ (TE12:22).

Unlike the research in CE and OE dissertations, research in TE and PE dissertations consists of building and testing both software and hardware systems. This means that these disciplines contain computational methods as well as the design of physical artefacts. However, TE and PE students write less in the System Design stages than in the Theory stage because of cost-related constraints. Although the majority of TE and PE research designs can be constructed, the expense of prototyping in these sub-disciplines makes it difficult (if not impossible) for the institute or students to afford to do so. Students compensate for the fact that they are not able to construct a physical artefact, which is a major objective in Engineering, by providing considerable detail of the Theory. This demonstrates that they would have the necessary theoretical knowledge to put their proposed design into practice, if the resources were to be made available in the workplace.

A significant number of OE (14/17) dissertations presented the System Design in two chapters. In this case, the first chapter of the System Design presented the simulation part of the work whereas the second presented the implementation and results. The simulation part explained how the proposed work was intended to be implemented through the hardware or in a real-life situation. This chapter also described the use of software programs to simulate the entire operation digitally and showed how the suggested algorithm was intended to work. An example of this is found in OE1 where an algorithm was designed and simulated to control an arm of a robot. After the algorithm had been tested, the implementation of the system on the robot’s arm was represented in the second chapter of the System Design. In other words, the first chapter showed the software design and testing and the second chapter showed the hardware design and the implementation of the system. This type of structure comes from what supervisor 1 described as software and hardware-based project when answering question two of the interviews, see Section 4.2. The two-chapter System Design stage was found in 57% of OE dissertations, 40% of CE dissertations, 28% of TE dissertations, and 21% of PE dissertations.

Table 5.10 shows the table of contents for a dissertation with a two-chapter System Design in OE.

Table 5.10: Table of contents for a two-chapter System Design (OE01)

Table of contents	Rhetorical function
Abstract	Abstract
Introduction	Introduction
Chapter 1: Theoretical background	Theory
Chapter 2: Hardware design Chapter 3: System design	System Design
Conclusion	Conclusion

This example is taken from a dissertation with both software and hardware driven research. Chapter 2 discussed only the design and testing of the hardware part of the project, whereas Chapter 3 combined the design and testing of the software with the implementation of the software within the hardware component. Each chapter had a cyclical pattern of Introduction, Design, Simulation and/or Implementation and Conclusion.

Another structure is the three-chapter System Design stage was found in 53% of CE dissertations, 13% of PE dissertations, and 12% of OE dissertations; none of TE dissertations contained a three-chapter System Design stage. Unlike the two-chapter System Design shown in Table 5.10, in the three-chapter

System Design a separate chapter was dedicated to implementation and testing.

Table 5.11 shows a table of contents of a three-chapter System Design dissertation in CE.

Table 5.11: Table of contents for a three-chapter System Design (CE04)

Table of content	Rhetorical function
Abstract	Abstract
Introduction	Introduction
Chapter 1: System description	Theory
Chapter 2: System hardware description Chapter 3: Software description Chapter 4: System implementation and test	System Design
Conclusion	Conclusion

This example also represents software and hardware-driven research. The dissertation had a one-chapter Theory stage, but an elaborated three-chapter System Design. In this dissertation, students worked on how to control and maintain temperature, and tested their project on a small scale by maintaining the heat inside a glass box heated by a light bulb and cooled by a small fan. This was a relatively feasible realisation of the project. While Chapter Two and Three in Table 5.11 discussed the design and simulation of the hardware and software systems separately, the fourth chapter combined both elements for implementation and testing.

The four-chapter System Design stage was the least used structural option occurring only in two dissertations from the field of PE. Every chapter of the System Design in these two dissertations explained the design and testing of a specific component. This is similar to the topic-based structure identified by Bunton (1998) and Dudley-Evans (1999) and discussed in Chapter Two, Table 2.1. Each component was designed and tested in a separate chapter before everything was put together in the final simulation chapter. Again, the number of chapters in the System Design stage seems to be related to the complexity of the project.

5.1.2 Overall structure of the MSc dissertations in ACE

Figure 5.18 presents a summary of all the structural patterns found in the Algerian MSc dissertations. The one-chapter System Design provides a description of the experimental research design, the simulation, the implementation, and the discussion of results, all in one chapter. This option was particularly common in TE (71% of dissertations) and PE (56% of dissertations), as shown in Figure 5.17. The two-chapter System Design reported on the system hardware design in one chapter and on the software design in another chapter. Both chapters contained sections that discussed the results of the simulation and the implementation. This option did not include a stand-alone chapter for implementation and evaluation, as in the case of three-chapter System Design stages, which were particularly associated with CE (53%) compared to PE (13%), OE (12%), TE (0%). The four-chapter System design is not included in Figure 5.18 as it was found in only two dissertations.

Abstract
Aim (100%), Methods (87%), *Evaluation of results (13%)*

Introduction
Claiming centrality (90%), *Literature review (2.8%),* Indicating a real-world problem (83%), Announcing present research (85%%), Overall structure of the project (74%)

Theory
As a single-chapter: TE (40%), PE (30%), CE (67%) and OE (71%)

System Design
As a single-chapter: TE (71%), PE (57%), CE (7%) and OE (6%)

Single-Chapter System Design	Multiple-Chapter System Design
Software Design: Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion	**Hardware Design:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion **Software Design and overall testing:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion **Or** **Separate Overall testing chapter** Introduction Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion

Conclusion:
Restatement of the work carried out (100%), Restatement of the methods (100%), Evaluation of the main findings (100%), Practical implications (73%), Limitation (38%), Recommendation for future research (21%)

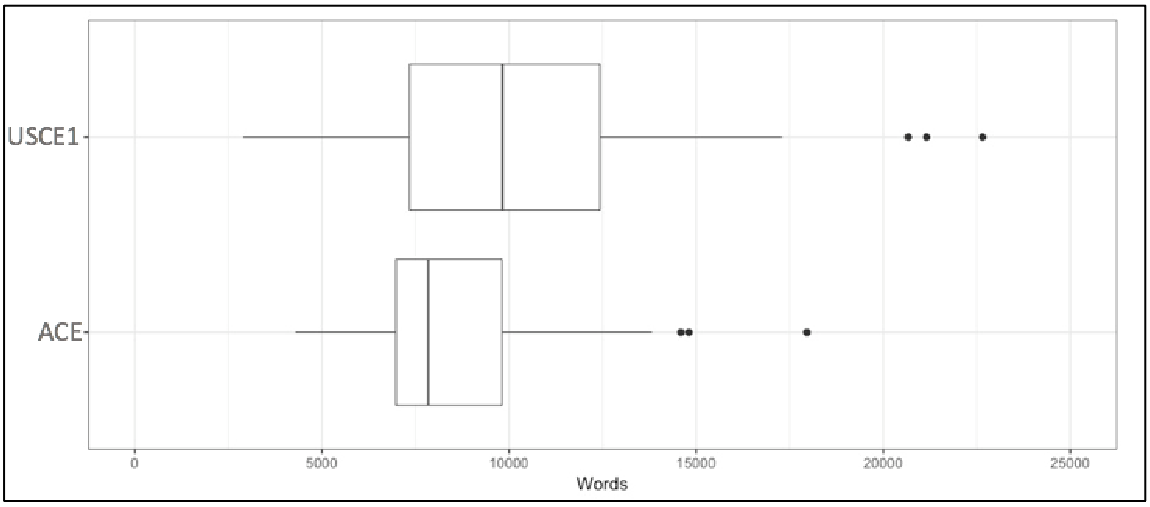
Figure 5.18: Overall organisational model of the Algerian MSc dissertations

5.1.3 Conclusion

This section explained the macro and micro-structure of the Algerian Corpus of Engineering (ACE) dissertations across four disciplines: Power, Control, Computer and Telecommunication Engineering. A general structural model derived from the 70 dissertations is presented in Figure 5.18. It is worth making clear that the Design Specification genre has not been investigated in such great detail in any of the prior studies I have reviewed. All previous studies on the structure of PhD theses and Masters' Dissertations have reported on derivative forms of the IMRD structure. However, the results discussed in this chapter show that the IMRD structure is not applicable to the Algerian dissertations in Electrical and Electronic Engineering. The second part of this chapter follows similar steps in reporting the structure of MSc dissertations from the United States Corpus of Engineering (USCE), with reference to the findings from ACE.

5.2 Organisation structure analysis of MSc Dissertations in USCE

As in the previous section, this section starts by briefly commenting on the length of the United States Corpus of Engineering (USCE) dissertations in comparison to ACE dissertations, before investigating the overall structure of USCE dissertations. As discussed in Chapter Three, Section 3.3.3, USCE contains 109 dissertations from seven American universities, representing three disciplines. Unlike ACE, USCE dissertations are not written by more than one student. Every dissertation is written by a single student to obtain a MSc degree in Engineering. The length of the dissertations in USCE varies considerably from 2,900 to 22,658 words. Figure 5.19 shows the word count distribution of all dissertations in USCE in comparison with the word count of dissertations in ACE. The dark dots represent outliers.



F**igure 5.19**: Median of dissertation word count in USCE and ACE

As shown in Figure 5.19, USCE dissertations are longer than the Algerian dissertations with a median of 9,9589 words in USCE compared to 7,630 words in ACE. However, USCE also contains shorter dissertations than ACE. This word count difference between the two corpora is particularly interesting especially as USCE (unlike ACE) consists of dissertations produced by individual students. A possible explanation of the differences in length between ACE and USCE, and resorting to joint projects in ACE might be because the Algerian students are oriented more towards becoming professional engineers in the work place as it is supported by the interview findings in Chapter Four. This team work at the MSc level might be preparing them to what they are expected to be doing after graduation. Another possible explanation could be related to the pressure the Algerian IEEE might be facing with the rising interest of the public to switch from using French to English in the Algerian higher education.

Next, I will explore the macro and micro structure of USCE.

5.2.1 Identification of rhetorical stages and their internal structure in USCE

This section explores the rhetorical function of every chapter in USCE. I followed the same approach as I did with ACE, identifying the most common stages first: Abstract, Introduction, and Conclusion. However, in this section I will not draw attention to cross sub-disciplinary differences in USCE.

5.2.1.1 Abstract stage

As expected, all 109 dissertations in USCE have an Abstract. This section reports on their wordcount and their moves and steps. Figure 5.20 shows the word count distribution in the Abstracts in USCE and ACE. The average length of Abstracts in USCE was 239 words which is almost twice the average word count found in ACE (126 words). The average word count of abstracts from both corpora is less than half the average word count of the 21 PhD abstracts examined by Bunton (1998:124). As discussed in the previous section, this is due to genre differences between Bunton's data and ACE and USCE data.

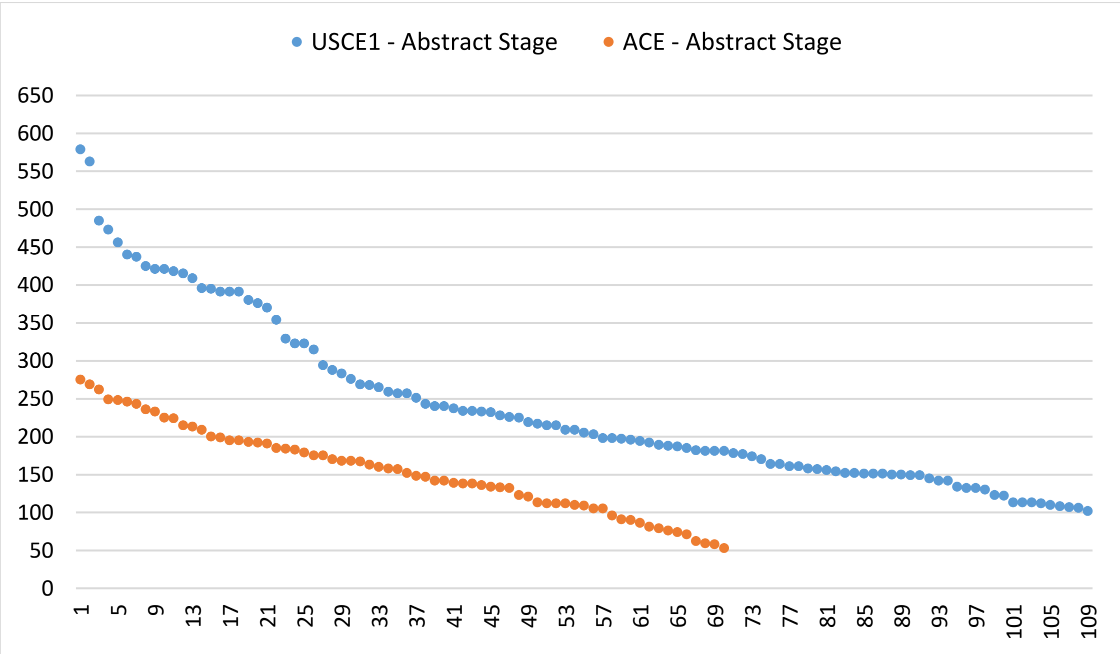


Figure 5.20: Word count distribution of the Abstract Stage in USCE and ACE

Unlike ACE Abstracts, which started directly by stating the aim of the study (see Section 5.1.1.1), USCE abstracts started more in the manner of RA introductions: 'Claiming centrality' and 'Making topic generalisations' as in the CARS model (Swales, 1990). Table 5.12 presents some examples of these first steps.

Table 5.12: Examples of the first two steps in USCE Abstracts

Claiming centrality	Making topic generalisation
'Compressed sensing is becoming a new paradigm in signal processing by acknowledging that information has a compressible form in some representation' (USCE-04).	'With the rise of social media and big data, graph analytics are increasingly being called upon to provide insights based on network connectivity and the concept of centrality' (USCE-8).
'The PID controller is the most widely used controller in industry' (USCE-7).	'The size and complexity of integrated circuits is continually increasing, in accordance with Moore's law' (USCE-65).
'Renewable energy sources for electricity were introduced only a few decades ago and they are becoming an integral part of conventional power systems to meet increasing energy demands with reduced emissions' (USCE-3).	'Unlike humans, the identification of a specific human user can be a very difficult task for computers. The creation of several classification algorithms in the fields of pattern recognition, data mining, and machine learning now assist computers with this task' (USCE-94).

As shown in Table 5.12, USCE abstracts claimed centrality by using statements such as 'is becoming a new paradigm in X', 'they are becoming an integral part', 'have received a lot of attention'. They made topic generalisations by using statements such as *'Various control techniques have been developed'*. These two steps, not identified in ACE dissertations, accounted for the overall difference in the length of abstracts in the two corpora. Perhaps this might mean that writers of USCE dissertations were more influenced by RA practices compared to writers of ACE dissertations. Overall, USCE Abstracts followed the following pattern: Introductory statements ('Claiming centrality' and 'Making topic generalisation), what the research is about (Aim) and finally how the research was carried out (Methods). This pattern also failed to fully map onto Hyland's RA abstracts model of 'purpose, method, product' (2000:68), in the sense that it lacked the *'product'* part. The next section will explore the introductory stages (*i.e.: Introduction, Background and Literature review)* in USCE.

5.2.1.2 Introduction, Background and Literature Review stages

Unlike ACE introductions, which were stand-alone sections, USCE introductions were longer, stand-alone first chapters. The word count distributions of the 109 American introductory chapters is shown in Figure 5.21, in comparison with ACE introductions.

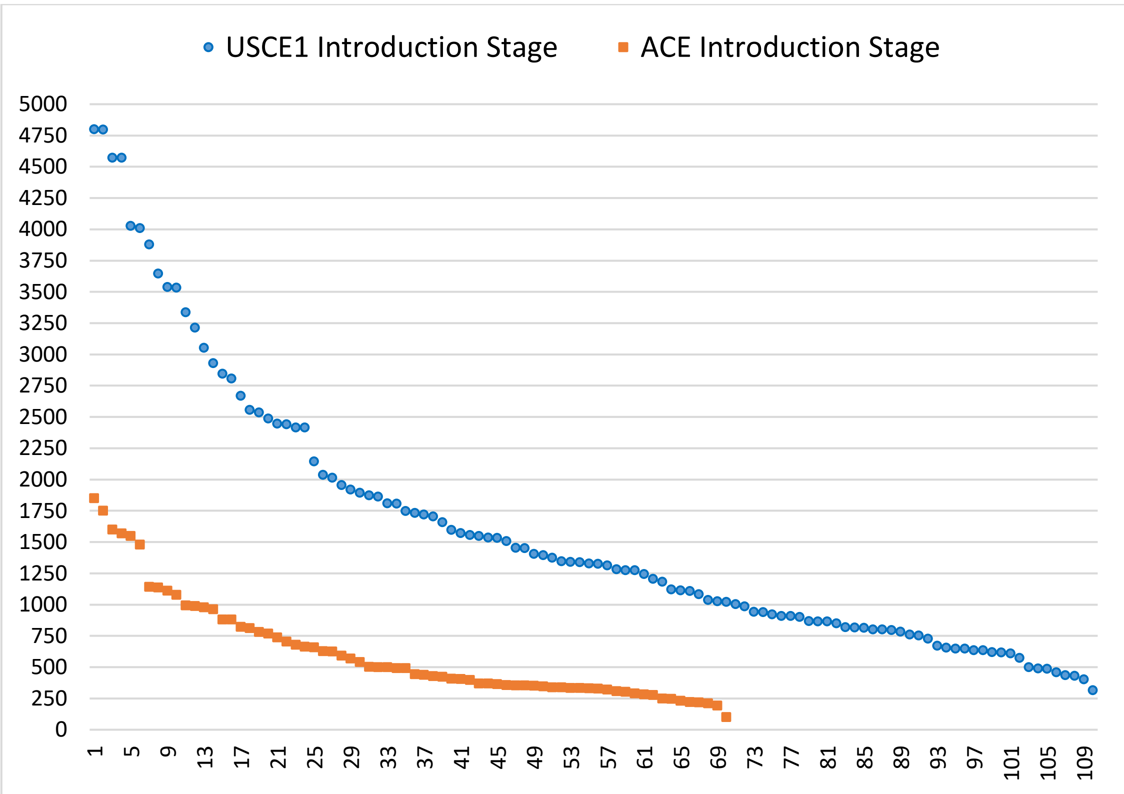


Figure 5.21: Word count distribution of the Introduction stage in USCE and ACE

As shown in Figure 5.21, there is a considerable difference in the size of the introduction stage in the two corpora; the average word count of USCE introductions was 1,608 words, whereas the average word count of the introductions in ACE was 646 words (see Section 5.1.1.2). This suggests that there might be some moves or other stages within USCE introductions which were not present in ACE Introductions.

The first notable finding is that seven out of the 109 USCE introductory chapters did not have a typical introductory function, and did not follow the conventional internal structure found in the other 102 introductory first chapters. Five of these seven first chapters represented the Background stage and the other two represented the Theory stage. Both stages will be explained in detail in their respective sections. These stages did not mention anything about the research and its significance and did not outline the study; they took a more direct approach by explaining and presenting the historical background and technical theories. These seven chapters were not grouped with the other introductory chapters as they had their own rhetorical function.

The remaining 102 introductory chapters, all entitled ‘Introduction’, were found to contain a number of different sections. Table 5.13 shows the seven most frequent section headings. The titles in bold were more common than the other titles. Some infrequent section headings such as ‘Primary Collaborators and their Contributions’ gave biodata on the researchers and supervisors involved in the research.

Table 5.13: The most frequent headings in the introduction chapters of USCE

Sections within the introduction stage/chapter	Freq	%
'Introduction' *'Problem statement'* *'Problem context'*	62	60%
'Background'	22	21%
'Literature review' *'Literature survey'* *'Related work'* *'Previous Research'*	9	9%
'Motivation of the study *'purposes of research'* *'Significance of research'* *'Thesis rationale'*	35	34%
'Research objectives' *'Objectives in research'* *'Objective of the study'*	15	14%
'Contribution of the study' *'Contributions'*	25	24%
'Outline of the study' *'Thesis overview'* *'Thesis outline'* *'Project roadmap'* *'Thesis organisation'* *'Structure of the thesis'* *'Organisation of work'*	58	57%

The order of the sections shown in Table 5.13 reflects how these sections appear in the Introduction stage in USCE. Most started with a section entitled

‘Introduction’ and ended with a section entitled ‘Outline of the study’. The Introductory sections shown in Table 5.14 contained a step that maps onto the Swalesian initial move of ‘Establishing territory’ (Swales, 1990; 2004); more specifically, step two ‘Making topic generalization(s)’ within move one in Swales (1990) and step one ‘Topic generalisations of increasing specificity’ within the same move in Swales (2004). This step was found in all 62 introduction sections. Example 4 taken from a section entitled ‘Introduction’ at the beginning of the first chapter in USCE-40 clearly shows the step *‘Topic generalisations of increasing specificity’* (Swales, 2004):

> (4) Introduction:
> Constantly increasing demand of electricity due to growing population and industrial development is putting power industry on great pressure of increasing the power generation. Increasing demand potentially causes deterioration of environment due to combustion of fossil fuels to meet the energy generation needs. Continuing adding new generation capacity while keeping carbon dioxide (CO2) emission at minimum level require extensive modifications to existing power systems. The environmental impact of increased energy needs can be taken care by adding more renewable energy sources (RES) for electricity generation [1]. (USCE-40)

Topic generalisations such as these were used to show the importance of the overall research territory. Patterns such as *‘constantly increasing X’ (*where an adverb (*constantly)* is used to modify a gerund (*increasing*) and both modify the noun *demand*) were used to assert continuing centrality from the past to the present. Topic generalisations also drew the readers’ attention to real-world problems that needed to be addressed, such as growing populations and their need for electricity. As in the ACE introductions, we also notice the use of booster adjectives such as *great, extensive*. The Vancouver referencing style was used in USCE, as in ACE.

Four dissertations labelled the first section of the Introduction stage *'Problem statement'*. Example 5 shows how USCE students introduced the problem.

> (5) 1.1 Problem Statement
> The modern smartphone consumes a significant amount of energy due to its technology density. Consumers expect their smartphone's battery life to sustain appropriate levels for operation throughout the day. Hence, longer operation times are necessary for practical usage and customer satisfaction. A software technique should be developed to increase the energy savings for Android smartphones. This software technique must possess the following attributes; low overhead, manual or automatic triggering, and have a gentle learning curve for software programmers'. (USCE-77)

In Example 5, we can note the use of some lexico-grammatical features typical of the step 'indicating a gap', which is a real-world gap in the case of USCE. These include words with negative meaning (e.g. *consumes, expect, poor, unstable, heavy, and expensive)* and contrastive connectors (e.g. *however, despite, but and yet*). '*However'* is used to contrast two propositions presented in adjacent sentences. An example of this is *'there are a wide range of X to choose from. <u>However</u>, most of them have been developed for specific reasons'* (USCE40). The remaining contrastive connectors contrast propositions in adjacent clauses within the same sentence, such as *'Despite the reduction in X, these challenges are hard enough to demand for change in technology' (USCE19)* and *'X is often not implemented on Y, but X is necessary as it can be used to …' (USCE23)*. Another frequent feature in these sections is the use of *'not'* (e.g.: *'this X is not acceptable for practical application'*).

Although USCE dissertations were produced at a variety of different universities, 60% started by presenting the problem that the research aimed to address. In the case of dissertation number 77 from USEC1, for example, the problem was the ‘significant amount of energy’ modem smartphones consume due to their ‘technology density’, made clear in the second sentence which stated that *‘consumers expect their smartphone’s battery life to sustain appropriate levels’*. The writer of this dissertation gave two reasons why longer battery life is important: *‘practical usage and customer satisfaction’*. This was followed by a statement of purpose: *‘a software technique should be developed to increase the energy savings for Android smartphones’*.

In USCE, the ‘Introduction’ stage was followed by a ‘background’ and a ‘literature review’ stage (see Table 5.14), which could be sections in the first introductory chapter or stand-alone chapters. In the second case, the background and the literature review stages were sometimes realised as first chapters in dissertations that did not have an introductory chapter. The choice between the two options seemed to be due to the amount of research details that needed to be covered. Some dissertations had a brief highly focused ‘Literature Review’ section; others had an elaborated ‘Literature Review’ Chapter, and still others did not have a literature review stage at all. Table 5.14 provides a breakdown of the number of background and literature review stages realised as stand-alone chapters or as sections within the Introduction stage.

Table 5.14: The Background and the Literature Review sections and chapters in USCE

	Presented as a section within a chapter	Presented as a stand-alone Chapter	Total
Background	23	29	52/109
Literature review	11	21	32/109

The Background stage (shown in Table 5.14) did not realize the Swalesian Move One, ‘Establishing a territory’ because it did not affect the narrowing down process towards ‘Occupying the niche’. Instead it gave extra information about the research such as historical information, as shown in Example 6, from a section entitled ‘Background’ within a stand-alone one-chapter Introduction stage entitled ‘Introduction’:

> (6) 1.2 Background:
> The first hybrid car was built in the year 1899, and was called the System Lohner-Porsche Mixte. It used a gasoline engine to charge the accumulators which powered the electric motors for the vehicle propulsion. The efficiency of the system was quite low and the price was significantly high. In 1904 when Henry Ford started making automobiles powered by gasoline engines at low cost when compared to hybrid electric vehicles, it shrunk the market for the hybrid vehicles [4]. In 1999, Honda developed its first mass produced of hybrid electric vehicle, the Honda Insight. The Toyota Prius sedan, released in the year 2000, has marked its own position in the market of hybrid electric vehicle manufacturers. (USCE-41)

This section talked about the history of Hybrid car development from 1899 to 2000. This type of information did not help justify the purpose of the study, which was ‘to develop appropriate range extenders which will increase the distance covered by the vehicle with a single fully charged battery pack’ (USCE-41). Instead, the background information in USCE-41 demonstrated the student’s knowledge about the topic to be investigated.

A literature review stage was found in 11 introductory Chapters and in 21 stand-alone chapters (see Table 5.12). In two dissertations (number 109 and 78) from two universities (Ohio University and Wright University), the literature review Chapter was placed at the end of the dissertation right before the conclusion stage; its placement at the end suggests that it was of less importance and had been downgraded and foregrounded the analysis/testing part. Example 7 taken from a literature review section realised within a one-chapter Introduction stage is shown below:

> (7)
> 1.2 Literature review:
> Most research in the control of the dc microgrid focuses on operation during grid connected mode [5]. For example, Zhang, Wu, Xing, and Sun's study of Power Control of a dc Microgrid Using dc Bus Signaling tests the grid in four operating modes [6]. Two of these modes are islanded, which means the grid does not receive any power from the main grid and must supply its loads based on its own generation. In their study, one mode uses the main battery to supply power to the grid for a short period of time. The other supplies dc bus voltage regulation by photovoltaic (PV) sources. Lopes, Moreira, and Madureira's study, Defining Control Strategies for MG Islanded Operation, examines two operating modes, one of which is islanded in an Emergency Mode [7]. In this situation a fault in the system has occurred, such as an open transmission line, or certain maintenance requirements on the network. Again, this mode fails to deliver sustainable operation for islanded dc microgrids. (USCE-2)

In example 7, the student discussed studies that had used a particular design in order to show the drawback of that design. This function mirrors Swales step of '*Counter claim'* where writers introduce an opposing viewpoint or show the weaknesses in previous research. Example four, suggests that all the other techniques in use were imperfect; this is expressed through the use of negation (e.g. '*the grid does <u>not</u> receive any power')*, and words with an implied negative meaning (e.g. '*to supply power to the grid for a <u>short</u> period of time', 'a <u>fault</u> in the system has occurred', 'this mode <u>fails</u> to deliver').* The literature review discussed what prior interventions had achieved and where they had failed (e.g.: *'this mode fails to deliver sustainable operation for islanded dc microgrids'*). There is a frequent use of prepositional phrases indicating location of information inside and outside the text (e.g.: *'In [reference],…', 'In this situation …', 'in four operation modes', 'on the network').*

Typically, claims in the literature review section were supported by references to the prior literature, something which was not common in ACE Introductions (e.g.: *'Most research in the control of the dc microgrid focuses on operation during grid connected mode [5]' and 'The commercial batteries can be scaled greatly, upwards of 1GWh [9]').* USCE dissertations seem more likely to find a gap in the prior research, whereas ACE dissertations are more likely to identify real-world problems. This supports the argument raised in this thesis of ACE students are being trained to be professional engineers, while USCE students are being trained to be researchers.

Overall, the USCE Engineering students critique the literature which makes them more concerned with filling research gaps than with solving real-world problems. However, this does not mean that their findings cannot find ways to be applied in the real-world completely. For example, in example 5 of the Literature review ended by narrowing down the research and guiding the reader towards the niche that the study was addressing by making a statement of purpose, such as *'in order to conduct a meaningful study on the implementation of grid storage, our study will observe multiple battery storage systems attached to local power sources to study the additional control abilities in our simulated dc microgrid'* (USCE-2). Although this example comes from a dissertation which critically reviews the literature, the study still shows relevance to the real-world. However, USCE dissertations are primarily trying to contribute to research whereas the primarily focus of ACE dissertations is to learn the required skills to fixed technical problems. This difference might be related to educational policies which focus on preparing students for the workplace or academia, as discussed in Chapter Two. Students dedicated to becoming practising engineers are more interested in learning and demonstrating technical skills. Students interested in academia, on the other hand, are more likely to be more consider with research contributions.

After the Literature review section comes a section entitled '*Motivation of the study', 'Purpose of the study', 'Purposes of research', 'Significance of research', or 'Thesis rationale'* as shown in Table 5.14. In this section students listed different reasons to show the importance of the project. Example 8, taken from USCE-03, showed the importance of studying the performance of energy storage.

> (8)
> 'The study of performance of energy storage system under these applications allows us to determine the avoided capital cost of additional upgrades that are required to integrate large wind generation units into utility service areas. In addition, it also evaluates the ability of the energy storage system to provide reactive power reserves and support to improve voltage stability and security'. (USCE-03)

As example 8 shows, the student listed a number of reasons behind the research using patterns such as '*it allows us to…'*, '*it evaluates X to improve Y*'. In this section, there was always a positive indication of the benefits of the project. Students did not include any negative aspects of their design in this section. The difference between this section and the next section, entitled 'Research objectives', was that the former stated why the research was worth doing whereas the latter stated what would be done. Example 9 is taken from a section of the same dissertation entitled 'Research Objectives'.

> (9)
> The main objective of this study is to evaluate energy storage system (ESS) performance in the presence of high wind energy penetration. We assume the ESS is located between the transmission and distribution systems. This location was chosen as the most suitable to evaluate the possible value of ESS to both the transmission and distribution systems together. (USCE-3)

This section was marked by the use of the pattern '*the objective of this study is to* X', where X was always an action verb (e.g.: *test, evaluate, improve, design*). In Example six, we note the use of *'main',* used in cases where the project had multiple objectives.

The next section was entitled *'Contribution of the study'*, and usually consisted of a bullet point list where every bullet point presented one contribution, for example:

1. The performance of the 2-D infinite-impulse response (IIR) spatially-bandpass (SBP) filter was verified using real crab-pulsar data, acquired by the GAVRT' (USCE-88). We can see from this example that one of the contributions of the study is to verify the performance of a specific type of filters. Another contribution is shown in bullet point two:
2. A novel massively-parallel mixed-microwave-digital beamformer for wideband applications is proposed, by combining a passive microwave channelizer and 2-D IIR SBP digital filter' (USCE_88). In this point we see that the research has proposed a new (novel) beamformer. A beamformer is a method that has to do with multiple antenna arrays sending and receiving signals (Haynes, 1998).

This section was found in 25 of the 102 Introduction Chapters in USCE. The *'Contribution of the study'* section found in the introductory chapters of the American dissertations was not found in the Algerian Introductions. ACE dissertations preferred to place the *'Contribution of the study'* in the conclusion stage, another indication that there are regional differences in MSc dissertation writing traditions.

Finally, the last section in the Introduction stage of USCE outlined the organisational structure of the dissertation. This section always started with statements such as: ‘The rest of the chapter is organized as follows’, ‘The structure of this thesis is’, ‘This thesis is organised as follows’. Although different titles are used for this section they all meant the same: *’Thesis overview’, ’Thesis outline’, ’Project roadmap’, ‘Thesis organisation’, ’Structure of the thesis’,* and *’Organisation of work’*. Out of the 102 Introductions 57% ended with this section, 36% referred to the structure of the project in another stage, and only 7% did not include any reference to the overall structure of the project.

The majority (77%) of the ACE introductions, with or without labelled sections, also included an outline of the dissertation. We can see that indicating the overall structure is a shared step in dissertations as it is in PhD thesis introductions (Bunton, 1998, 2002; Samraj, 2008) and RA introductions (Swales, 1990, 2004). The explanation of the overall structure of the project varied greatly in length from one dissertation to another due to the varying number of chapters and the amount of detail students decided to include.

The difference in the word count between the American and Algerian Introductory Chapters is related to the inclusion or exclusion of some sections, and the amount of detail included in some sections of the Introductory Chapters. The Background and the Literature Review sections were not present in the Algerian dissertations, and this made a great difference in the overall length of the Introduction stage. The literature review stage was removed from USCE Introductions for the purposes of comparison with the ACE dissertations, following the lead of studies that have considered the Literature review as a stage that merits its own analysis (Kwan, 2006; Hsiao & Yu, 2008; Jian, 2010;

Hsiao and Yu, 2015; Soler-Monreal, 2015). The background stage, as a section or as a chapter, was also removed. Figure 5.22 shows the word count distribution of every introduction stage in both corpora, both before and after the deletion of the Background and Literature review stages from USCE.

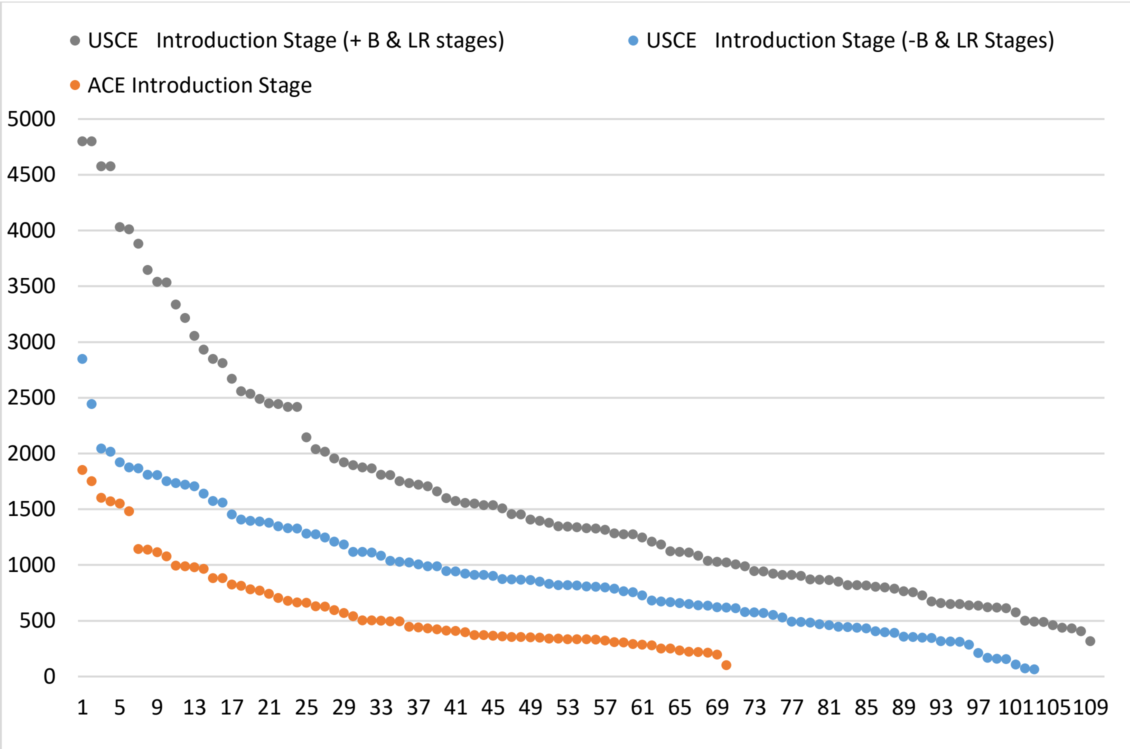


Figure 5.22: Word count distribution of the Introduction in ACE and USCE (with & without the Background/Literature review stages)

As shown in Figure 5.22, the exclusion of the Background and Literature review stages made a significant difference, dropping the word count of USCE introductions by half. The remaining sections of the introduction stage in USCE were 'Introduction', 'Motivation of the study', 'Research objectives', 'Contribution of the study', and 'Outline of the study'. The new average word count of the American Introduction stage is 919 words compared to the average word count of the Algerian introduction stage of 646 words. The American introductory chapters, however, still fell outside the word count range of the Algerian introductory chapters, which contained less detail in every section and lacked certain sections such as ‘Contribution of the study’.

The inclusion of the Background and Literature review stages in USCE dissertations might reflect a dual focus on preparing graduates for academia as well as the workplace. ACE dissertations foregrounded technical practice rather than research practice skills and focused primarily on preparing graduates to become qualified engineers rather than academics. All the contributors to ACE were Algerians and the overwhelming majority were expected to be employed as engineers in companies and not as researchers in universities. This focus made the Algerian introductions shorter and more direct in their presentation of the different moves and steps than the American introductions. This also applied to all other stages apart from the theory stage (i.e. Abstract, System Design, and Conclusion). The fact that the Algerian IEEE is a state-funded institute makes it necessary for it to meet the state’s objective, which is to create more qualified engineers for the workplace.

So far, this section has discussed the length and internal structure of the introductory chapters in the American MSc dissertations with reference to multiple sections such as Background, Literature review, Motivation of the study, Research objectives, Contribution of the study and Outline of the study. Table 5.15 shows a summary of the internal structure of the 102 dissertations in USCE that start with an introductory chapter. It also shows the options to present the Literature review and Background stages either as a section within the Introduction stage or a stand-alone chapter after the Introduction stage. The upcoming sections will follow the same approach to identify the remaining stages in the remaining chapters.

Table 5.15: The organisation of 102 introductions in USCE

- the Literature Review & Background stages (34%)	+ Literature review & background stages (66%)
Chapter One: Introduction Introduction, and Motivation of the study, and Research objective, and Contribution of the study, and Outline of the study	**Chapter One: Introduction** Introduction, and Background (19%), or Literature review (8%), or Background and Literature review (1%), and Motivation of the study and Research objective, and Contribution of the study, and Outline of the study. With/without **Chapter Two: Background** (20%) or **Chapter Three: Literature review** (15%) or **Chapter Two: Background** and **Chapter Three: Literature review** (3%)

5.2.1.3 Theory stage

Only 61 dissertations in USCE contained what I identified to be a Theory stage; presented in at least one stand-alone chapter. Some clear examples of chapter headings which signalled the Theory stage were: 'Chapter 2: Mechanical Theory', 'Chapter 3: Theory behind the work', 'Chapter 3: Evolutionary Algorithms', and 'Chapter 3: Intrusion detection systems (IDS)'. In some cases, the Theory stage was also confirmed by references to an earlier 'theory' chapter in later chapters, as in the following examples:

- As described in the theory in Chapter III, the phase angles of phase-C and phase-D are varied simultaneously to find the maximum torque. (USCESD42)
- It is observed that, the phase advances under different open phase faults are different, which has been discussed in the theory in Chapter IV. (USCESD42)

In one case (USCE-74) a chapter entitled 'Theory', presented a research hypothesis and not the conventional Theory stage found in the other dissertations, as shown in Example 10 below:

> (10)
> The two terms of relevance to this hypothesis are V and n. With these terms, the hypothesis is written as: a decrease in P can be observed if n is raised due to adding fault tolerance but V is allowed to be lowered due to this fault tolerance. (USCE-74, Chapter 2)

This chapter only had a word count of 311 words, and realised a step found in the move 'Announcing the Present research' (Bunton, 2002) and 'Occupying the Niche' (Samraj, 2008). For this reason, it was not counted as a Theory stage but was counted together with the introduction chapter as part of an Introduction stage. The word count distribution of the Theory stages in USCE and ACE are presented in Figure 5.23.

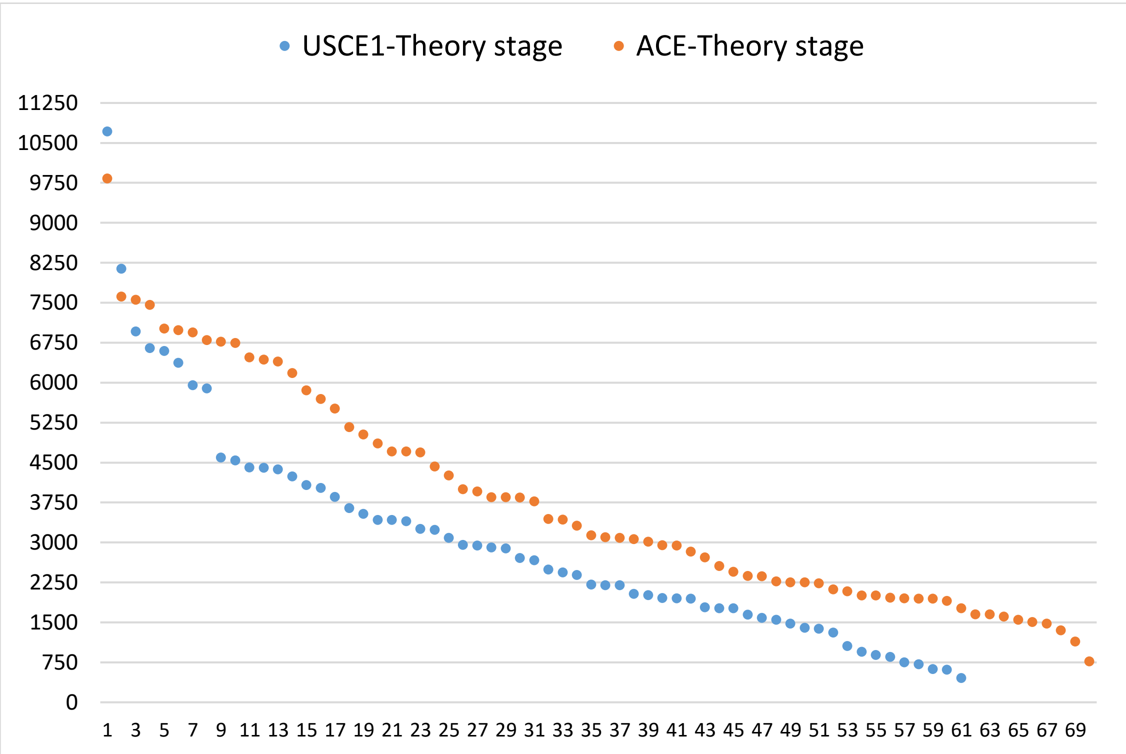


Figure 5.23: Word count distribution of the Theory stage in USCE and ACE

As shown in Figure 5.23, The Theory stage in ACE was longer than the Theory stage in USCE. However, there is not a great difference in word counts with an average of 3,052 words in USCE dissertations and an average of 3,792 words in ACE dissertations. Figure 5.24 shows a summary of the number of chapters in which the Theory stage was realised.

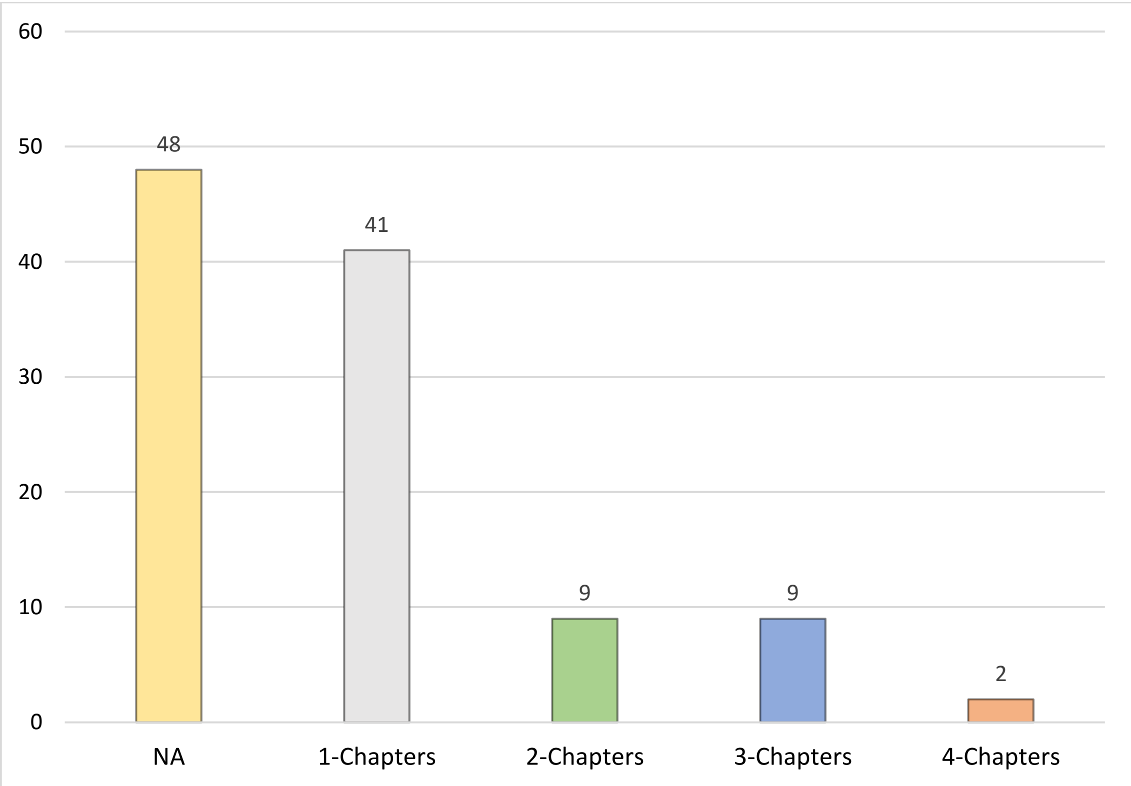


Figure 5.24: Chapter distribution of the Theory stage in USCE

As shown in Figure 5.24, a large proportion of dissertations (41 dissertations) presented their Theory in one chapter. The number of chapters can help us (at least partially) to understand the variations in word count distribution previously shown in Figure 5.23. Multi-chapter Theory stages are likely to be longer than single chapter Theory stages.

The Theory explains 'the purpose of the system [or device] and its basic design rather than referring to methodological issues' (Nesi and Gardner, 2012:185). Although I was unable to come up with a clear explanation for the lack of a Theory stage in 44% of the American MSc dissertations, it seems to be connected with the nature of the project. The more technically complicated and innovative the project is, the more likely it is to include a Theory stage to explain the new theories, frameworks, concepts and systems.

However, it is also possible that the 44% of dissertations in USCE that did not contain a Theory stage were written by students who were planning to continue to higher studies and academic careers. ACE students used the Theory stage to explain the main components of an artefact and its working principles. Many USCE students, on the other hand, seemed to prefer to prepare their readers for the System Design stage by critically evaluating relevant prior research. This was especially the case in dissertations without a Theory stage.

It is beyond the scope of this thesis to go any further than this in the analysis of this stage. The next section will present the chapters that I identified to belong to the System Design stage.

5.2.1.4 System Design stage

The System Design stage was found in 103 dissertations, realised as single or multiple chapters. Some examples of System Design chapter headings are *‘Chapter 3: DC Microgrid Simulation’*, *‘Chapter 4: Hardware Demonstration Results’*, *‘Chapter 4: Robust control design’*, *‘Chapter 4: Experimental Measurements’*, *‘Chapter 3: ABBY— System Design’*, and *‘Chapter 3: Experimental setup and results’*. The word count of all chapters classified as System Design in USCE and ACE are shown in Figure 5.25.

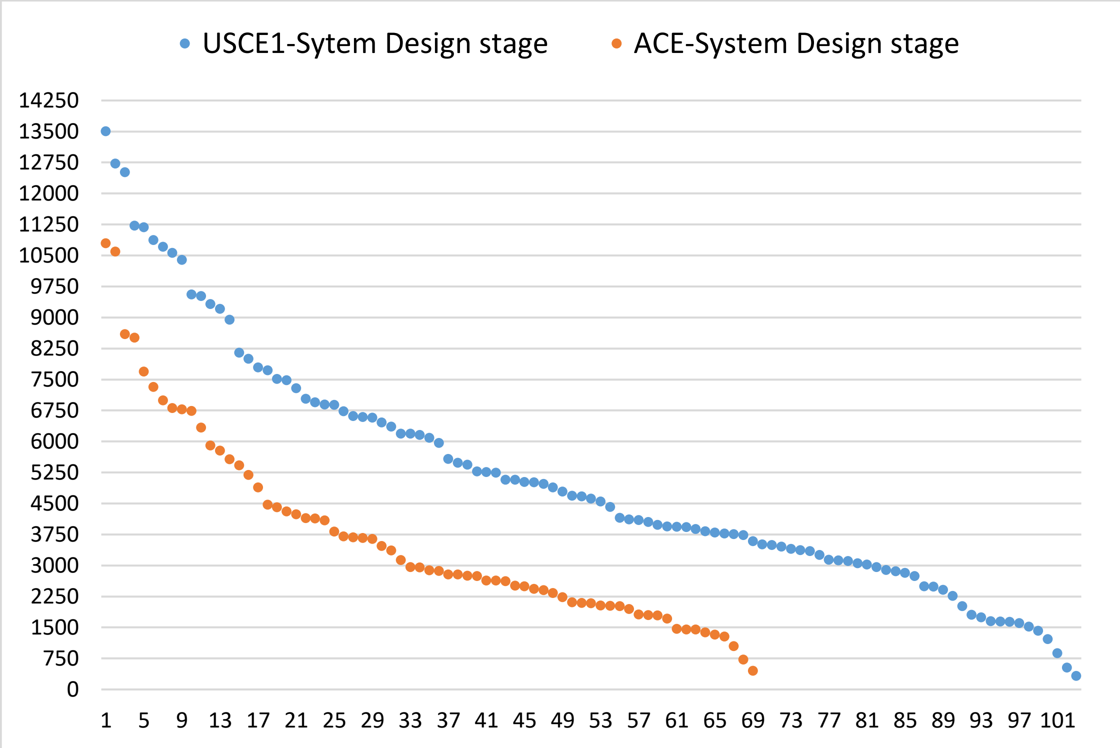


Figure 5.25: Word count distribution of the System Design stage in USCE and ACE

As shown in Figure 5.25, the System Design stage in longer in USCE, with an average of 5,160 words than in ACE, with an average of 3,697 words. Overall, USCE dissertations have shorter Theory stages and longer System Design stages; the opposite is the case in ACE. As discussed in Section 5.1.1.5, the length of the System Design stage could be related to the nature of the project and the availability of resources. In resource-rich institutions students may have more opportunity to focus on the experimental part of their projects, whereas in public universities with less access to resources and materials there may be fewer opportunities to create prototypes, leading to a greater focus on the Theory stage of the study. Limited access to resources may particularly affect the organisation of Algerian dissertations in PE and TE, where prototyping might be prohibitively expensive.

The number of chapters in which the System Design stage is realised in USCE dissertations is shown in Figure 5.26.

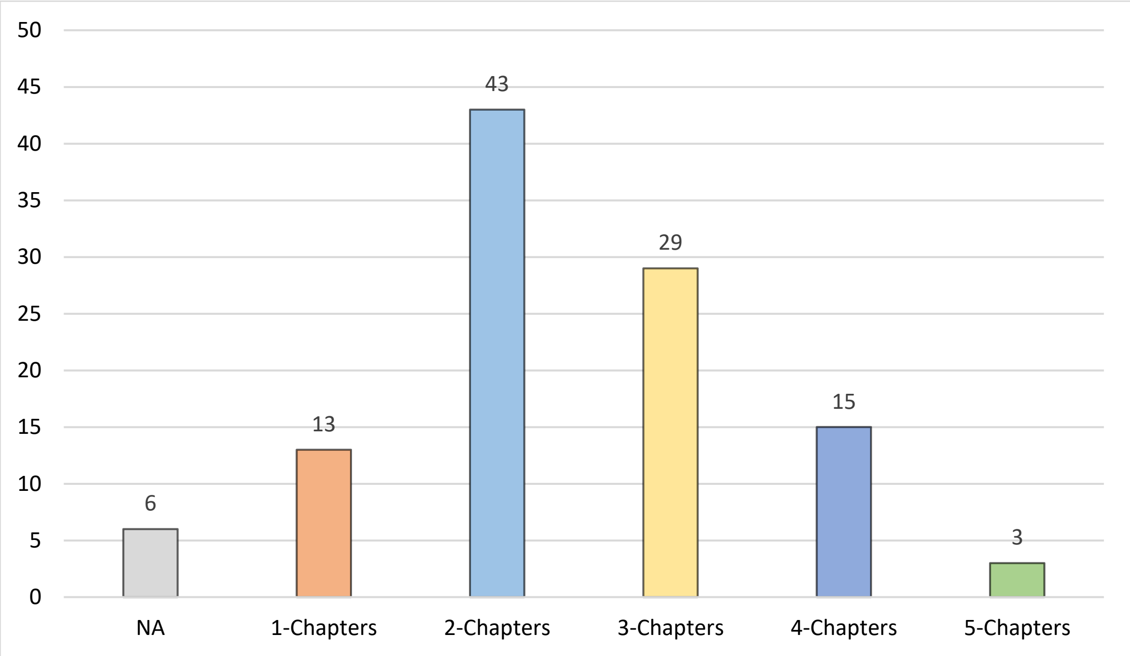


Figure 5.26: Number of chapters realising the System Design function in USCE

As shown in Figure 5.26, more than quarter of the dissertations in USCE presented the System Design stage over two chapters, in the same way as in the ACE dissertations (see Figure 5.16).

Single-chapter System Design

Thirteen dissertations (13%) presented the System Design stage in a single chapter. These were what I consider "software-driven studies"; they were purely computational, and did not manufacture any physical hardware. This type of research is a type of 'System Development' (Nunamaker, Chen and Purdin, 1991:93) or 'Conceptual Development' research which helps to create new systems which do not necessarily have any physical realization (Järvinen, 2007:42). The output of Conceptual/System Development research has been described as a bridge between 'Technological Research' (discussed next) and 'Social Research' and is part of what is known as the 'Concept – Development – Impact' lifecycle of Design Research (Nunamaker, Chen and Purdin, 1991:93-94).

In these thirteen cases, students started with a brief recount of how they followed the research methods which may have been previously discussed in the Theory stage. This recount was written in the past tense, as shown in Example 11 below.

> (11)
> 'The interior-point algorithm was selected from the four algorithm options within fmincon [14]. This method was selected when trust-region-reflective algorithm, the current default, was incompatible with this optimization problem and the active-set algorithm always returned the starting values for the parameters'. (USCE-SD07)

This example referred to the methods as having been 'selected'. Approaches taken in these dissertations included testing algorithms to improve image quality for CCTVs, and building frameworks capable of performing automated missions. Multiple methods were tested to know which suited best and under what conditions. As stated earlier, this type of dissertation did not design any hardware and was purely computational. Therefore, they did not contain any visual representation of physical components involved in the research. Instead, this type of dissertation contained many visualisations of the computational analysis results, examples of which are shown in Figure 5.27.

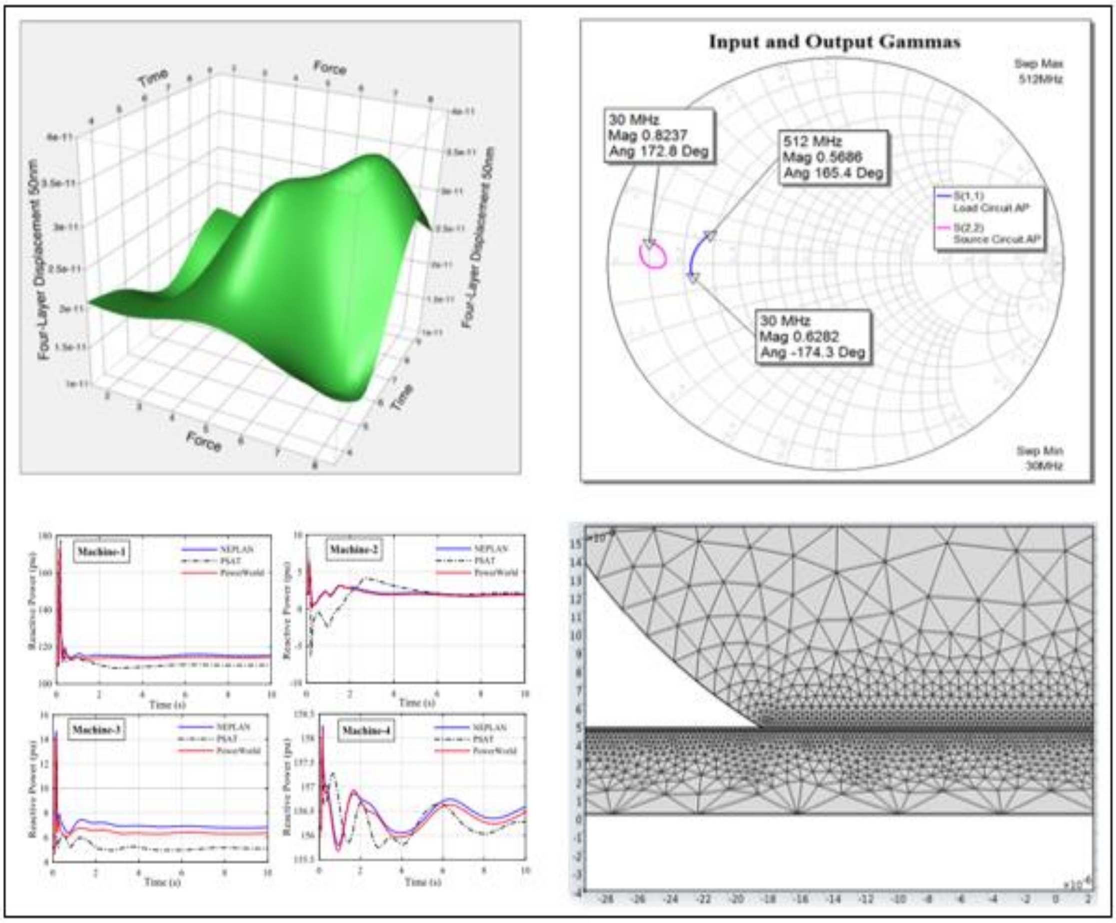


Figure 5.27: Examples of data analysis in software-based dissertations

Multiple-chapters System Design

As with ACE, the remaining multiple-chapter System Design stages in USCE came from dissertations about projects combining software and hardware-driven research. This means that these dissertations created both hardware and software. This type of study contained both types of visual data shown in Figure 5.27 and Figure 5.28. The examples shown in Figure 5.28 came from projects which developed machines controlled by software systems. This type of research is ‘Technical Development’ research, which generally produces ‘physical’ artefacts (Järvinen, 2007:43).

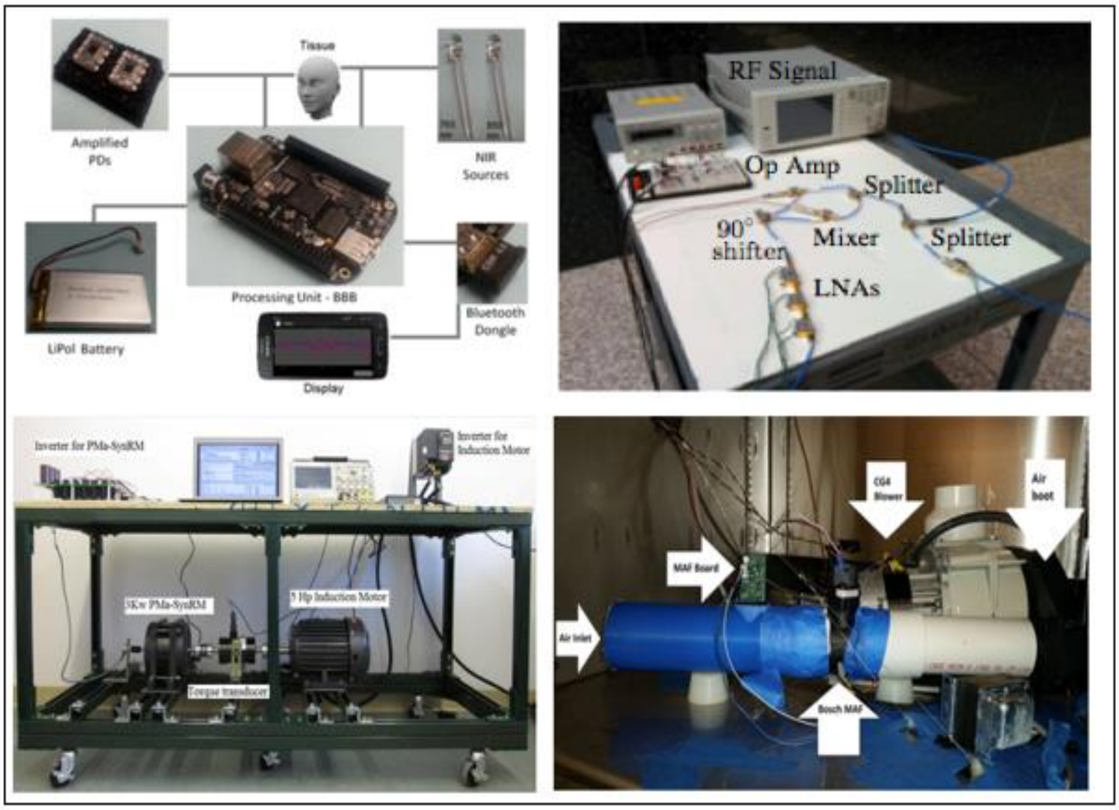


Figure 5.28: Examples of materials used in hardware and software-based dissertations

The most common multiple-chapter System Design stage consisted of two chapters and was found in 42% of dissertations (see Figure 5.26). This type of System Design contained one chapter for the software-based research and one chapter for the hardware and software-based research. Both chapters contained results and discussion with the second System Design chapter describing the implementation of the software and hardware.

Dissertations with a three-chapter System Design stage were found in 28% of dissertations. This type of System Design discussed the design of two components, each presented in a stand-alone chapter, and then the implementation of these two components together presented in a third stand-alone chapter. An example of this type was found in USCE-60 with one chapter about the design of an 'Automatic gain control AGC[12]', one chapter about the design of a 'Mixer[13]', and the third chapter about the implementation of both the AGC and the Mixer.

Dissertations with a four (15%) or five-chapter (3%) System Design stage reported on complex research projects which involved the creation and testing of multiple components in a system. For example, USCE-64 was about the creation of a wheelchair that could be controlled by voice recognition. The System Design stage of this project contained five chapters, one about the hardware design and testing, one about software design and testing, one about localisation and retrieval of the device in case it was lost or damaged, one about planning and motion and another about the ability of the wheelchair to interact with humans. This structure was only found in three dissertations (see Figure 5.26). The difference between four- and five-chapter System Design stages was in the function of the last chapter. In the four-chapter System Design, the last chapter did not include the methodological design of the project; this was discussed in the previous chapters. This type of System Design devoted a separate fourth chapter to the simulation and implementation of all previously designed components of the system. The five-chapter System Design, however, did not contain this chapter. Instead every chapter built on what had been designed and tested in the previous chapters. Table 5.16 provides a summary of the internal structure of all System Design stages found in USCE.

[12] AGC is an analogue circuit that prevents sudden changes in audio levels that may arise from variations in the recorded sound.
[13] Mixer is a device added to AGC to multiply its signals.

Table 5.16: The internal structure of the System Design stage in USCE

Software-Driven Research	Software and Hard-Driven Research	
Single-Chapter System Design (13) Simple	Multiple-Chapter System Design (72) Simple	Multiple-Chapter System Design (18) Complex
Software Design: Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion*	**Software Design:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* **Hardware Design and Overall Testing:** (43) Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* *With/without* **Separate Overall Testing Chapter:** (29) Introduction Simulation: *Results & Discussion* Implementation: *Results & Discussion*	**Part 1:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* **Part 2:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* **Part 3** (etc): Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* *With/without* **Separate Overall Testing Chapter:** (15) Introduction Simulation: *Results & Discussion* Implementation: *Results & Discussion*

The Theory and System Design stages in USCE did not end with a conclusion section. Unlike dissertations from ACE, the System Design in USCE was directly followed by the conclusion to the whole dissertation, without preparing the reader for the next chapter or summarising what had been discussed in the Theory or System Design stages. In contrast System Design stages in ACE ended with a brief conclusion section to clarify the overall function of individual chapters (see Figure 5.18). ACE contained only two four-chapter System Design stages, as shown in Figure 5.17. Both of these were from PE. This might be because ACE projects were not as complicated as USCE projects, again possibly due to differences in the availability of resources. The next section will look at chapters that represent the Conclusion stage in USCE.

5.2.1.5 Conclusion stage

The Conclusion stage was found in all 109 dissertations in USCE. As shown in Figure 5.29, the conclusions varied greatly in terms of word count. The shortest conclusion reported only on recommendations for future research, with a total count of 35 words: '*As part of future study, the interrogation of the samples with additional wavelengths from the visible and NIR spectrum will provide additional information regarding the optical properties of the polymer nanostructures'* (USCE-50). Overall, however, the conclusions in USCE (501 words on average) were longer than the conclusions of ACE (333 words on average).

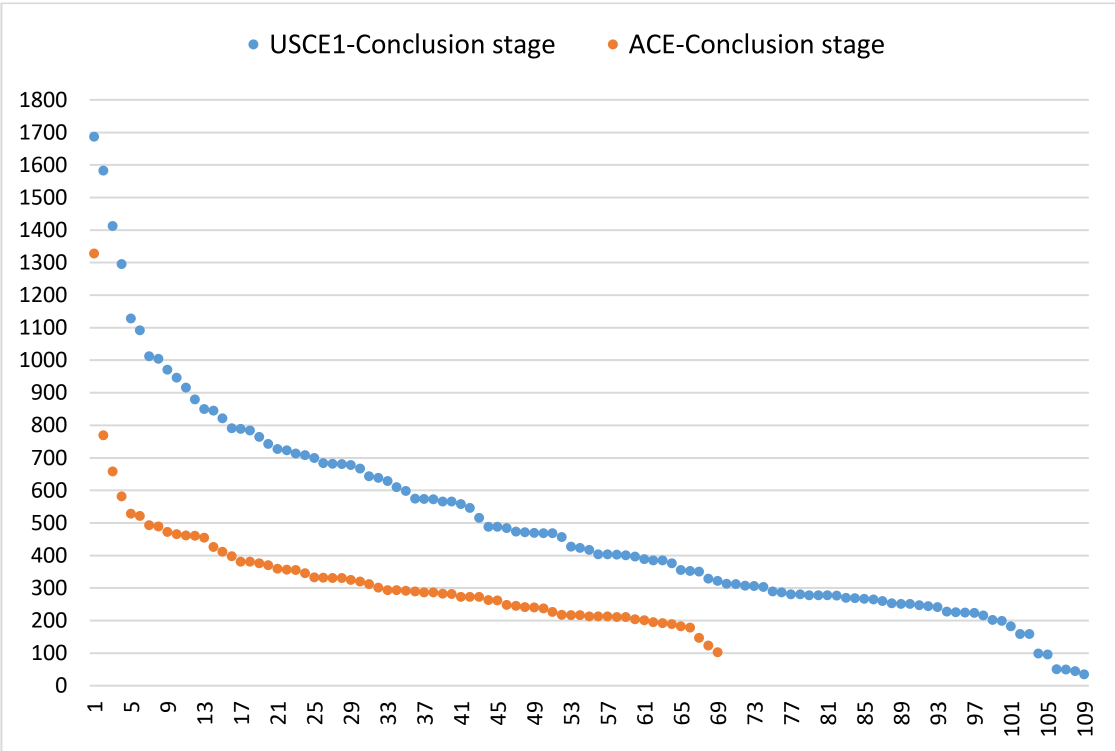


Figure 5.29: Word count distribution of the Conclusion stage in USCE and ACE

Table 5.17 shows the internal structure of all 109 Conclusions in USCE with reference to their steps and typical linguistic features. The steps in the conclusions occurred largely in the order shown.

Table 5.17: The internal structure of USCE Conclusions

Steps	Typical linguistic features	%
Restatement of the problem	'With technology scaling in nanometre regime IC technology is facing major barriers including high gate-leakage and switching power. 'There is a threat to the industry that the trustworthiness of integrated circuits may be compromised. The industry is moving towards finding a comprehensive solution to this problem'. 'The lack of cheap, robust mobile manipulators has prevented manufacturers from adopting them and has hampered research into mobile manipulation.'	18%
Structure of the conclusion	'This first section gives a summary of ...' 'The second section discusses some ...'	1%
Restatement of proposed work, research objectives, RQs.	'In this work we have developed a ...'. 'This thesis shows the flexibility of micro-grid management, using ... to ...'.	72%
Restatement of methods	'The performance of X was measured using ...' 'Encoding is used on the Arai fast algorithm for DCT computation to ...'	62%
Evaluation of methods, findings, design	'The results obtained suggests that ...', 'The current study provides evidence for the ...', 'The X was found to perform significantly better than Y' 'It was demonstrated that the proposed precoding scheme greatly outperforms the method in [35]'. 'The first approach gives close to 20% improvement in ...'	77%
Practical Implications	'Using this software, ABBY can pick up recognized objects and store them in an onboard carrying bin'. 'By doing this, the cost of the system can be reduced and BLDC can be more affordable'.	42%
Contributions	'The major contributions of this research are summarized below: ...'	10%
Limitations	'In addition, there are still some problem related to our model'.	8%
Recommendations for Future Work	'There are mainly two directions in which this work can be further expanded'. 'Potential future extension, related to the work presented in this thesis, include: ...'	85%

As shown in Table 5.17, the most common steps, occurring in more than half the conclusions, were 1) Restatement of the proposed work, research objectives, or research questions, 2) Restatement of methods, 3) Evaluation of methods, findings or design, and 4) Recommendations for future work. The shorter the conclusion was, the less likely it was for all the steps to occur. The longest conclusions were found in software and hardware-driven dissertations.

For example, USCE-102, which had the longest conclusion chapter, was concerned with the design and development of 'low-cost wireless small-sized Near-Infrared Spectroscopy (NIRS) Systems[14]'. The conclusion covered many points and also made recommendations for future research. As discussed previously (see Table 5.17), dissertations of this kind involve the design and implementation of multiple software and hardware components, so they must be longer in order to cover all the methods and all the suggestions for the improvement of the various parts. Most short conclusions were purely summaries of computational research, and only contained a few of the steps listed in Table 5.17.

Overall, there was more structural variation in the USCE dissertations than in the ACE dissertations. It is difficult to know exactly why some students in USCE decided to include a limited number of steps while others included more steps, to provide a clearer and more comprehensive summary of their project. A possible reason, however, might be that some universities pay close attention to both form and content and instruct their students to follow a certain format, whereas other universities do not. We do not know what grades the dissertations received, or what the career intentions of the writers were, but it is likely that some were more familiar with structure of research papers than others. The next section will report on stages that map onto the IMRD structure discussed in Chapter Two.

---

[14] NIRS system is defined in dissertation number USCE_102 as 'a non-invasive optical method that can measure physiological parameters such as blood volume and tissue oxygenation changes using light waves'.

5.2.1.6 Other stages

Six dissertations (USCE_04/21/22/24/25/102) had a stand-alone chapter for the methods and another stand-alone chapter for both the results and discussion. Examples of Methodology Chapter headings were: *'Chapter 3: Methods'*, *'Chapter 3: Research Methodologies'*, *'Chapter 3: Proposed methodology'*. In these cases, the general research methods were explained in detail in a single stand-alone chapter before the Results and Discussion chapter. The Methodology chapter was written in the past tense as a recount of the procedures followed, using statements such as *'This method allowed for flexibility in the …', 'First, the phantom is created from the …', 'The algorithm test bed used the phantom image for tests'*. We note from these statements that there was no reference to human agency.

The Results and Discussion chapter came immediately after the Methodology Chapter, and started by giving an overall structure of the analysis of the results chapter: '*The results are divided up into two different experiments. For our first experiment, the classifier was trained for 10,000 iterations. The second experiment allows the network to converge to have a mean-squared error (MSE) of 0.01'* (USCE21). This chapter also had a cyclical pattern, presenting and discussing the results of every experiment involved in the study. Example number 12 taken from USCE21 gives an example of the kind of language used in this chapter.

(12)
The next best features are the maximum and minimum values, giving 72.04% and 75.51% overall recognition. *This is surprising because one would think that* averaging statistics *would give a better* indicator of variation changes, but the maximum and minimum of the signals *give even better recognition*. *This may be due to the* maximum and minimum values *giving an even more* compressed range of signals for the classifier to process. (USCE-21)

In example 12, we see some evaluation (underlined) of the results. We can note the use of evaluative adjectives to comment on the findings such as in '*the next best feature', 'give even better recognition', 'this is surprising'.* The writer also tried to modify their commitment to claims through the use of hedging, as in *'this may be due', 'one would think that'.* This shows that the writer of the above example was expressing an opinion towards the research findings. These kinds of expressions are also found in ACE dissertations especially in the Conclusion stage where students evaluate their findings (see Section 5.1.1.3).

An important finding was that not many USCE dissertations followed the conventional IMRD structure discussed in Chapter Two, and that the majority followed the System Design structure, like the ACE dissertations.

5.2.2 Overall structure of the MSc dissertations in USCE

Figure 5.30 provides a summary of all structural options found in USCE. Unlike the ACE dissertations, there was considerable variation in the structural possibilities in USCE. Each letter in Figure 5.30 represents a different stage. The most common structure was Abstract (A), Introduction (I), Theory (T), System Design (S) and Conclusion (C), or AITSC. Unless presented in brackets, the letters shown in Figure 5.26 are stages presented in stand-alone chapters. For example, in the case of AI(B)TSC, the Background Section is part of the Introduction stage, the remaining stages (excluding the Abstract stage) are presented in at least one stand-alone chapter.

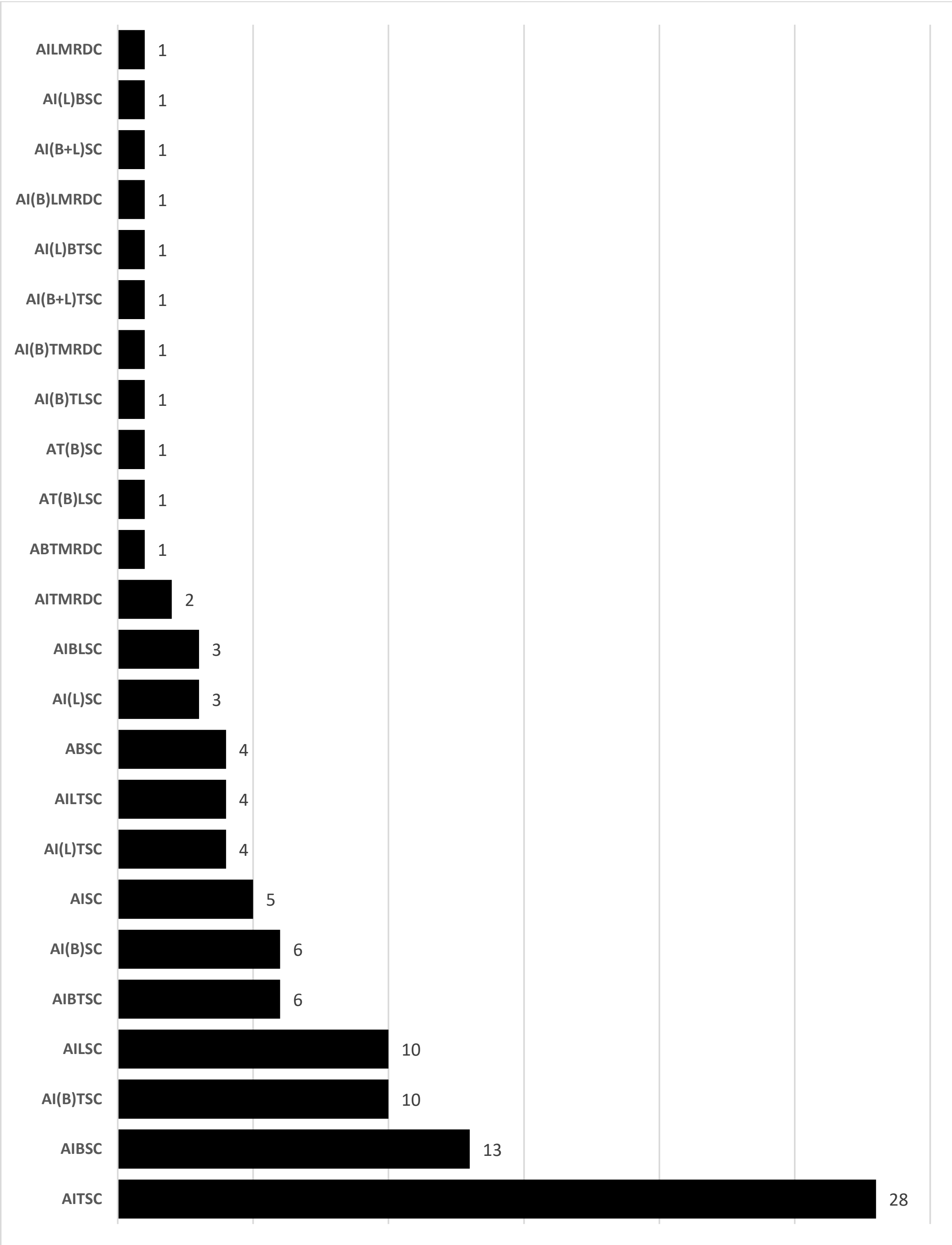


Figure 5.30[15]: Summary of all organisation structures found in USCE

[15] **A**: Abstract, **I**: Introduction, **B**: Background, **L**: Literature review, **T**: Theory, **M**: Methods, **R**: Results, **D**: Discussion, **S**: System Design, **C**: Conclusion (letters presented between brackets are sections within the previous stage).

As shown in Figure 5.30, derivative forms of the IMRD structure (i.e.: dissertations containing separate stand-alone Methodology, Results, Discussion and Conclusion stage - MRDC) were the least frequent. This finding is not in line with what was previously discussed in Section 2.4.1.1 with reference to Lin and Evans' (2012) findings. As previously stated, Lin and Evans found that 80.3% of the 433 RAs (23 of which from Electrical Engineering) follow derivative forms of the IMRD structure, with the ILM[RD]C being the most frequent. This might mean that the IMRD structure and its derivative forms are more applicable to RAs than to the MSc dissertations analysed in this thesis. Engineering writers of RAs follow the more common IMRD structure and its derivative forms (Lin and Evans, 2012) perhaps because they are writing for a different audience and for a different purpose.

As only six dissertations (out of 109) are derivative forms of the IMRD structure, they are not included in Table 5.18 which gives a summary of the overall structure of the 103 remaining MSc dissertations with Design Specification structure in USCE.

Table 5.18: Overall structural model of the MSc dissertations in USCE

<table>
<tr><th colspan="3">Abstract (100%):</th></tr>
<tr><td colspan="3">Introductory statements (Claiming centrality and Making topic generalisation),
What the research is about (Aim), How the research is carried out (Methods).</td></tr>
<tr><th colspan="3">Introduction (98%):</th></tr>
<tr><td>Without the Literature Review
and Background stages (32%)</td><td colspan="2">With Literature review
and background stages (66%)</td></tr>
<tr><td>Chapter One: Introduction
Introduction,
Motivation of the study,
Research objective,
Contribution of the study,
Outline of the study.</td><td colspan="2">Chapter One: Introduction
Introduction and Background (19%), or Literature review (8%), or
Background and Literature review (1%), and Motivation of the study,
Research objective, Contribution of the study, Outline of the study.

With/without

Chapter Two: Background (20%) or
Chapter Two: Literature review (15%) or

Chapter Two: Background and Chapter Three: Literature review (3%)</td></tr>
<tr><th colspan="3">Theory (56%):</th></tr>
<tr><td colspan="3">Single-chapter (38%), Two-chapter (8%), Three-chapter (8%) and Four-chapter (2%)</td></tr>
<tr><th colspan="3">System Design (94%):</th></tr>
<tr><td>Software-driven Research (12%)</td><td colspan="2">Hardware- and Software-driven Research (82%)</td></tr>
<tr><td>Single-Chapter
System Design</td><td>Multiple-Chapter
System Design (Simple, 66%)</td><td>Multiple-Chapter
System Design (Complex, 16%)</td></tr>
<tr><td>Software Design:
Introduction,
System Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.</td><td>Software Design:
Introduction,
System Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

Hardware Design and overall
Testing (39%):
Introduction,
System Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

With/without

Separate Overall Testing
Chapter (27%):
Introduction,
Simulation: Results & Discussion,
Implementation: Results & Discussion.</td><td>Part 1 …etc:
Introduction,
Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

Part 4 (14%):
Introduction,
Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

With/without

Separate Overall Testing
Chapter (3%):
Introduction,
Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.</td></tr>
<tr><th colspan="3">Conclusion (100%):</th></tr>
<tr><td colspan="3">Restatement of the problem (18%); Restatement of the proposed work/solution to the problem (72%); Restatement of methods (62%); Evaluation of methods, findings, design (77%); Practical implications (42%); Contributions (10%); Limitations (8%) and Recommendations for future research (85%).</td></tr>
</table>

5.3 General Conclusion

The structure of dissertations in both corpora was found to be similar to the Design Specification structure for Engineering students' lab reports, discussed in Nesi and Gardner (2012), rather than the more conventional IMRD structure and its derivational forms which are typically found in RAs (West, 1980; Heslot, 1982; Hill et al., 1982; Posteguillo, 1998; Swales, 1990; Geerts, 2011; Lin and Evans, 2012). The Design Specification structure is made up of five main stages: Abstract, Introduction, Theory, System Design and Conclusion. Although both corpora had these five main stages, the Algerian MSc dissertations were shorter than their American counterparts. I found that the reason for this was the existence of extra stages and steps within stages in the United States Corpus of Engineering (USCE).

First, while both corpora had an Abstract stage, the average word count of the American abstracts (239 words) was almost twice that of the Algerian abstracts (126 words). The American abstracts were generally longer because they had two steps which the Algerian abstracts did not have ('Claiming centrality' and 'Making topic generalisations'). The Algerian abstracts started by directly reporting on the aim and methods without introducing the topic. 'Claiming centrality' and 'Making topic generalisation' are steps which are typically found in RA introductions (Swales, 1990; Kanoksilapatham, 2005, 2007, 2011, 2012, 2015). Their existence in the American abstracts of MSc dissertations might reflect a transfer of RA writing conventions to MSc dissertations, perhaps due to the American students' exposure to RAs. This strengthens the point made in Chapter Two about the influence of RA writing on other research genres.

A second difference was that the introductions to the Algerian dissertations were also shorter (average 646 words) than the American introductions (average 1,608 words), as shown in Figure 5.21. Unlike the American introductions, which were written in extended stand-alone chapters, the majority of the Algerian Introductions (62/70) were written as one short section within another chapter. Overall, the moves and steps structure in the 62 Algerian introductions mapped onto the CARS models (Swales 1990 and 2004) discussed in Chapter Two, but they did not contain all the steps identified in previous studies of MSc dissertations and PhD theses (Dudley-Evans, 1986; Bunton, 1998; Bunton, 2002; Samraj, 2008). The steps found in the Algerian introductions were 'Claiming centrality', 'Making topic generalizations', 'Indicating a problem', 'Announcing present research in general terms', and 'Dissertation structure', as shown in Section 5.1.1.2 of this chapter.

The eight introductions which were written as extended stand-alone chapters contained the following sections, ordered in terms of sequence and frequency: 'Overview' (8/8), 'Literature review' (2/8), 'Problem statement' (2/8), 'Motivation' (5/8), 'Project objectives' (4/8), 'Organisation of the report' (5/8).

These eight Algerian introductions were more similar to their American counterparts in terms of section labelling. The most common sections in terms of sequence and frequency in the 102 stand-alone one-chapter USCE Introduction stages were 'Introduction' (60%), 'Background' (21%), 'Literature review' (9%), 'Motivation of the study' (34%), 'Research Objectives' (14%), 'Contribution of the study' (24%), and 'Outline of the study' (57%), as shown in Table 5.11. The main difference between the two corpora, however, was that 66% of dissertations in USCE contained a Background and/or a Literature review, as shown in Table 5.12, presented as stand-alone chapters or as sections within the Introduction stage. Previous studies, discussed in Chapter Two, have not noted the distinction between Background and Literature review sections in Introductions to theses and dissertations.

The third area of difference related to the Theory stage, which was realised in single or multiple chapters in both corpora. I found cross-disciplinarily differences in the size of the Theory stage in ACE. Computer Engineering and Control Engineering students generally wrote longer Theory stages compared to Telecommunication Engineering and Power Engineering students, whereas students of these last two sub-disciplines wrote longer System Design stages.

The reason for these differences, as noted, may be cost-related. Research in TE and PE often requires the use of expensive components in the construction or prototyping phase of projects TE and PE students might therefore have tended to write more in the Theory stage to demonstrate their mastery of the theoretical framework, sometimes only conducting computational simulations because they did not have the resources to build prototypes of physical artefacts. In contrast, research in CE and OE tends to require less expensive components, so perhaps this was why in these disciplines the students wrote more in the System Design than the Theory stage, as shown in Figures 5.9 and 5.14.

Overall, the Algerian dissertations had slightly longer Theory stages (on average 3,792 words) compared to their American counterparts (on average 3,052 words), as shown in Figure 5.23. Any interpretation of these findings should, however, consider the fact that, while the Theory stage was found in all dissertations of ACE, it only occurred in 56% of dissertations in USCE. This reflects the clear importance of the Theory stage in the Algerian dissertations.

Apart from six dissertations in USCE, all the dissertations in both corpora contained the System Design stage. Like the Theory stage, the System Design stage can be realised in either single or multiple chapters. The System Design stages in the Algerian dissertations were typically shorter (average 3,697 words) than their American counterparts (average 5,160 words). This might mean that the American universities provided more support to their students (at least financially) which gave them more opportunities to construct and test their projects in real life. American universities tend to offer more options regarding the way a Master's degree is obtained. For example, graduates can often choose either to write an MSc dissertation or instead take additional courses to make up credits for their degree, a point I confirmed by the graduate technical communications specialist Joanne Lax from Purdue University (personal communication). This administrative flexibility, may reduce the supervisory pressure on subject lecturers have the consequence of shifting students' focus from Theory writing to System Design writing.

At the System Design stage, a distinction was noted between purely software-driven research and mixed hardware- and software-driven research. This has not been mentioned in prior studies of Masters' dissertations and PhD theses, perhaps because these studies were not discipline-specific (Dudley-Evans, 1986; Dong 1998; Bunton, 1998; Dudley-Evans, 1999; Thompson, 1999, 2001; Bunton, 1998, 2002; Paltridge, 2002; Samraj, 2008). Purely software-driven System Design stages were presented in single chapters and were particularly common in TE (71%) and PE (57%) ACE dissertations (see

Figure 5.13). Mixed hardware- and software-driven System Design stages were presented in multiple chapters in ACE and USCE. The size of the System Design stage seemed to be affected by the complexity of the project and the existence of a separate final chapter discussing the findings and their implementation.

The Conclusion stage was found in all the dissertations in both corpora. The Algerian conclusions were less structurally varied than the USCE conclusions (see Table 5.5), perhaps because the USCE dissertations came from a range of universities whereas the ACE dissertations came from just one university. The Algerian conclusions were also shorter (average 333 words) than their American counterparts (average 501 words), perhaps due to the fact that the American conclusions had some extra steps such as *'Restatement of the problem'* (found in 18% of dissertations) and *'Contributions'* (found in 10% of dissertations). It is worth noting that these two steps were not identified in Bunton's analysis of conclusions in Science and Technology theses (1998, 2005), shown in Table 2.9.

The main reason why the American conclusions were longer, however, is that American students wrote more in steps such as *'Restatement of methods'*, *'Evaluation of methods, findings, design'* and *'Recommendations for future research'*. The *'Recommendations for future research'* occurred in 85% of all Conclusions in USCE compared to only 21% of all Conclusions in ACE, which might suggest that the American students were more oriented towards further study beyond MSc level.

In this chapter, we have seen that although both corpora had (more or less) a shared overall Design Specification structure, they differed in a number of aspects such as their length and the amount of detail students included at each stage. The most important differences in the analysis of ACE and USCE are the overall tendency to identify a gap in the literature emphasized in USCE compared to the general focus on addressing a real-world problem in ACE. Another point is the critical evaluation of the prior research in USCE. These differences seem to be affected by many factors such as cost-related constraints, the nature/complexity of the project, and perhaps also the future orientation of students after graduation. All of these findings help to support the argument that the writers of Engineering MSc dissertations in the medium of English in Algeria are more oriented towards practice compared to their American counterparts.

Chapter 6
Lexical Bundles Analysis
In ACE and USCE

6. Introduction

This chapter explores the distribution, structure and function of the most frequent 4-word strings, or Lexical Bundles (LBs; see Sections 2.5 and 3.4.3) found in my corpora. This chapter is divided into two sections: the first explores the distribution, structure and function of lexical bundles in the two corpora (ACE and USCE). This cross-corpus comparison aims to show any regional differences in terms of the distribution, structure and function of LBs, which may give insights into phraseological differences in the Algerian dissertations compared to their American counterparts. The second section focuses on differences in the distribution, structure and function of LBs within ACE (i.e.: across the four sub-disciplines: Power Engineering, Control Engineering, Computer Engineering and Telecommunication Engineering). It is worth mentioning that the second section has been published in Rezoug and Vincent (2018). The detailed analysis of LBs across the four sub-disciplines aims to identify sub-disciplinary sensitivity to LBs which might have pedagogical implications related to MSc dissertation writing.

Before starting reporting on the results, it is worth recalling that the selection criteria of 40 times per million words (pmw) and range across 20% of texts is applied on the total number of texts in each sub-discipline and across the two corpora as previously discussed in Section 3.4.3.

6.1 Analysis of distribution, structure and function of LBs in ACE and USCE

This section is divided into three parts. Part one discusses the distribution of LBs in ACE and USCE with reference to types and tokens. Part two addresses the structural classification of LBs in ACE and USCE. Part three addresses differences in the functional classification of LBs in the two corpora.

6.1.1 Distribution of lexical bundles in ACE and USCE

Using the thresholds mentioned earlier, 69 types and 2923 tokens of LBs were retrieved from ACE (596,817 words) and 42 types and 3327 tokens were retrieved from USCE (1,094,737). Although both ACE and USCE contain similar numbers of LBs, ACE dissertations contain considerably more different types of LBs than USCE.

Table 6.1 shows the 20 most frequent 4-word bundles in ACE and USCE in order of frequency. It also gives an idea of the extent of the overlap in terms of bundle use across the two corpora. I have indicated high frequency bundles that occur across the two corpora (bundles in **bold** occur in both corpora).

Table 6.1: The top 20 most frequent 4-word bundles in ACE and USCE (bundles in bold occur in both lists)

ACE	USCE
as shown in figure	**as shown in figure**
is shown in figure	**is shown in figure**
in this chapter we	**the output of the**
can be used to	**can be used to**
as shown in fig	can be seen in
with respect to the	**as shown in fig**
the output of the	**the size of the**
one of the most	**the performance of the**
in the case of	**in the case of**
we are going to	on the other hand
the performance of the	are shown in figure
is one of the	is shown in fig
shown in figure the	it can be seen
is based on the	as well as the
as shown in the	at the end of
the size of the	are shown in table
the position of the	in terms of the
as well as the	with respect to the
is defined as the	as a function of

The most striking aspect of Table 6.1 is the number of bundles found that involve writers referring to data contained in figures. This reflects the fact that these Engineering students frequently present and discuss their results in reference to visual data, a point also made by Hyland (2012). Indeed, overall, it seems that there is quite a large degree of similarity across the two corpora

(ACE and USCE). Apart from the 8 shared bundles, we also note the prevalence of the verb '*shown'* followed by the preposition *'in'* in both corpora which reinforces the point made in Chapter Five that Electrical and Electronic Engineering students discuss their findings with frequent reference to visual data. As discussed in Section 5.1, the average number of figures in ACE dissertations is 39 (42 in CE, 40 in TE, 37 in OE and 36 in PE) which is almost a figure per page. The functional analysis carried out below reveals more details regarding bundles used to refer to visual data.

Although there appear to be many similarities across the most frequent bundles retrieved from the two corpora, it is important to see if these apparent similarities are reflected in more detailed analysis of all bundles retrieved. To this end, the next section will examine the grammatical structures of all retrieved LBs from ACE and USCE.

6.1.2 Grammatical structure analysis of LBs in ACE and USCE

The structural investigation of bundles in Algerian MSc dissertations follows the classification scheme set out by Biber et al. (1999), previously discussed in Chapter Two (see Figure 2.10). Figure 6.1 presents the results for all LBs retrieved, using the thresholds discussed earlier, and Biber et al.'s (1999) scheme, shown in Table 2.10.

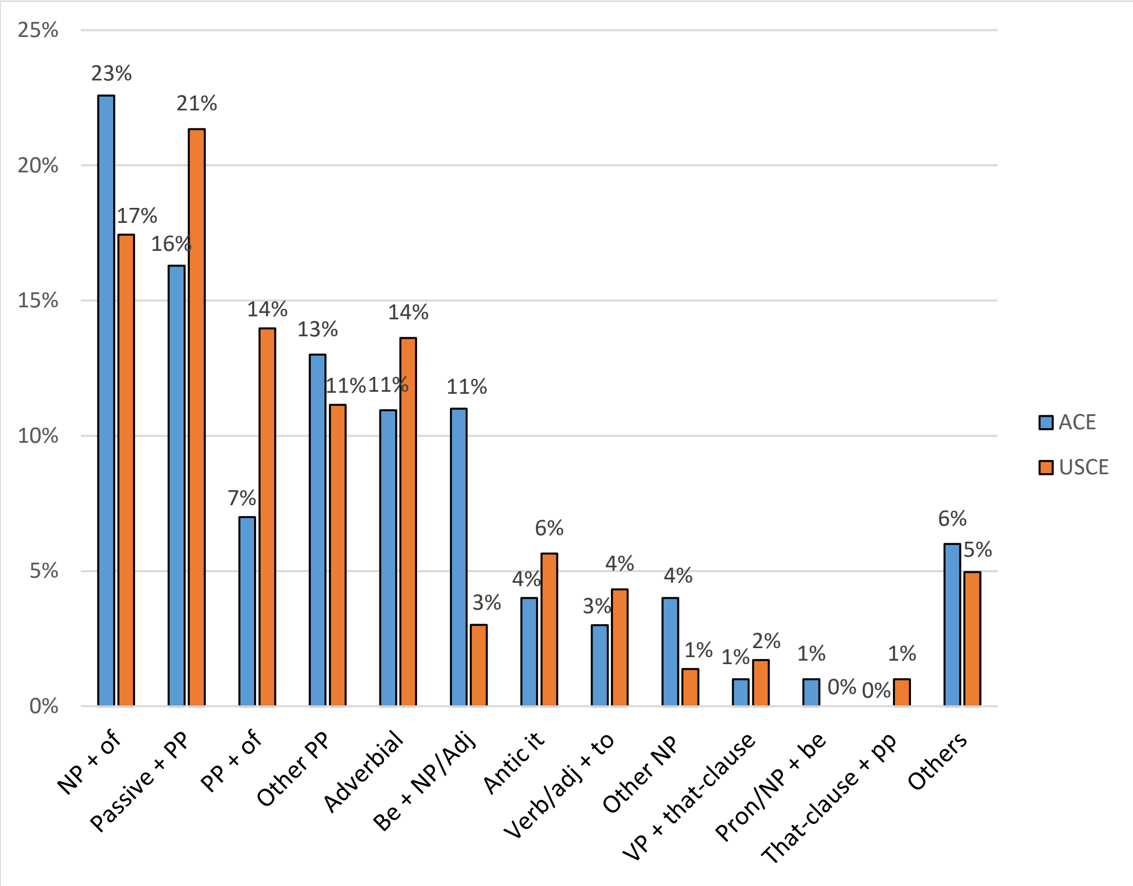


Figure 6.1: Proportions of structural types of bundles in ACE and USCE using Biber et al's (1999) classification scheme.

As shown in Figure 6.1, there were many differences between ACE and USCE in terms of the proportions of LBs retrieved falling into different structural categories. One of the most striking findings shown in Figure 6.1 was the high proportion of *NP + of* bundles in ACE compared to USCE. *NP + of* bundles include those that express a descriptive and/or a quantification function *(e.g. 'the speed of the', 'the size of the', 'the position of the', 'the effect of the').* The pattern for this type of bundles was typically *'the + noun + of + the'.* Conducting a search with all bundles of this type in AntConc[16] showed that this bundle was

[16] I used a wild card (*) to retrieve and count all examples that fitted this pattern '*the * of the'* in all stages of ACE and USCE

highly common in the Theory and System Design stages of both corpora (ACE and USCE) and relatively infrequent in the other stages, as shown in Figure 6.2.

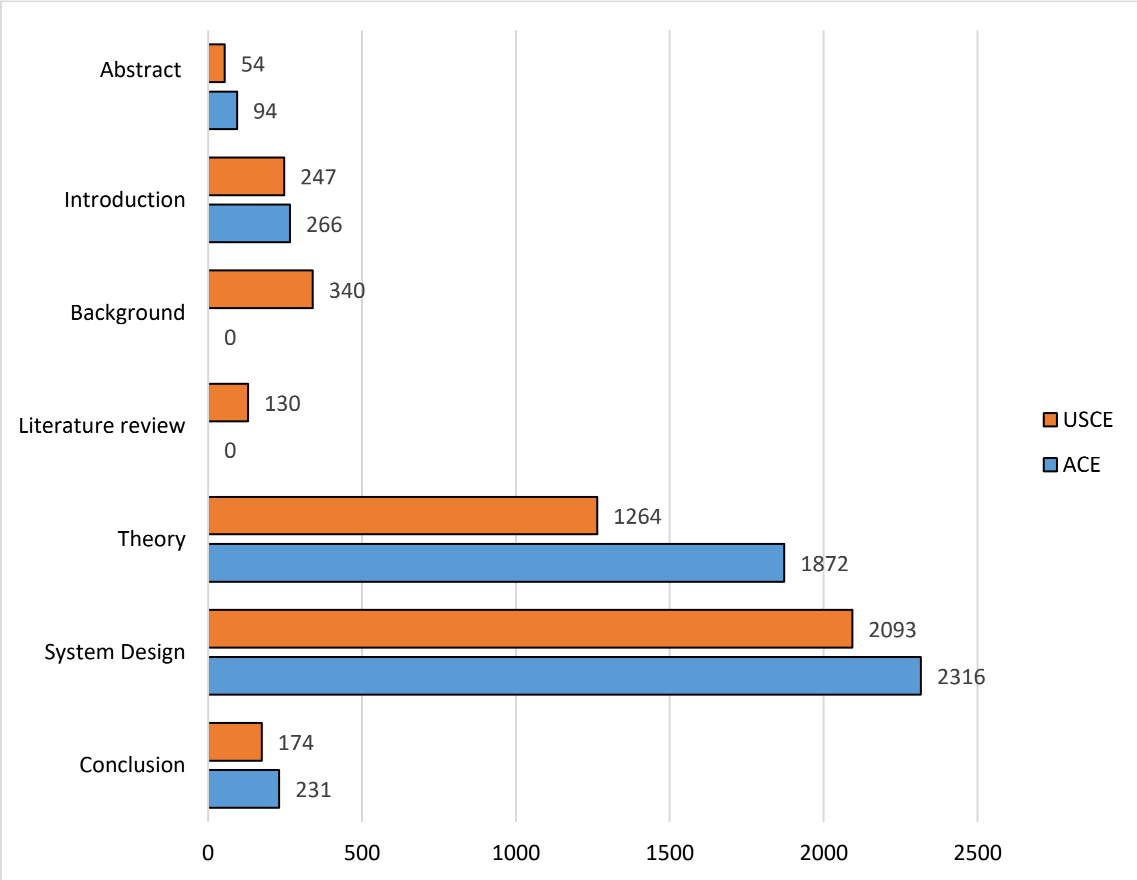


Figure 6.2: Normalised frequencies (pmw) of all '*NP + of*' bundles and their distribution across the main rhetorical stage of ACE and USCE.

As shown in Figure 6.2, a significant number of *NP + of* bundles occur in the Theory and System Design stages. We can also see that this structure was far more common in the Theory stages of ACE. The reason for this might be because all 70 of the ACE dissertations contained a Theory stage, whereas only 61 out of the 109 dissertations of USCE contained a Theory stage, as discussed in Chapter Five.

Similarly, as shown in Figure 6.1, ACE contained a higher proportion of '*Other NP'* bundles (e.g.: *'the difference between the', 'the fact that the', 'one of the most'*). Some contexts for LBs with the *Other NP* structure from both corpora are shown in examples a) and b) below.

a) *'Given the fact that the free space is one connected component in the grid, the Dijkstra-algorithm will visit all the free cells and computes their navigation field vector' (ACE-CE8)*.

b) *'Rotating machines are one of the most important actuators not only in the industrial applications but also in every day applications' (USCE9).*

As shown examples a) and b) these bundles give more descriptive information. Examples c) and d) provide contexts for '*NP + of'* LBs from both corpora:

c) '*Therefore, the speed of the system response will be small to reduce the overshoot of the output' (ACE-CE4).*

d) *Factors like Peukert's Law and changes in temperature will also affect the performance of the battery. In a more sophisticated system, taking a measurement of the actual battery capacity at every iteration would yield greater accuracy in the controller (USCE2).*

Both of the structural types occur more in ACE dissertations compared to their American counterparts, with *'NP + of'* bundles being around six times more frequent than '*Other NP' bundles,* as shown in Figure 6.1. As Figure 6.2 shows, the highest proportions of these bundles are found in the Theory and System Design in both corpora. We can say that overall both sets of Engineering students, especially those represented by USCE, avoid writing *NP* forms of bundles followed by the proposition '*of'.* 'NP + of' structures tend to occur in dense, succinct text – the frequency of the *NP + of* was used by Marco (2000) as a sign of lexical density. 'NP Other' structures might be more discursive, and might be linked to a more clausal complex style (more common in the humanities) as opposed to a dense phrasal complex style (more common in the sciences), (Gardner, Nesi & Biber 2018). However, perhaps the more indicative of systematic differences in the grammatical structure of bundles in ACE and USCE were those found between preposition-based phrases followed by *of (*i.e. *PP + of*, e.g. *in the field of, at the end of)* and in passive constructions followed by prepositional phrases (i.e. *Passive + PP*, e.g. *is shown in Figure*). In both types of structures, USCE dissertations had higher proportions of bundles than ACE, as shown in Figure 6.2. Before moving to the functional analysis of LBs across both corpora, some initial comments can be made which can help us understand more about these structural differences.

To start with, let us consider first the apparently low figure of '*PP + of'* bundles which was twice as high in USCE (14%) as in ACE (7%) with a frequency of 425 pm and 337 pmw, respectively. The most frequent bundle with this structure in both corpora is '*in the case of'* with a normalised frequency of 94 pmw in USCE and 50 pmw in ACE. Some contexts for this structural type of LB from both corpora are shown in e) and f) below.

e) *'<u>In the case of</u> no object, the light is never reflected and the reading shows no object*', (*ACE-OE14)*.

f) '*<u>In the case of</u>* low idle speed, this band is critical as a large drop from reference speed could cause the engine to stall' (USCE5).

From examples e) and f) 'in the case of' is used to express conditional meaning. In other words, *if the X situation occurs the Y situation will occur*.

The 'Passive + PP' bundles, on the other hand, was the third most frequent structure, with only a slight contrast between ACE and USCE. In terms of proportion, *'Passive + PP'* made up 21% of the total bundle types in USCE with a normalized frequency of 649 pmw, compared to 16% in ACE with a normalized frequency of 798 pmw. Table 6.2 shows a summary of all retrieved bundles which were classified as *PP + of* and *Passive + PP* ordered in terms of frequency. Bundles in bold or underlined were shared by ACE and USCE.

Table 6.2: Summary of all of the most frequent '*PP + of*' and '*Passive + PP'* bundles found in ACE and USCE

ACE		USCE	
PP + of	*Passive + PP*	*PP + of*	*Passive + PP*
in the case of	is shown in figure	**in the case of**	is shown in figure
at the end of	shown in figure the	**at the end of**	can be seen in
to the number of	is based on the	in terms of the	are shown in figure
of the system the	is defined as the	as a function of	is shown in fig
of this project is	are shown in figure	in the form of	are shown in table
in the field of	used in this project	for each of the	can be found in
	shown in the following	to the number of	is based on the
	is connected to the		
	can be divided into		
	shown in the figure		

As we can see in Table 6.2 bundles located at the top of the table in both corpora depend highly on two prepositions (i.e.: '*in'* and '*at').* Like *NP + of* bundles, *PP + of* bundles occur most in the Theory and System Design stages. In the Theory stage they are used to express conditional statements where something will be affected or changed in the case of a specific situation. Conditional statements are important in the Theory stage because they help to explain the working principle of software and hardware components and how they react in different environments.

It is also worth looking at bundles consisting of the frame '*at + (the) + noun + of*' as they are used differently depending on the stage they are found in. Some contexts are shown in examples g) and h) below.

g) *'At the end of each trial, the robot's estimated position, as measured by the odometry system, was recorded'* (USCE10).

h) *'At the end of this project, we concur that there is still work to be done and enhancements to be made to further improve this study' (ACE-PE15).*

'*At + of*' bundles are usually used either to indicate what Hyland (2008) refers to as a '*Process Signal'* as in example *g)* where students explain what has been done, or as a *'Structural Signal'* as in example h) where students help the reader understand the structure of the project. The noun in '*at + the noun + of*' was *end* in both corpora. No other nouns were found to fit this structure. More about the function of these LBs will be discussed in Section 6.1.3. Because of the dual function of these bundles they can be found in the Conclusion, as in example h), or in the System Design stage, as in example g).

As shown in Table 6.2, although ACE dissertations contain a number of variations of *'Passive + Of'* bundles, both corpora have high frequencies of passive constructions with *shown* (e.g. *is/are shown in figure/fig*). To show in which stage these bundles occur the most, I used AntConc wide card to retrieve all '*is/are * in figure/fig'* bundles across the main stages in ACE and USCE. The normalised (pmw) frequencies are shown in Figure 6.3. Other past participles *(e.g.: illustrated, demonstrated, presented)* also occur in this pattern. However, these forms remain relatively infrequent compared to *shown.*

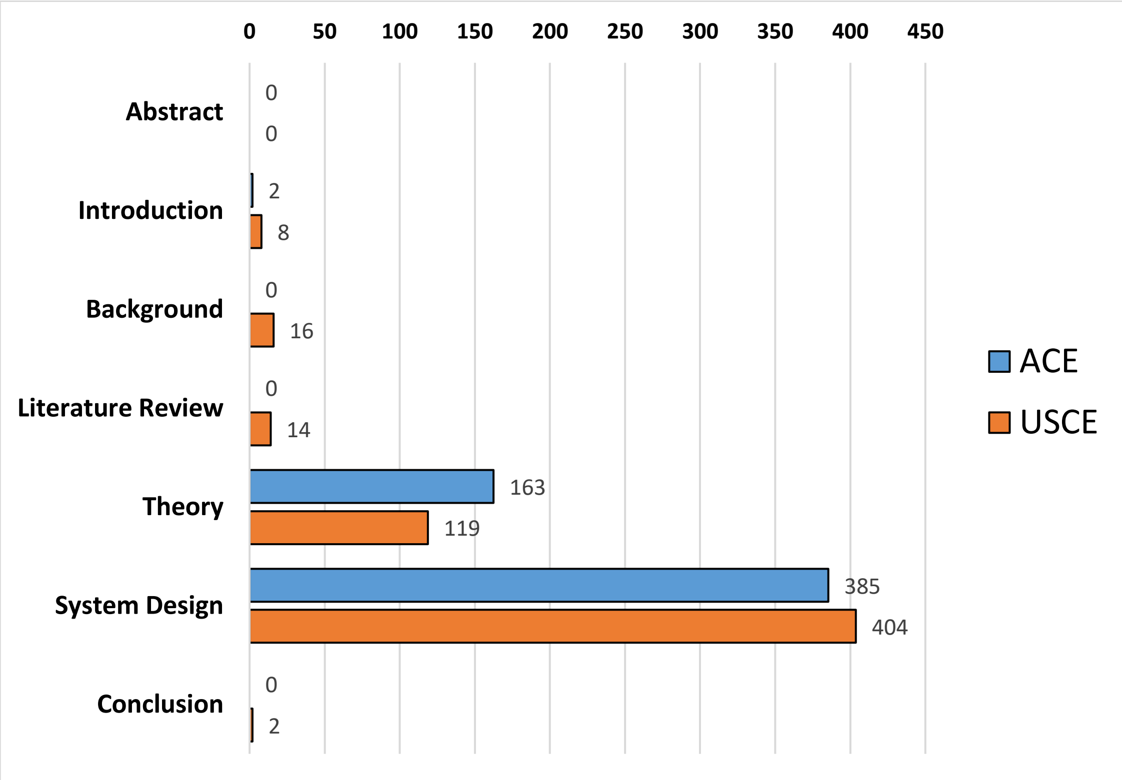


Figure 6.3: Normalised frequencies (pmw) of all 'is/are + past participle + in figure/fig' bundles and their distribution across the main rhetorical stage in ACE and USCE.

As shown in Figure 6.3, the Theory and System Design stages contain the highest frequencies of *'is/are + (past participle) + in figure/fig'* bundles which express *'Structural Signals'* (Hyland, 2008). This is expected because these two stages are where students distribute all their visuals to support their research. Overall, the System Design is where engineers present and discuss their results using descriptive and quantification language with the use of visual data.

A similar point is in the use of the past participle '*shown'* is found in adverbial constructions which are also amongst the best represented structural types of bundles in both corpora, as shown in Figure 6.1. Although *Adverbial* bundles are slightly higher in proportion in USCE (14%) compared to in ACE (11%), as shown in Figure 6.1, they are more frequent and variable in terms of types in ACE compared to USCE. The same three *Adverbial* constructions of bundles were retrieved from ACE and USCE, all with the past participle *shown (as shown in figure/fig, and as shown in the) - 'as shown in figure'* was the best represented bundles with this structure occurring 332 pmw in ACE and 263 pmw in USCE. This result mirrors that for '*Passive + of*' bundles, where the most frequent verb was also *shown*. It supports the point that due to the technical nature of the discipline, Engineering students discuss their research with high reference to visual data.

Another apparent contrast is in the proportion of '*be + NP/Adj'* bundles in ACE (11%) and USCE (3%), as shown in Figure 6.1. This type of structure is also largely used for descriptive and quantification purposes *(e.g.: 'is one of the', 'is the number of', 'is equal to the').* The higher use of these bundles in ACE may indicate the importance of quantification and precision to the Algerian students. The remaining structures presented in Figure 6.1 are relatively infrequent in both corpora with slight variations, with the *'Other'* category still holding a relatively small proportion of unclassified bundles which did not fit in any of the categories found by Biber et al. (1999) or Hyland (2008).

Overall, the structural analysis shows many differences in the LBs in ACE and USCE, indicating that though from the same disciplines the MSc dissertations from these two groups contain different forms of lexical bundles. Although there is no clear reason for these differences, this may be due to the overall structure of the MSc dissertations, which were shown to be different in Chapter Five.

To better understand the differences between the two corpora, the next section will explore in detail the function of the identified lexical bundles in ACE and USCE.

6.1.3 Functional analysis of LBs across in ACE and USCE

This section explores the function of LBs retrieved from ACE and USCE. Functional analysis helps us to understand the meanings that students express more frequently and can build on the insights already arrived at in the structural analysis.

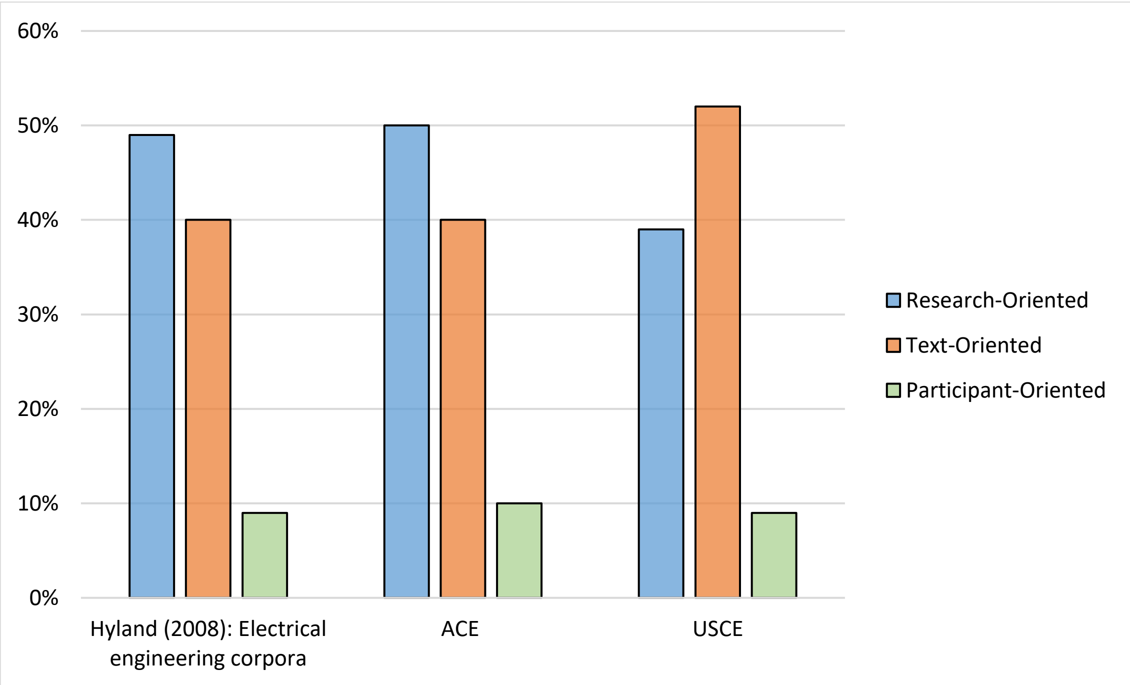


Figure 6.4: Distribution of functional types of bundle by percentage of total in ACE, USCE and Hyland's (2008) Electrical Engineering corpora[17].

[17] Hyland's (2008:8) Electrical Engineering corpus contains MSc dissertations (190,000 words), PhD theses (334,800), and RAs (107,000 words).

Figure 6.4 shows the comparison by main bundle function in ACE and USCE; Hyland's (2008) results relating to his Electrical Engineering corpus (632,500 words) are also included for the purposes of comparison. However, some caution must be expressed regarding comparisons with Hyland's findings. First, Hyland's Electrical Engineering texts also include RAs and PhD theses. Second, Hyland's thresholds are not as strict as the ones used in this study, which explains the large number of bundles he retrieved. This note of caution notwithstanding, it is interesting to note which categories differ considerably from Hyland's (2008) findings for Electrical and Electronic Engineering writing (see Figure 6.8).

Surprisingly, we can see a great degree of similarity between ACE and Hyland's findings, although Hyland's Electrical Engineering texts also include PhD theses and RAs in addition to MSc dissertations. There is no clear reason for this especially without access to Hyland's lists of bundles for each genre. However, there are some fairly significant differences between USCE and these two corpora. Around half of the total percentage of bundles found in ACE and Hyland (2008) were classified as RO, with TO accounting for around 40% and PO at about 10%. In contrast, 52% of bundles in USCE were classified as TO, with RO making up around 40% and PO bundles accounting for around 10% of the total. Thus, while PO bundles are the least frequent in all cases, the contrasting results for RO and TO across the three cases are interesting from several different perspectives.

First of all, bearing in mind the differences in the size and the structure of the dissertations in ACE and USCE, outlined in Chapter Five, it is logical that

USCE dissertations should contain more TO bundles in contrast to ACE, which contains more RO. The fact that USCE dissertations were found to be longer and contain more stages (i.e. *Background and Literature review*) than ACE suggest that USCE writers might have added more TO bundles to help orient the reader throughout the dissertation. On the other hand, the smaller size and focused, technical nature of ACE dissertations compared to USCE may be what led to higher proportions of RO bundles in the Algerian dissertations. Although the proportions of the three functional classification of bundles in ACE and Hyland‘s corpus of Electrical Engineering are almost identical (as shown in Figure 6.4), we cannot know exactly the proportions of bundles found in Hyland’s MSc dissertations because he reported only the amalgamated results of the three genres. One would assume, for example, that because PhD theses are longer than MSc dissertations and RAs, they would therefore be expected to use more TO bundles.

PO bundles consist of *Stance* and *Engagement signals*, and are more associated with advanced genres such as PhD theses and research articles (Biber et al., 1999). However, the proportion of PO bundles in Hyland’s corpus is not higher than in ACE or USCE, as shown in Figure 6.4. As Hyland’s analysis of LBs also included RAs and PhD theses, one would expect higher use of PO bundles. Hyland points out that the generally low use of PO bundles in his texts could be due to the first language of the writers, as all his MSc and PhD texts were produced by Cantonese-speaking students from universities in Hong Kong. However, another possible argument could be that PO bundles are more associated with advanced genres in the Health and Social Sciences, rather than Electrical Engineering. It appears that PO bundles occur with equal frequency in Electrical Engineering dissertations, theses and RAs, although Without Hyland's lists of bundles this argument remains as speculation which cannot be investigated further.

It is also important to consider the differences in the functional sub-types of bundles in order to identify the dominant from the underrepresented sub-types in each case. Therefore, in what follows each major function will be broken down into multiple sub-types. As I do not have access to Hyland's (2008) Electrical Engineering dissertations, I will only report on normalised frequencies (40 pmw) in ACE and USCE.

6.1.3.1 Research-oriented (RO) bundles in ACE and USCE

As Figure 6.4 shows, RO bundles played an important role in the two main corpora, especially ACE, where they accounted for 51% of all bundles. As noted already, the prominence of bundles expressing this function is in itself unsurprising as it has already been noted in Hyland's (2008) research. It is worth noting that although reporting on proportions of all types of bundles allows for a comparison across the three corpora, it can remove a quantitative aspect of comparability otherwise found through normalised findings.

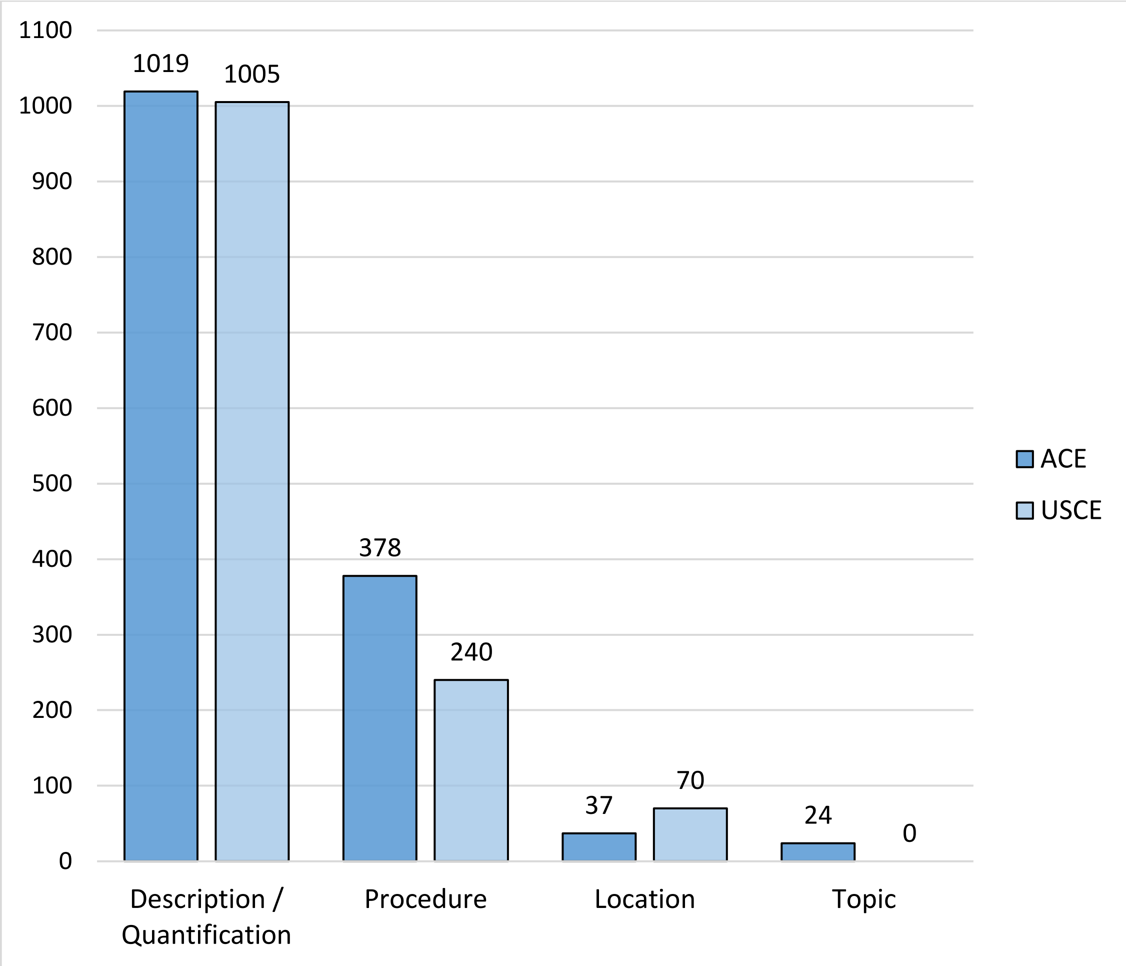


Figure 6.5: Normalised (40 pmw) frequencies of RO bundles in ACE and USCE

We can also see in Figure 6.5 that the distribution of the different sub-types of RO bundles varied somewhat between ACE and USCE. However, the overwhelming majority of bundles in both corpora functioned as 'Description/ Quantification' bundles (e.g. '*is equal to the', 'the total number of', 'the effect of*'). This strengthens the point previously discussed in Section 6.1.1 that '*NP + Of'* and '*Other NP'* bundles are used for descriptive and quantification purposes. As expected, these bundles occurred in both the Theory and System Design stages, but more frequently in the System Design stage where students design, simulate and implement their projects.

The clearest variation was seen in 'Procedure bundles' (e.g. *'is based on the', 'the implementation of the', 'used to control the', 'can be divided into'),* which were far more frequent in ACE compared to USCE. This sub-function of bundles was found more frequently in the Theory stage in ACE where students try to explain working principles of mechanisms and their sub-components (see Section 5.1.1.4). As ACE dissertations had slightly longer Theory stages than USCE, as outlined in Figure 5.23, it makes sense that 'Procedure bundles' were found more frequently in ACE. This might also suggest that USCE dissertation writers did not work as hard to explain the procedures taken in their projects, or at least did not rely on such conventionalised phraseology to do so.

Although it is also clear that 'Location' bundles – which include bundles indicating time (e.g. '*in the beginning of*') or place (e.g. '*in this study we')* – were a minor sub-type in terms of frequency, they were more frequent in USCE than in ACE. 'Topic' bundles (e.g.: *'in the field of'*) were also a minor sub-type in terms of frequency. Although not many 'Topic' bundles were retrieved from the ACE, functional analysis across its sub-disciplines might be able shed more light on possible sub-disciplinary differences in their use.

6.1.3.2 Text-oriented bundles in ACE and USCE

As Figure 6.4 shows, Text-oriented bundles played a more important role in USCE (accounting for 52% of all bundles) compared to ACE (accounting for 39% of all bundles). Figure 6.6 gives normalised figures (40 pmw) for all TO bundles passing the thresholds introduced in Section 6.5, providing figures also by sub-function.

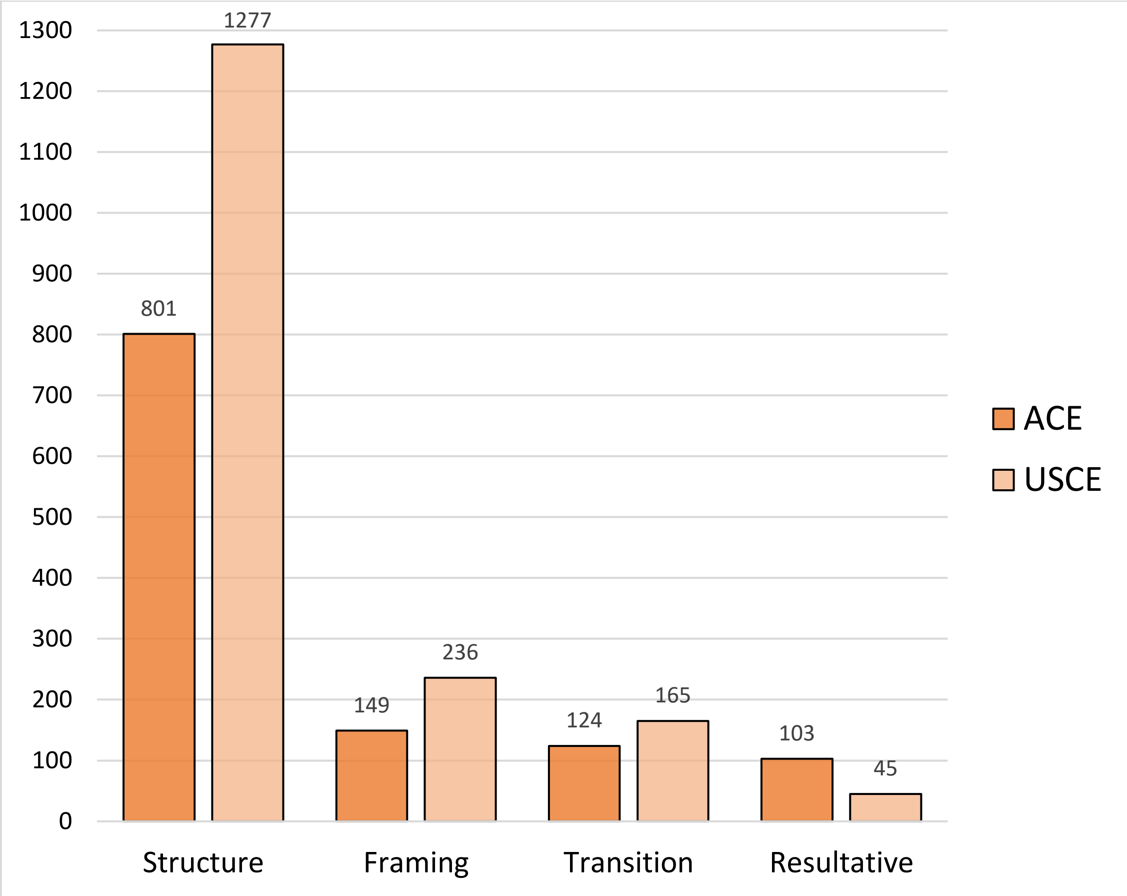


Figure 6.6: Normalised (40 pmw) frequencies of TO bundles in ACE and USCE

The clearest distinction in terms of distribution can be seen in relation to the *'Structure'* sub-category which was far more frequent in USCE than in ACE. This might suggest that ACE writers did not place as much emphasis on guiding the reader through their texts, or at least did not rely on such conventionalised phraseology to do so. Another explanation for this could be the relatively shorter length of the Algerian MSc dissertations with a median of 7,630 words compared to 9,9589 words in USCE (as shown in Figure 5.19). This might mean that writers did not need to guide the reader through the text to the same extent.

Bundles classified in this subcategory were found principally to fall into three structural types *Passive + PP (e.g.: 'are/is shown in figure/fig/table'), Other PP (e.g.: 'in this chapter/thesis/section we'),* and *Adverbial (e.g.: 'as shown in the/figure/fig').* The first of these was realised by a form of the verb *to be,* followed by a past participle; almost all three bundles included *'shown,'* to direct the reader to where particular information is being presented either in a figure or a table. In USCE this grammatical structure was by far the most frequent in this sub-functional category, whereas in ACE it was Adverbials (e.g. '*as shown in the', 'as shown in figure/fig'*). In the majority of cases in each corpus both structures were placed at the end of the sentence (e.g.: *'The shaft and impeller assembly, called the rotor, are seated in the casing <u>as shown in Figure 1.9</u>' ACE7* and *'The battery voltage and the currents are shown in Figure 4.13' USCE13).* Overall, these structural types and sub-functions occurred in the Theory and System Design stages, where there were multiple series of discussions with reference to visual data, as discussed in Chapter Five. A summary of all '*Structural signals'* bundles that met the required threshold is presented in Table 6.3 and ordered in terms of frequency. The bundles in bold are shared by both corpora showing a great level of similarity in the way both groups of writers referred to visual data.

Table 6.3: Most frequent Text-oriented bundles in ACE and USCE.

ACE	USCE
as shown in figure	**as shown in figure**
is shown in figure	**is shown in figure**
in this chapter we	can be seen in
as shown in fig	**as shown in fig**
shown in figure the	on the other hand
as shown in the	are shown in figure
are shown in figure	is shown in fig
shown in the following	as well as the
in this project we	are shown in table
in the previous chapter	in this thesis we
shown in the figure	in this chapter we
this chapter we will	**as shown in the**
this project is to	can be found in
	in this section we

The remaining bundles with 'Framing', 'Transition', and 'Resultative' functions were far less frequent compared to *Structural* bundles, with some degree of variation in both corpora.

'Framing signals', are those that 'situate arguments by specifying limiting conditions' (Hyland, 2008:14). This sub-functional group accounted for 149 pmw in ACE and 236pmw in USCE with a small list of three bundle types in each corpus ('*in this case the'*, '*in terms of the', and 'with respect to the'* and '*in the case of'* occurring in both corpora). This shows that USCE writers put more effort into framing their sentences compared to ACE writers.

Transition bundles, those making 'additive or contrastive links between elements' (Hyland, 2008:14) such as '*as well as the'*, '*on the other hand'* and '*in* *addition to the'* were also relatively infrequent compared to *Structural* bundles (as shown in Figure 6.6) counting for 124 pmw in ACE and 165 pmw in USCE. This shows that there were slightly higher frequencies of Transition bundles in USCE than in ACE.

'Resultative' bundles were the least frequent sub-function in the TO category. According to Hyland's system (2008), these bundles are of two main types: those that express a cause-effect relationship and those that report results. Neither of these types were widely found in the two corpora. In fact, the only two examples of Resultative bundles were *'in order to reduce'* in USCE (103 pmw), and *'is due to the'* in ACE (45 pmw), as Figure 6.6 shows.

Overall, USCE contained more TO bundles compared to ACE with the *Structural* function being the clearest distinction amongst its sub-functional types. Next, I will address differences in the Participant-oriented bundles in ACE and USCE.

6.1.3.3 Participant-oriented bundles in ACE and USCE

As Figure 6.4 shows, Participant-oriented bundles played a less important role in both corpora, accounting for only 10% of all retrieved bundles in ACE and 9% in USCE. This is in line with Hyland's (2008) finding regarding the relative lack of PO bundles in Electrical Engineering writing, as explained in Section 6.1.2. However, it is still interesting to explore how MSc students incorporated this function in their dissertations. Figure 6.7 gives normalised figures (40 pmw) for all PO bundles passing the thresholds introduced in Section 6.1, providing figures also by sub-function.

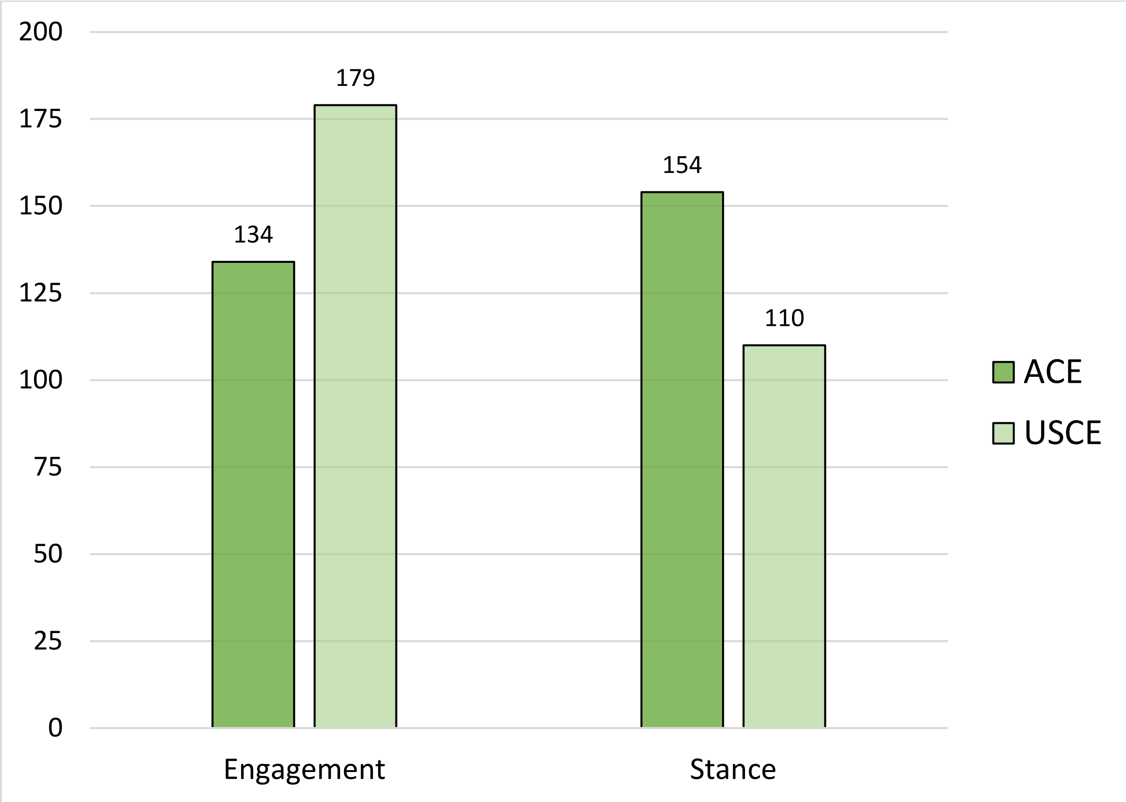


Figure 6.7: Normalised (40 pmw) frequencies of PO bundles in ACE and USCE

Through *Stance* bundles, writers passively express judgements of likelihood and possibility (e.g. *the fact that the, it is possible to, to be able to*), whereas through *Engagement* bundles, they intervene to 'actively address readers as participants in the unfolding discourse' (Hyland, 2008:18), for example *we can see that* and *it is important/necessary to*.

As shown in Figure 6.7, there is a contradictory relationship between the use of the two sub-functions of bundles in ACE and USCE. While Engagement bundles were slightly more frequent in USCE (179 pmw) compared to 135 pmw in ACE, Stance bundles were more frequent in ACE (154 pmw) compared to 110 pmw in USCE. Three types of Engagement bundles (*it can be seen, be seen that the, can be seen that*) were retrieved from USCE, all of which redirect the reader to visual data. The only two types of Stance bundles retrieved from

USCE are *it is possible to* (counting for 49 pmw) which express tentative stance, and *it is important to* (counting for 61pmw) which express opinion.

In the case of ACE, four types of *Stance* bundles were retrieved: tentative bundles (e.g. '*it is possible to'*), factual bundles (e.g. *'the fact that the'*), conditional bundles (e.g. '*to be able to'),* and first-person pronoun stance (e.g. *'we are going to'*). *Engagement* bundles in ACE referred to visual data (e.g. *'it can be seen'*) or engaged the reader in more general sense (e.g.: *'we can see that'*). The other two types of *Engagement* bundles (*'it is important/necessary to'*) were used to draw attention to key points. As Hyland (2008) observes, Engagement bundles are used either to draw the reader's attention to writer interpretations of data from a figure or table (it can be seen, we can see that) or to emphasise the importance of a particular step or of noting or understanding a point (*it is important/necessary to*).

6.1.4 Conclusion

At the structural analysis level, there is a noticeable difference in the proportion of structural types of bundles in each corpus. The highest proportion of all structural types of bundles is '*NP + Of'* bundles which is account for almost a quarter of all bundles in ACE. The second most represented structure is *'Passive + PP'* accounting for a fifth of all bundles. This was interpreted to mean that overall ACE writers are more descriptive of the technical part of their research compared to USCE writers. USCE writers, on the other hand, appeared to refer to visual data more than ACE, through the use of '*Passive + PP'* bundles. The *Other PP* and *Adverbial* bundles occurred in similarly low proportions in the two corpora, with a range of 11% to 14%. There was a big contrast in the use of '*PP + of'* and '*Be + NP/Adj'* bundles; the former was found four times more often in USCE and the latter was found twice as often in ACE. Both of these structural forms were used for descriptive and quantification purposes. The remaining structures shown in Figure 6.1 were relatively infrequent ranging from 0% to 6%.

Overall, there were interesting differences in results between the two corpora in terms of the function of their bundles. The proportion of RO bundles was high in ACE (51%) and slightly lower in USCE (39%). This was because ACE writers included slightly more 'Description/Quantification' and 'Procedure' bundles, as shown in Figure 6.5. This is related to the fact that ACE had longer Theory stages where these sub-functional types of bundles were used to explain project-related theories and their working principles. The proportion of TO bundles, on the other hand, was lower in ACE (39%) than in USCE (52%). This was because USCE writers included far more 'Structure' and 'Framing' bundles than ACE writers, as shown in Figure 6.6. This seems related to the greater length of USCE dissertations, and the fact that they also contained rhetorical stages which were not identified in ACE, such as Literature review and Background stages, as discussed in Chapter Five. This might have necessitated a higher use of TO bundles. Although the function of PO bundles is associated with advanced writing (e.g.: PhD Theses and RAs), the ACE and USCE Electrical and Electronic Engineering dissertations contained as many PO bundles as the texts in Hyland's corpus. Another unexpected finding was the slightly higher use of bundles belonging to the sub-function *Stance* in ACE than in USCE, as shown in Figure 6.7.

Although the comparison across ACE and USCE has revealed intriguing differences in terms of structural and functional types of bundle, it tells us nothing about differences in terms of the structure and function of bundles specific to Engineering sub-disciplines. Therefore, and as this thesis primarily focuses on the Algerian dissertations, the next section will present the comparisons of bundles across the four sub-disciplines of ACE with reference to Hyland's (2008) findings.

6.2 Distribution, structure and function of LBs in ACE sub-disciplines

This section explores the distribution, structure and function of LBs across the four sub-disciplines in the Algerian Corpus of Engineering. It starts with frequency distribution to give a general idea of the frequent bundles across the four sub-disciplines before moving to the structural and functional analysis of LBs. This part of the lexical bundles analysis is already published, see Rezoug and Vincent (2018) for the full paper.

6.2.1 Distribution of lexical bundles across ACE sub-disciplines

Table 6.4 shows the top 20 most frequently occurring bundles in each of the Engineering sub-disciplines in order of frequency, and gives an idea of the extent of the overlap across sub-disciplines. Where more than 20 are included, this indicates that all bundles in the final row had the same frequency. As in Hyland (2008), I have indicated high frequency bundles that occur in multiple sub-disciplines: bundles in bold occur in the top 20 of all sub-corpora, while those in italics occur in three sub-disciplines.

Table 6.4: The 20 most frequent 4-word bundles across ACE four sub-disciplines.

Control Engineering	Computer Engineering	Power Engineering	Telecommunication Engineering
in this chapter we	**is shown in figure**	**as shown in figure**	**as shown in figure**
as shown in figure	**as shown in figure**	**is shown in figure**	**is shown in figure**
the closed loop system	in this chapter we	as shown in fig	with respect to the
with respect to the	**can be used to**	of the power system	as shown in fig
as shown in the	the nios ii processor	in the case of	is defined as the
of the closed loop	one of the most	**can be used to**	is equal to the
in the case of	the size of the	is one of the	the total number of
can be written as	it can be seen	it is necessary to	the length of the
if and only if	the implementation of the	*the output of the*	to the number of
the position of the	the speed of the	is equal to the	**can be used to**
we are going to	*we are going to*	is given by the	is given by the
the length of the	the performance of the	it is possible to	is the number of
the steady state error	a wide range of	*we are going to*	the center of the
shown in the figure	is connected to the	is based on the	at the same time
can be divided into	that can be used	one of the most	the performance of the
can be used to	at the same time	the difference between the	can be written as
is shown in figure	is the number of	the effect of the	is based on the
the difference between the	speed of the motor	we can see that	the end of the
the output of the	is one of the	as well as the	the size of the
to be able to	a graphical user interface can be divided into in addition to the in this project we nios ii based system *the output of the* the state of the this project is to	at the end of on the other hand the voltage and current	are shown in figure as a function of at the end of the effect of the the upper and lower

It is noticeable that the bundles found towards the top of all the lists shown in Table 6.4 involve writers referring to data contained in figures, reflecting that these Engineering students frequently present and discuss their results with reference to visual data, a point also noted by Hyland (2012). This is also in line with the results of cross corpora comparison of the distribution of bundles in ACE and USCE discussed in Section 6.1.1.

We can also see that, overall, there is quite a large degree of variability across the four sub-corpora of each sub-discipline. It is quite surprising that so few of the bundles were found in all four sub-corpora (three bundles) or even in three of the four sub-disciplines (two bundles), even if quite a number of bundles were found in the top 20 of two different sub-corpora. This at once suggests a fair degree of sub-disciplinary specificity in terms of bundle use. It is also notable that the three ubiquitous bundles are all listed in the top 10 of Hyland's (2008:12) list of bundles found in Electrical Engineering, which also has a preponderance of bundles including *shown*. This is also in line with the analysis of bundles in ACE and USCE in the previous section, where I found high use of passives with the verb form *shown* + the preposition *in* (e.g. *'as shown in figure'*).

In contrast to Table 6.4, which illustrates some of the variability in terms of bundles across the sub-disciplines, Table 6.5 presents the 21 bundles which meet all the criteria and are common to all the sub-disciplines; bundles that are in italics occur at least 100 times per million words.

It is interesting to note the predominance of reference to 'figures' and 'chapters' at the top of these lists; Hyland (2008) classifies these as 'Text-oriented: structuring signals' (as explained in Section 3.4.3). As previously found in Section 6.1, the high incidence of bundles of this type reflects the fact that Engineering writing is particularly reliant on reference to visual representations of data, leading to its greater conventionality (Hyland 2012).

Table 6.5: Four-words lexical bundles that occur in all four disciplines of ACE

Control Engineering	**Computer Engineering**	**Power Engineering**	**Telecommunication Engineering**
in this chapter we	*is shown in figure*	*as shown in figure*	*as shown in figure*
as shown in figure	*as shown in figure*	*is shown in figure*	*is shown in figure*
is shown in figure	*in this chapter we*	*shown in figure the*	*with respect to the*
with respect to the	*can be used to*	*in the case of*	*is defined as the*
as shown in the	*one of the most*	*can be used to*	*can be used to*
in the case of	*we are going to*	*Is one of the*	*shown in figure the*
we are going to	*the performance of the*	*it is necessary to*	*at the same time*
can be used to	at the same time	*the output of the*	*the performance of the*
the output of the	Is one of the	*we are going to*	*is based on the*
is based on the	shown in figure the	is based on the	in the case of
is one of the	the output of the	one of the most	on the other hand
the performance of the	this project is to	as well as the	as well as the
as well as the	as well as the	on the other hand	is one of the
is defined as the	as shown in the	in this chapter we	one of the most
on the other hand	on the other hand	is defined as the	as shown in the
one of the most	is based on the	as shown in the	in this chapter we
at the same time	it is necessary to	the performance of the	we are going to
shown in figure the	is defined as the	with respect to the	it is necessary to
in this case the	with respect to the	in this case the	the output of the
it is necessary to	in the case of	at the same time	in this case the
this project is to	In this case the	this project is to	this project is to

Additionally, we can note the use of some bundles that seem to vary across sub-disciplines. For example, *'with respect to the'* is found frequently in Control Engineering and Telecommunication Engineering dissertations but not as frequently in Power Engineering and Computer Engineering.

While Table 6.5 indicates the bundles which the sub-disciplines have in common, it is hard to get a clear perspective of the nature of bundles. Therefore, the next section will examine the grammatical structure of lexical bundles to better investigate possible sub-disciplinary sensitivity to the structure of lexical bundles.

6.2.2 Grammatical structure analysis of LBs in ACE sub-disciplines

As noted in Section 3.4.3, the structural investigation of bundles in Algerian MSc dissertations follows the scheme set out by Biber et al. (1999) and Hyland (2008). This allows for comparison across the sub-disciplines as well as with Hyland's (2008) findings for Electrical Engineering. As mentioned in Section 6.1.3, comparing findings from ACE with Hyland's findings of Electrical Engineering corpus requires a degree of caution.

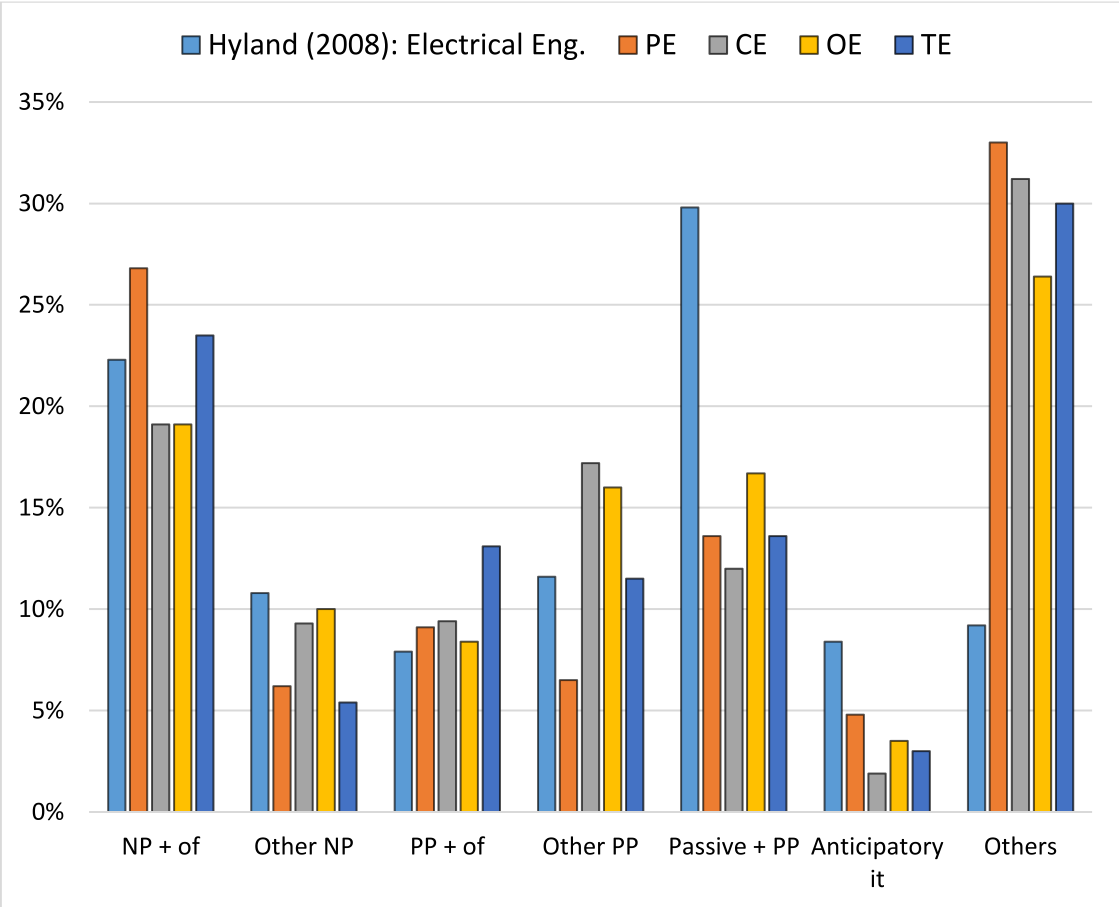


Figure 6.8: Proportions of structural types of bundles in sub-disciplines of ACE and in Hyland's Electrical and Electronic Engineering sub-corpus (2008)

The proportion of the structural types of bundles across the five sub-corpora shown in Figure 6.8 are generally similar to those shown in Figure 5.1 (i.e. *NP + of* (and *Other NP*)*, Passive + PP,* and *PP + Of* (and *Other PP*)*.* However, Figure 6.8 indicates that there are some differences in individual sub-disciplines, which were not shown in Figure 6.1, such as the lower incidence of *Other PP* bundles – bundles based on prepositional phrases that do not contain *of* – in Power Engineering.

Perhaps more indicative of systematic differences are the major and consistent differences from Hyland's (2008) findings. These are most clearly shown across all the sub-corpora in three main areas: passive constructions followed by prepositional phrases (*Passive + PP*, e.g. *is shown in Figure*); *Anticipatory it* structures (e.g. *it can be seen*); and the *Other* category. To some extent, explanations of these findings can be sought in the 'associations' Hyland (2008) notes between structural features and main functions of bundles which will be discussed in more detail in the following section. But some initial comments can be made which can help us understand more about these dissertations.

If we consider first the apparently low figure for *Other PP* found in Power Engineering, closer investigation indicates that this is mainly due to the dissertation writers' relative avoidance of prepositional phrases with a Text-Oriented (TO) function. Following Hyland's (2008) terminology, whether these phrases were used as '*Transition Signals'* (e.g. *on the other hand*) 'Framing signals' (e.g. *with respect to the*) or as 'Structuring signals' (e.g. *in this chapter we*), Power Engineers were less likely to use them than their peers in the other sub-disciplines, while the higher proportions found in Control and Computer Engineering can be attributed to their use of ‘Other PP’ structures with these functions. The reasons for these differences, however, remain unclear.

If we look at the more systematic differences compared to Hyland’s findings, the far lower proportions found for *Passive + PP* across all the sub-disciplines is also an interesting finding. It is, however, harder to explain without full access to Hyland’s data. One possible cause of this discrepancy is the tendency of this sort of construction to be associated with the Text-oriented function, for example *is shown in figure*, as shown previously in Table 6.2 in the comparison between ACE and USCE. Another possibility is the general tendency of advanced academic writing to contain higher frequencies of passive structures, a tendency that has been associated with a more objective stance (Biber et al., 1999).

Similar points might be made with caution concerning the relatively low proportion of *Anticipatory it* bundles in ACE and USCE (see Figure 6.1). Research has shown that *Anticipatory it* – also referred to as *Introductory it* in e.g. Charles (2000) and Groom (2005) – is associated with more advanced academic writing; Hyland (2008) notes the general lack of this type of construction in his postgraduate texts compared to research article writing. As a relatively advanced feature of academic discourse, again, this finding was not altogether unexpected. However, the instances of *Anticipatory it* bundles in this thesis counted only for those that occurred in the list of the most frequent n-grams. It is possible that other less frequent instances of *Anticipatory it* bundles might have been identified under lower cut-off thresholds.

The final feature of Figure 6.8 that is particularly striking is the high proportions of ‘Other’ structures that are found in these corpora when compared to Hyland’s (2008) results for Electrical Engineering writing. To better understand the type of structures that made up this category in the four sub-disciplines of ACE, I had to use Biber et al.’s (1999) full list of structural categorisations, shown in Table 2.10, Section 2.6., to get a better idea of the categories which were well represented in the sub-disciplines. This level of analysis was also adopted for the ACE and USCE comparisons in Figure 6.1.

The presence of significant proportions of Adverbial constructions in each of the sub-corpora, in particular in Telecommunication Engineering, are explained by the preference of these students for the bundles *as shown in figure* / *fig*, which we have already seen in Tables 6.3 and 6.4. Another structural category that was well represented in all the sub-corpora, but not in Hyland (2008) was *‘be + NP / Adjective’*. This is due to the occurrence of a number of bundles falling into Hyland’s (2008) Research-Oriented (RO) category, most often the sub-category of ‘Quantification’, which includes bundles such as *is equal to the*, *is the sum of* and *is one of the*, indicating the importance of quantification and precision to these students.

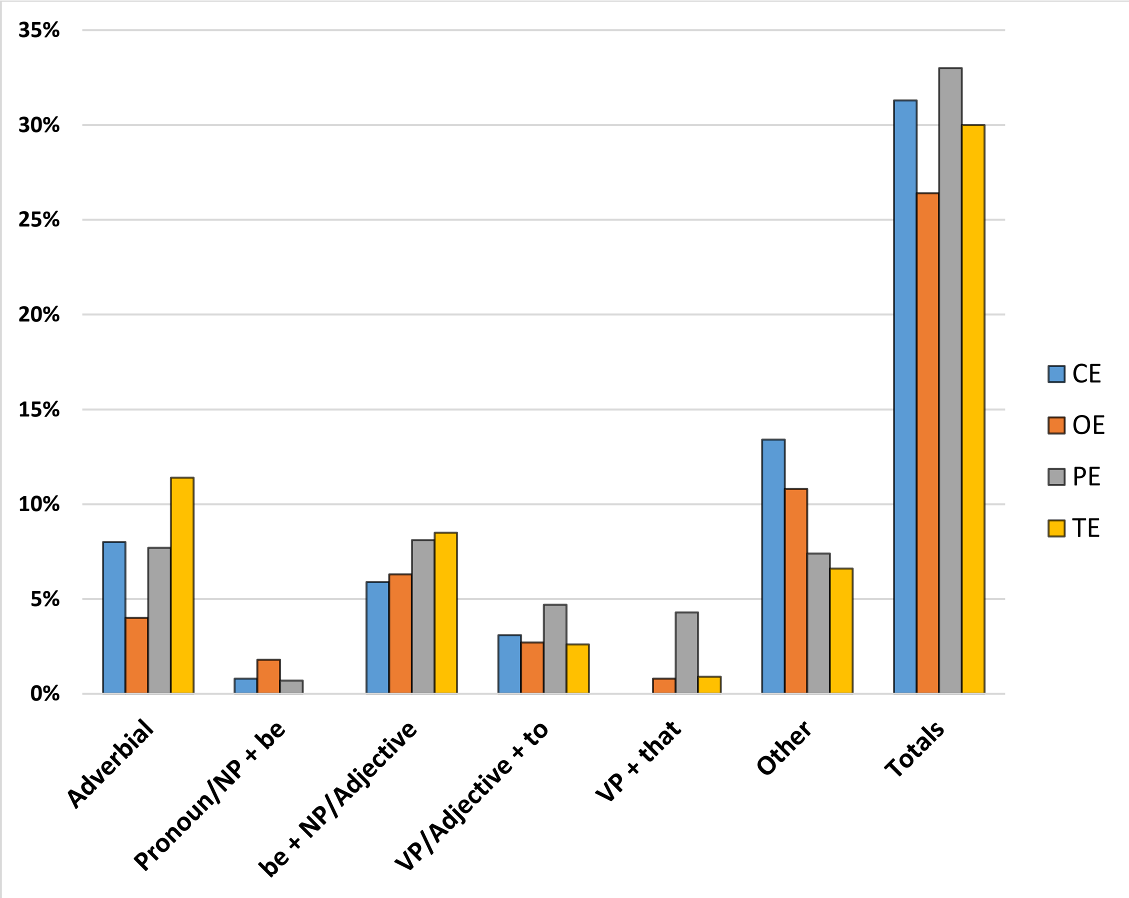


Figure 6.9: Breakdown of the 'Other' structural category of bundles by sub-discipline in ACE

Despite the more detailed breakdown provided in Figure 6.9, we still find quite a large proportion of 'Other' bundles, that is, those that do not fit into the structural patterns found most commonly by Biber et al. (1999) and Hyland (2008). These bundles remained uncategorised principally because they crossed traditional structural boundaries, by including (fragments of) noun phrases followed by verb phrases (e.g. *this chapter we have*), (fragments of) verb phrases followed by noun phrases (e.g. *solve the problem of*) and other combinations, which tend to be on or around the frequency and range thresholds, such as *in order to* with one other word (e.g. *robots in order to*, *in order to achieve/get/avoid*). The other significant contributor to the rather high proportions found in Control and Computer Engineering was the bundle *we are going to*, which is associated more with spoken contexts (Biber et al., 1999; Biber, 2006). From a functional perspective, these bundles tended to be (parts of) impersonal constructions which were used to express the writer's view or to address the reader; they were therefore typically categorised as PO bundles, as in Hyland (2008). This stylistic infelicity could be argued to reflect the relative inexperience of these writers when it comes to academic prose.

The next section will explore in more detail the functional classification of the most frequent four-word bundles across the four sub-disciplines in the Algerian Corpus of Engineering.

6.2.3 Functional analysis of LBs across ACE sub-corpora

As already noted in Section 6.2.1, some of the differences in terms of structural types of bundle suggest intriguing comparisons both across the sub-corpora investigated in this study and with Hyland's (2008) findings regarding Electrical Engineering. It is interesting to pursue this comparison also with the functional classification of bundles, although this is an area that, unsurprisingly, presents rather more difficulties to the analyst, with the result that conclusions have to be more tentative.

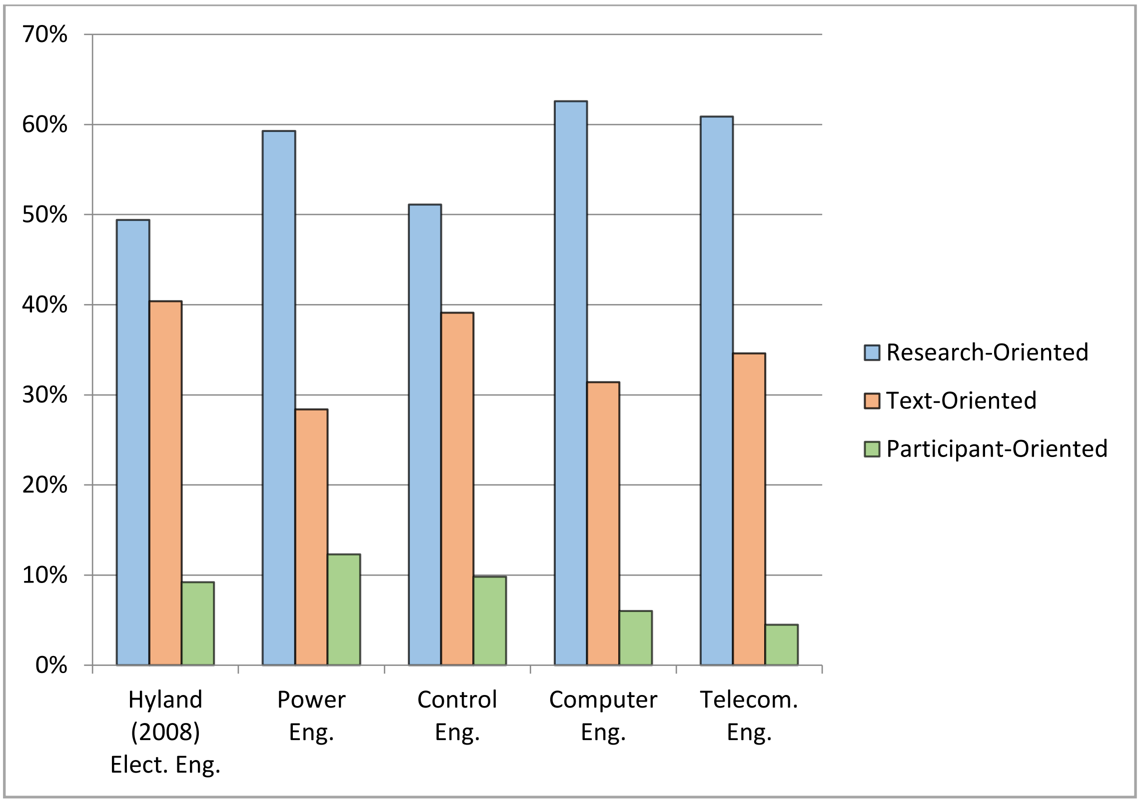


Figure 6.10: Distribution of functional types of bundle by percentage of total; comparison with Hyland's (2008) Electrical Engineering sub-corpus.

Figure 6.10 shows the comparison by main bundle function across the sub-disciplines investigated in this study as well as the proportions reported in Hyland (2008) for Electrical Engineering texts. We can see that, although there is a degree of variability, in each case, RO bundles are the most frequent, then TO bundles, with PO bundles as the least frequent. The proportions found for Control Engineering almost exactly match Hyland's (2008) findings and the other sub-corpora are broadly comparable. This is interesting from several different perspectives.

First of all, bearing in mind the differences in the composition of the corpora and the thresholds, it is quite surprising to find such a close match between the proportions found for Control Engineering and those reported by

Hyland (2008) which is, after all, composed of PhDs and RAs as well as dissertations. For this reason, one would expect to find different distributions of functions in Hyland's corpus. This is particularly surprising when we recall the considerable differences in terms of the structural types identified in the two corpora, presented in Section 6.2.1, and serves as a reminder that, while certain structures may be associated with particular functions, this is far from a one-to-one relationship; other structures realise these functions too.

In many respects, the results found for the other corpora, and particularly Computer and Telecommunication Engineering, are much more to be expected. This is because one would expect there to be a lower proportion of PO and TO bundles than in Hyland (2008) due to the composition of his corpus. In the case of PO this is expected as it is a function more associated with research articles, while in the case of TO, Hyland's corpus included PhD theses, which, as longer pieces of work, by necessity contained more indications of organisational structure to guide readers through (Hyland, 2008). It is also important to consider the differences across these sub-disciplines in terms of the functions that they realise in order to flag any sub-disciplinary sensitivities and potentially provide guidance to teachers of the sub-disciplines in question. For this, each major function is considered in turn.

6.2.3.1 Research-Oriented bundles distribution in ACE sub-disciplines

As Figure 6.10 shows, Research-Oriented (RO) bundles clearly play an important role in all Engineering dissertations, accounting for between 49% and 64% of all bundles. As noted already, the prominence of bundles expressing this function is in itself unsurprising as it has already been noted in Hyland's (2008) research and in ACE which had more RO bundles than USCE (see Figure 6.2). However, reporting only proportions of all bundles rather than normalised frequencies removes a quantitative aspect of comparability which we can reintroduce here. Figure 6.11 gives normalised figures (40 pmw) for all bundles passing the thresholds introduced in Section 6.8, providing figures also by sub-function.

In terms of overall frequencies, Figure 6.11 indicates that Computer Engineering had the greatest preponderance of RO bundles, while Control Engineering had the lowest. It can also be seen that the distribution of the different sub-types of RO bundles varied somewhat across the four sub-disciplines. This variation is most clearly seen when comparing Computer Engineering with Telecommunications Engineering: the former had a far greater proportion of 'procedure' bundles such as *can be used for/to*, while the latter appeared to downplay procedure but be more focused on 'description' bundles such as *is equal to the, the total number of*. It is also clear that 'location', which includes bundles indicating time or place such as *in the beginning of* and *in this study we* – was a minor sub-category in terms of frequency.

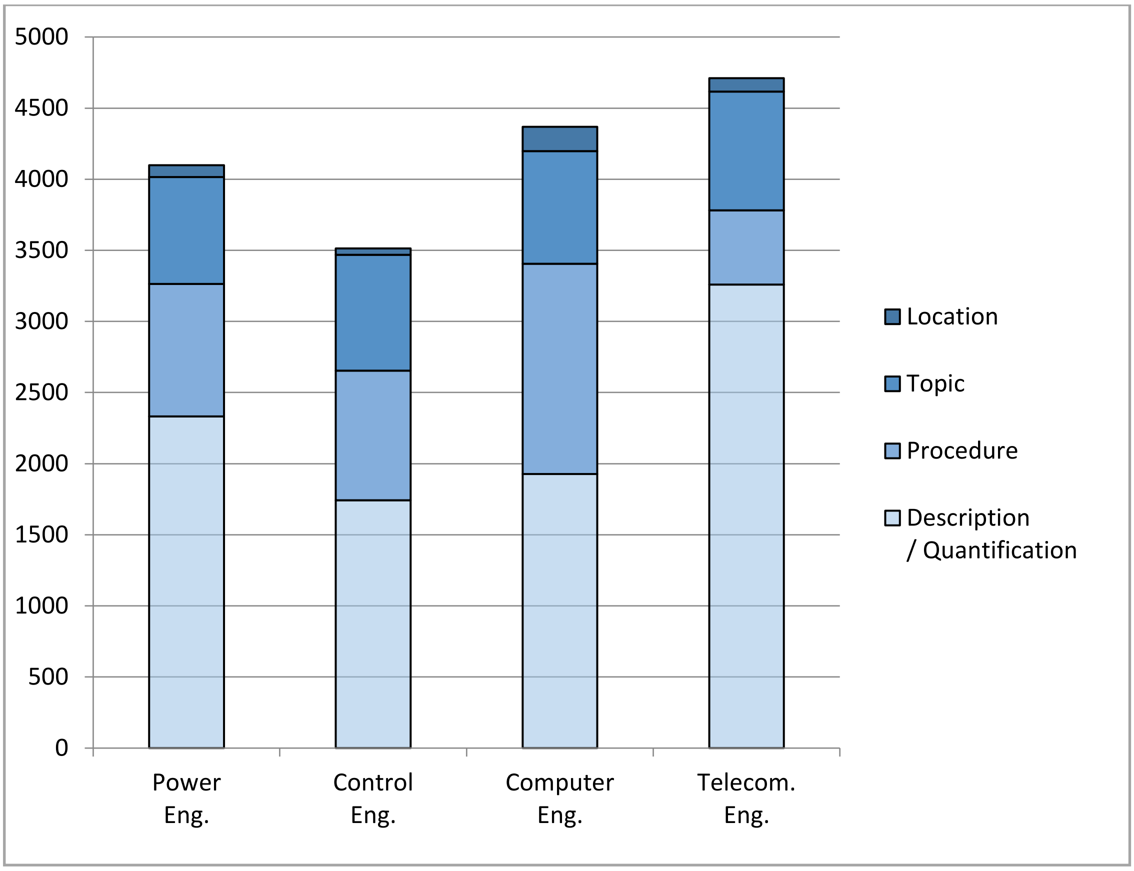


Figure 6.11: Normalised (40pmw) frequencies of RO bundles across the four sub-disciplines

As we can see in Figure 6.11, the clearest distinction in terms of distribution was in relation to the *‘Description/Quantification’* sub-category, which was the most common sub-function in the RO category. This is not surprising as the *‘Description/Quantification’* functional type of bundles were also the most represented type in the comparison of the entire corpora ACE (1063 pmw) and USCE (1005 pmw), as shown in Figure 6.5. Bundles classified in this subcategory were found principally to fall into two structural types. The first of these is realised by a form of the verb *be* followed by either a noun or adjective phrase; these bundles are typically used for quantitative descriptions (*is equal to the, is the sum of*), definition (*is a device that*) or exemplification/grouping (*is* *an example of, is a set of*). The second, and more frequent structural bundle type was noun phrases including the proposition *of*. The nouns involved across all the sub-disciplines were typically those referring to quantity/amount (*a wide range of*), behaviour/performance (*the performance of the*), and size/dimensions (*the length of the*). The types of bundles found here can give some insights into the extent to which these MSc writers referred to quantities, calculations and measurements, and generally what they might be interested in calculating or measuring. On this basis, it seems that all of the sub-disciplines were interested in measuring performance in some way and that the bundles they used to do this converged on a limited number of forms (e.g. *the behaviour/response/speed/output of the*). The higher number of *'Description'* bundles found in Telecommunication can largely be attributed to those referring to numbers and/or calculations, i.e. bundles such as *is equal to the, the total number of and is the number of*, but can also be attributed to bundles referring to size and dimensions (*the size/length of the*), which as stated in Section 6.1.2, occurred largely in the Theory and System Design stages. This suggests that MSc dissertations in this sub-discipline have a particular need to report calculations, quantities and dimensions. It also suggests that dissertation writers in OE and CE did not work as hard to describe and quantify information for the reader, or at least did not rely on such conventionalised phraseology to do so.

As Figure 6.11 shows, bundles classed in the *'Procedure'* sub-category came second in terms of order of frequency across the four sub-disciplines, which is also the case for ACE and USCE, as shown in Figure 6.5. While Telecommunication Engineering had lower frequencies, suggesting less of a focus on descriptions of (experimental) processes, the results for Computer Engineering suggested a much stronger focus on these processes. This could be explained with reference to the point made in Chapter Five where TE and PE were found to write shorter System Design stages and longer Theory stages due to the nature of their projects, which did not always allow for the final step of implementation after the simulation.

The distribution of '*Procedure'* bundles in Computer Engineering was more expected as it is a digital field that allows for implementation of the simulated results but does not necessarily require implementation of heavy physical equipment on a larger scale (e.g.: antennas or power plants). Earlier findings by Hyland (2008) indicate that Master's dissertation writers need to show their understanding of experimental procedures. However, some constraints might affect the extent to which and the stage where students can express this understanding. The majority of *'Procedure'* bundles were based around *be used to/for/in* (e.g.: *can be used for/to*) across all the sub-disciplines, but in particular in Power Engineering, where more than 70% involved these forms. Some examples in context are shown below.

i) 'This robot *can be used to* test control algorithms for underactuated robots' (PE13).

j) 'The built-in library of LabVIEW has a number of VIs that *can be used to* design and develop any system' (PE22).

k) 'Since the simulation results were as expected, so the SVPWM inverter model is reliable and *can be used in* the field-oriented control' (PE23).

Although it seems, from examples k), l), and m), that this type of bundle was used in the *Practical Implications* step often found in the Conclusion stage, they were also used in all other stages.

The higher frequency of *Procedure* bundles in Computer Engineering, as shown in Figure 6.11, mainly seems to be due to bundles making specific reference to design and implementation (*the implementation of the*) and to bundles that describe processes involved in the research more specifically (*is sent to the, is connected to the, can be divided into, control the speed of*) – these more specific process-describing bundles are all but absent from the other sub-disciplines, especially TE and PE.

Table 6.6: 'Topic'-related bundles with repeated sub-discipline specific items

Power	• *the current and voltage / the voltage and current / of current and voltage / of voltage and current* • *of the power system / the power system and / the power system is / in the power system* • *the transfer function of / transfer function of the*
Control	• *between the robot and / of the robot in / of the robot is* • *configuration of the robot / the robot and the* • *the closed loop system / of the closed loop*
Computer	• *the nios ii processor / on the nios ii / nios ii based system* • *system on a programmable / on a programmable chip / field programmable gate array*
Telecom.	• *of an antenna is / size of the antenna* • *the characteristic impedance of / the impedance of the* • *of the received signal / the transmitted signal and* • *the resonant frequency is / at the resonant frequency*

The final main point arising from Figure 6.11 relates to *'Topic'* RO bundles. As the name suggests, this grouping of bundles relates to the specific field of the research carried out and consists of bundles containing or comprising discipline-specific terminology. This is therefore the grouping that most clearly distinguishes the sub-disciplines from each other. It is interesting from this perspective to note that the overall frequency of 'Topic' bundles remained remarkably stable across the sub-disciplines. The specific bundles, as might be expected, showed very little overlap except in general electrical terminology (e.g. *the impedance of the*). Items occurring in more than one bundle in each sub-discipline are shown in Table 6.6. These bundles clearly indicate some of the key terms in each field and appear to represent material that writers in each sub-discipline needed to master.

It is also worth noting that, as these topic bundles are sub-discipline-specific, they hardly appeared at all in the comparison of the entire corpora (ACE with USCE) shown in Figure 6.5. Comparing the two corpora shows that only one bundle *'at the end of'* was retrieved for the location category in both corpora, and only one bundle '*in the field of*' for the topic category in ACE only. This shows the importance of analysis at the sub-disciplinary level to investigate functional bundles which are otherwise left out in the analysis of entire corpora. The next section will present the results for TO analysis at the sub-disciplinary level.

6.2.3.2 Text-oriented bundles across ACE sub-disciplines

As indicated in Figure 6.10, Text-oriented (TO) bundles also made up a significant proportion of bundles (between 28% and 39%) found across all the sub-corpora. These figures seem lower than the figure of TO bundles obtained for ACE as a whole corpus (see Figure 6.4) because of the effect of using the same thresholds, which retrieved different bundles in each case. It is of interest to consider the normalised frequencies of these bundles and their distributions by sub-discipline and in terms of the more fine-grained sub-categories proposed by Hyland (2008), as discussed in Section 3.5.3. These frequencies and distributions are presented in Figure 6.12.

The overall frequencies shown in Figure 6.12 indicate a degree of variation, with Control and Telecommunication Engineering showing higher overall usage of TO bundles, and Computer and Power Engineering having considerably lower frequencies. This suggests that dissertation writers in the latter two sub-disciplines did not work as hard to guide the reader through their texts, or at least did not rely on such conventionalised phraseology to do so. Overall, however, ACE writers did not include as many TO bundles as USCE writers, as shown in Figure 6.6. It is important to consider also the distributions of subcategories and realisations of the actual bundles to get a better idea of the similarities and differences in TO bundle usage across the sub-disciplines, particularly as most of this variation appears to be attributable to '*Structuring Signals'* and *'Resultative Signals'*.

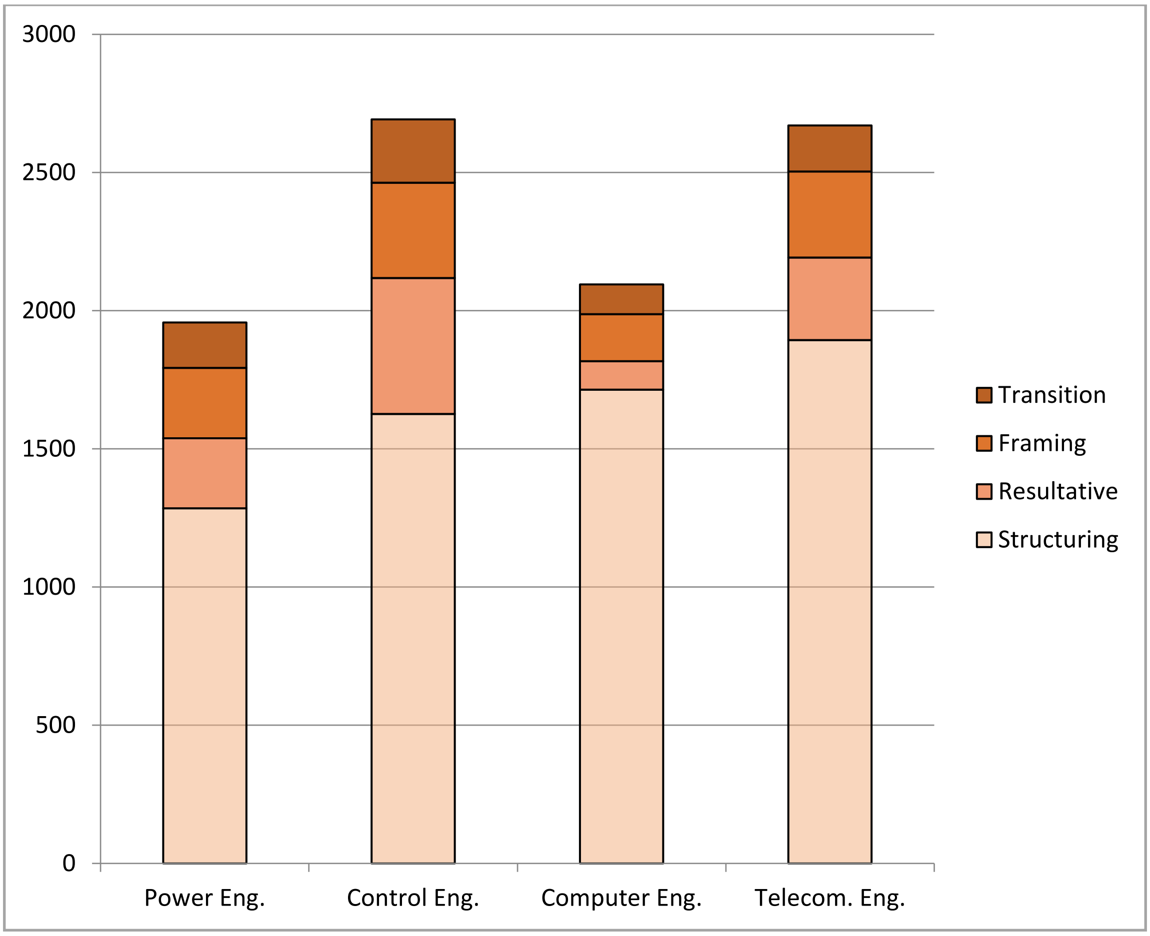


Figure 6.12: Normalised (40 pmw) frequencies of TO bundles across the four sub-disciplines.

As Figure 6.12 shows, bundles functioning as 'Transition Signals', that is, those making 'additive or contrastive links between elements' (Hyland, 2008:14), such as *as well as the* and *on the other hand,* were relatively infrequent across all the sub-disciplines (never above 10% of the total) and thus did not seem to have a great significance here. 'Framing Signals', meanwhile, were those that, as Hyland (2008:14) puts it, 'situate arguments by specifying limiting conditions'. Like 'Transition Signals', this was a low frequency group with a small number of bundle types (*in this/our case the*, *in the case of*, *with respect to the*, *in terms of the*). Inasmuch as variation can be seen across the sub-disciplines, Computer

Engineering had the lowest frequency and least variation in terms of these bundle types. These findings for ‘Framing Signals’ tend to support Hyland’s (2008) observation that these signals are more commonly found in disciplines with wider, less focused readerships such as Applied Linguistics, where specifying conditions and instances are more often needed. They also show that these MSc writers manage on a relatively small inventory of bundles in these two functional areas.

‘Resultative’ bundles, were also relatively infrequent, but there was a wider degree of variation, with Control Engineering having a far higher frequency and Computer Engineering having a far lower frequency than the mean. Following Hyland (2008), these bundles were of two main types: those that expressed a cause-effect relationship such as *is due to the,* and those that reported results, for example *it has been found*. Neither of these types, considered separately, were widely found in any of the sub-disciplines. This could also be explained by the point made earlier that the nature of OE encourages implementation of the students’ projects. Having many implementation-related points to cover resulted in longer System Design stages which involved more use of *‘Resultative’* bundles in OE compared to the other sub-disciplines (see Figure 6.12). However, while CE focussed more on *‘Resultative’* bundles in their System Design stage, OE in particular seemed to avoid bundles functioning as *‘Resultative signals’* and focussed far more on ‘*Procedure’* bundles, as shown in Figure 6.12.

The most significant sub-category of TO bundles in terms of frequency across all the sub-disciplines was ‘Structuring signals’, although, as Figure 6.12

indicates, this sub-category was not as well represented in Power Engineering dissertations. 'Structuring signals' may be divided into two main types. The first type comprises bundles which are parts of phrases which refer the reader to figures or tables; the vast majority of these included *shown*. Figure 6.13 presents the main variations on this bundle type, indicating how the paradigmatic choices at each step in the phrase are relatively limited; there is a close relationship between form and function.

is	*illustrated*		*fig*
are	*shown*	*in (the)*	*figure*
as	*given*		*table*

Figure 6.13: Schematic representation of structuring signals based around *shown* and similar verbs

As we have already seen in Table 6.3 and 6.4, these 'shown' bundles were prevalent across all the sub-disciplines – in particular in Power and Telecommunication Engineering – and reflect the high quantities of visual materials introduced into the dissertations (Hyland, 2008, 2012). A possible reason (based on the results of Chapter Five) why these 'bundles were particularly prevalent in PE and TE might be related to the fact that students of these disciplines used simulations, as they were not able to construct their projects in the real world. This meant that PE and TE students discussed their results with reference to visual data, often screen-shots of software programmes. Examples n) to q) below provide contexts for some LBs which refer to figures showing simulated results.

l) *‘The geometry of the* ***simulated*** *three ring array with central element is <u>shown in Fig 3.1</u>’ (TE07).*

m) *‘The obtained array factor for this* ***simulation*** *<u>is shown in Fig 3.3</u>’. (TE8)*

n) *‘The result of the* ***simulation*** *<u>is shown below in Figure 1.6’</u>. (PE1)*

The second type of ‘Structuring Signal’ bundles were those used to draw the reader’s attention to either the whole work or part of it in order to summarise what was said there (e.g. *in the next/previous chapter/section*), or in order to point out the aims or objectives of the study (*the aim of this, we are going to*). In contrast with the first type, the distribution of this second type of bundles was rather skewed. They were very much more commonly found in Control and Computer Engineering dissertations compared to Telecommunication Engineering (only just over half as frequently) and Power Engineering (less than a quarter). This is quite a surprising finding since there is nothing to suggest that Power or Telecommunications Engineering should, comparatively speaking, avoid such signals, especially as both of these sub-disciplines used bundles referring to figures and tables slightly more often. In the case of Power Engineering the very low frequency suggests that this type of ‘Structural signal’ was in some way dispreferred by writers, possibly due to the influence of advice or guidelines from tutors.

6.2.3.3 Participant-oriented bundles across ACE sub-disciplines

As Figure 6.10 shows, Participant-oriented (PO) bundles were the least frequently found across the four sub-disciplinary corpora; even in the sub-discipline with the highest proportion of PO bundles, Power Engineering (see Figure 6.14), only around 12% of bundles were of this type. This finding tends to support that of Hyland (2008) regarding the relative lack of PO bundles in Electrical Engineering. As noted in Section 6.1.3.3, PO bundles can be divided into two main types. The first of these is bundles expressing stance, which writers use to express judgements of likelihood and possibility (*the fact that the, it is possible to*), affective judgements and their level of commitment to a proposition (*is considered to be*). The second is Engagement bundles, by means of which ‘writers intervene to actively address readers as participants in the unfolding discourse’ (Hyland, 2008:18), for example *we can see that* and *it is important/necessary to*.

Figure 6.14 shows the distribution of PO bundles across the four sub-disciplines. As can be seen, Power Engineering had the highest overall frequency of PO bundles, with more than double the normalised frequency of Computer Engineering and Telecommunications Engineering. While Power and Computer Engineering had relatively even distributions of the two sub-types of PO bundles, Control and Telecommunications Engineering had a stronger tendency to use stance bundles. This is a somewhat unexpected finding since it contradicts Hyland (2008), who found a greater incidence of engagement than stance bundles in Electrical Engineering texts. Hyland points out that his finding could be due to the fact that his MSc and PHD writers used English as a second language, as mentioned in Section 6.1.3. The ACE writers were also users of English as a second language, of course.

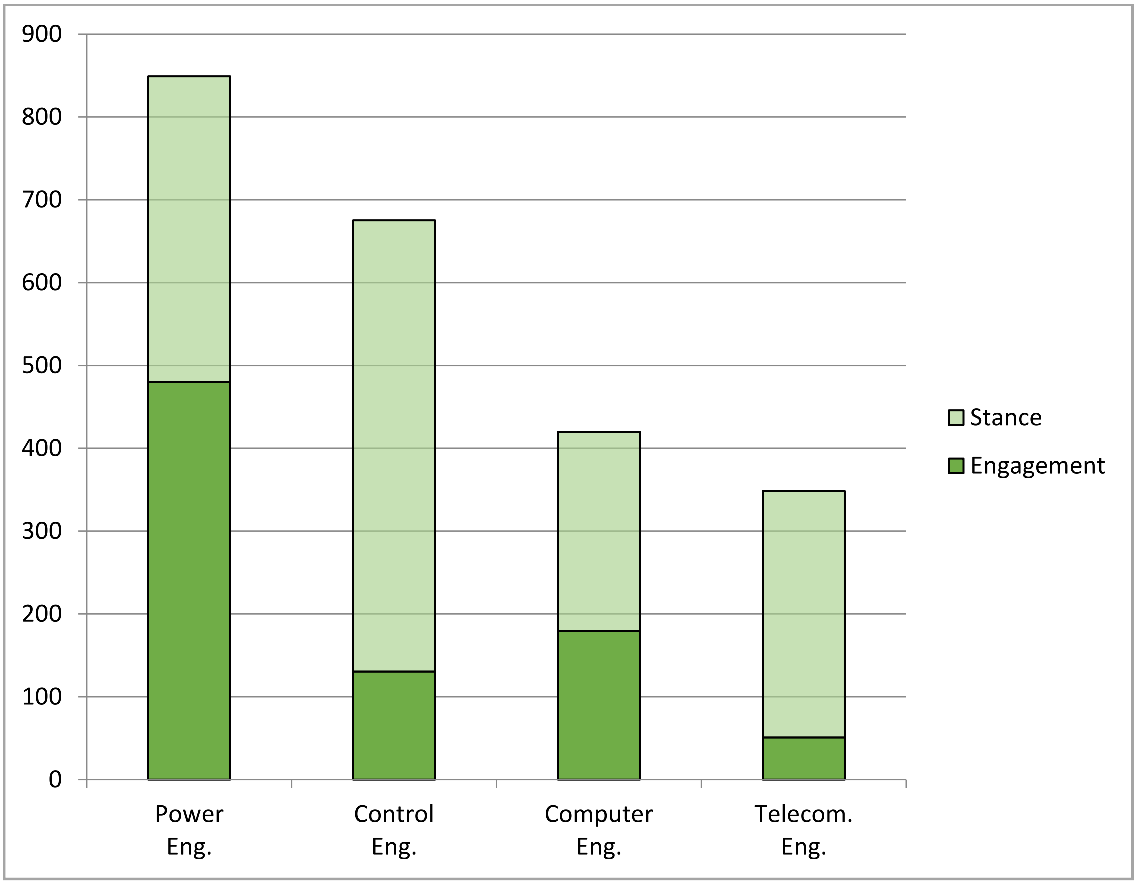


Figure 6.14: Normalised (pmw) frequencies of PO bundles across the four sub-disciplines

As Figure 6.14 indicates, Engagement bundles were favoured most by writers of Power Engineering dissertations, who seemed to find it most appropriate acknowledge the presence of the reader. Some examples of this type in context are shown in q) and r).

o) 'The gas turbine is essentially constituted of three main parts: - Compressor - Combustion Chamber – Turbine. The cold air drawn from the outside environment to the site is compressed and warmed in the same time across the compressor. To realize this phase, *it is necessary to* consume a certain amount of mechanical energy subtracting it from the turbine, through the shaft' (PE15).

p) '*It can be seen* from the diagram that waveforms by controller hardware are similar to the waveform of simulated open loop controller (PE17).

As Hyland (2008) observes, these bundles are used either to draw the reader's attention to writer interpretations of data from a figure or table (*it can be seen, we can see that*) or to emphasise the importance of a particular step or of noting or understanding a point (*it is important/necessary to*). The first of these uses was not found at all in Telecommunications Engineering.

Bundles involving the expression of stance were found across all the sub-disciplines in higher frequencies than expected, particularly in Control and Telecommunications Engineering. As noted above, these mainly related to the expression of what is generally termed 'epistemic modality', that is the degree of certainty that the writer attributes to a proposition (Lyons, 1977:787); included in this category is reference to ability (*to be able to*) as a 'special case of possibility' (Quirk et al., 1985:221). Whether the bundles concerned expressed high certainty (*the fact that the, it is clear that*) or more tentative expressions (*it is possible to, if the system is*), their frequencies were relatively low and the variety of bundles used was quite small. As with other low frequency sub-categories in all functional categories, these MSc dissertation writers found it only necessary to write a small number of bundles to express a specific meaning. Even in the sub-discipline with the highest frequency of *Stance* bundles, Control Engineering, only five different bundles were found (*can be written as, to be able to, we are going to, if the system is, if and only if*). This observation seems to capture a general rule regarding bundle distribution in these sub-disciplines, that is, it is strongly conventionalised – a comparatively limited number of forms were used to express specific meanings.

6.3 General Conclusion

In this chapter, I discussed in the first section the distribution, structure and function of the most frequent 4-word lexical bundles in successful Algerian Engineering MSc dissertations of ACE compared to successful American Engineering MSc dissertations of USCE with reference to Hyland's (2008) findings relating to electrical and electronic Engineering. In the second section, I discussed in more detail the distribution, structure and function of these bundles across ACE four sub-disciplines (i.e.: *Power Engineering, Control Engineering, Computer Engineering and Telecommunication Engineering*) also with reference to Hyland (2008).

The structural analysis of bundles across the two corpora (ACE and USCE) showed variations in terms of the proportion of structures used in each corpus. In terms of proportion, the order of the main structures in ACE was '*NP + Of', 'Passive + PP', 'Other PP', 'Adverbials'* and *'Be + NP / Adj'*, whereas in USCE it was *'Passive + PP'*, '*NP + Of', 'PP + Of', 'Adverbials'* and *'Other PP'.* These differences were found to have a relationship to the rhetorical stages they were used in. For example, the *'NP+ Of'* was more frequent in the ACE Theory Stage compared to USCE because the Algerian PE and TE students in particular depended on this stage to demonstrate their mastery of the project, given the lack of resources and the impossibility of real-life implementation. This structural type was mostly used to provide descriptions and quantifications of the relevant theories and their working principles. In line with findings from Chapter Five, this provides further evidence that there was a greater focus on the Theory stage in ACE compared to USCE.

The relatively high use of *'Passive + PP'* and *'PP + Of'* structures (particularly in USCE) was found to be related to the high use of visual data, especially figures, in ACE and USCE. This reflects the fact that Electrical and Electronic Engineering depends largely on discussing findings, including simulations and explanations of components' working principles, with reference to visual data.

The remaining structural types of bundles including '*Anticipatory it' (e.g.: 'it is necessary to')* were relatively infrequent in both corpora. The reason for this is the same as the one given in Hyland (2008), which is that these structural types are more common in more advanced writing such as RAs. This point was confirmed in the functional analysis of PO bundles which were relatively infrequent in ACE and USCE, and was also confirmed to an extent by findings from Hyland's (2008) Electrical Engineering texts, see Figure 6.7. However, what is surprising is that while USCE writers used more *Engagement* bundles (179 pmw) compared to *'Stance Signals'* (110 pmw) which are considered as a feature of more advanced writing (e.g. RAs), ACE writers used more *Stance* than *Engagement* bundles. Although PO bundles were relatively infrequent in both corpora compared to the other functions, it is interesting that *Stance Signals* were slightly more frequent in ACE compared to USCE, as shown in Figure 6.7.

In terms of overall contrasting findings, USCE writers did not focus on RO signalling bundles (accounting for 39% of all bundles) as much as ACE students did (51%) or at least did not rely on phraseology involving LBs to do so. The sub-functions most represented in the RO category in both corpora were Description/quantification, which made up a significant part of this category, accounting for 35% in ACE and 30% in USCE. USCE writers, however, focussed more on TO than RO signalling bundles. The most well represented sub-function in the TO category was ‘Structural Signals’. This might suggest a tendency for students of Engineering in America to focus on coherence and cohesion in their relatively long Engineering MSc dissertations. On the other hand, there were lower proportions of TO in ACE (39%) than in USCE (52%). This also seems to strengthen the point made in Chapter Five, Section 5.3 that the American MSc students of Engineering maybe were being prepared for future studies and perhaps were given more instruction in the organisation of long texts. Professional engineers probably will never need to produce anything similar to an MSc dissertation in terms of size or content. The Algerian MSc engineers, on the other hand, as the interview findings show in Chapter Four show, were being prepared for field work. They tended not to focus much on guiding the reader through the dissertation through the use of TO bundles.

Although comparing ACE and USCE revealed some interesting differences, it missed some aspects of the functions of LBs, revealed through the sub-disciplinary analysis of ACE. It is at this finer level of analysis that it is possible to get a clearer picture of both differences between the sub-disciplines and the consistencies of usage across them. Examples of such differences include the high numbers of RO bundles in Telecommunications Engineering that relate to quantification and description and the clear sub-disciplinary differences in terms of ‘Topic signals’ bundles, as shown in Table 6.6. As *Topic* bundles are specific to each sub-discipline, they were not picked up by the thresholds applied to the entire corpus. Therefore, these bundles were not clear in the initial comparison of ACE with USCE, as shown in Figure 6.5.

Another difference which became clearer at the finer sub-categories level related to 'Resultative Signals', which were revealed to be high in CE, whereas 'Procedure Signals' were high in OE. A possible reason for this difference, as discussed in Chapter Five, was the nature of CE and OE. Unlike PE and TE, CE and OE allowed ACE writers to write longer and more elaborated System Design stages to cover the design, simulation and implementation of their project.

In terms of consistent findings, we could point to the overwhelming frequency of TO bundles functioning as structuring signals and the general tendency of PO bundles to relate to functions of stance rather than engagement (with Power Engineering being the exception), as shown in Figure 6.14.

Both levels of analyses (especially at the finer-grained level) also helped with the identification of clusters of bundles which had commonalities in terms of both function and form, such as those based around *shown* and its synonyms, presented earlier in Figure 6.13. Indeed, adopting this form and function approach – inspired by work in phraseology such as Sinclair (1996), Stubbs (2002) and Hoey (2005) – seems a useful step if we take the position that bundles are worthy of pedagogical attention. This, I feel, represents a development on the presentation of the Academic Formulas List (Simpson-Vlach and Ellis, 2010:498-502). I take the view that it is useful not only to present the main bundle types that express a specific meaning relevant to a specific type of writing, but also to make the formal similarities between them as clear as possible. Section 6.2.3 provides examples of what we might term 'bundle clusters' such as those based around the verb use (*can be used to/for/in, it/which is used to*) for describing procedures, or those based around the semantic set of numbers/calculations (*the number/sum/ratio/value of the*) relating to quantification.

To the extent, then, that the sub-disciplines of ACE have been shown to differ in terms of their usage of these clusters; it may be helpful to draw the attention of instructors and/or students to these differences. It also seems important to point out commonalities in ACE and USCE, such as the need in Electronic and Electrical Engineering MSc dissertations to make frequent reference to visuals and the typical phraseologies used to do so, as shown in Table 6.2. At the same time, we should bear in mind Simpson-Vlach and Ellis's recommendation (2010:502) that findings of this sort are best viewed as 'a resource for developing teaching materials based on further contextual research... rather than a resource for teaching itself'. That is, pedagogical treatments of relevant bundle types may be more effective if they draw on phraseological research such as Sinclair (1991, 1996), Stubbs (2002) and Hoey (2005) and seek to investigate specific co-texts of bundles and bundle clusters, such as the words that typically precede *is/are shown in fig/figure* or the most common sentence position of *as shown in fig/figure*. This sort of information is key to helping learners to master the phraseology of their discipline.

It is important at this stage to raise some notes of caution regarding the findings of this study and their interpretation. A first note relates to the relatively strict thresholds which were used in the study, which may act to exclude potentially numbers of relevant bundles which fall just below the thresholds. A similar point could be made about the fixed nature of bundles themselves; where intervening words such as *also* occur (e.g. *it can also be used*), very similar phenomena were not retrieved by the software and were therefore ignored in the analysis. Both of these issues have the potential to introduce differences between sub-disciplines which would then be artefacts of the methodology, which is why it is unwise to make too much of the differences observed here without further information.

A further methodological point which seems important to raise here relates to the application of functional frameworks such as that presented in Hyland (2008). This issue was discussed in detail in Section 3.4.3 where differences in functional analysis between Biber (2004, 2006) and Hyland (2008) were noted. The essential difficulty for studies which seek to apply the frameworks created in these studies is the lack of detail regarding how the definitions proposed map on to specific forms beyond those exemplified in the studies. Problems of interpretation are not always brought out into the open for various reasons, including no doubt lack of space in the published research articles to cover all these points. However, as Ädel & Erman (2012) note, it is important to be clear about the issues faced in categorisation since otherwise comparability across studies is either difficult or impossible. Another alternative would be to provide access to the full list of bundles and their categorisations dealt with in a study by adding an appendix, but Hyland (2008) does not take this option. It remains a strong possibility, therefore, that some of the interpretations of Hyland's framework in this thesis differ from his own. Bearing in mind this issue, the full list of the bundle analysis used in this study has been made available online[18].

As Hyland (2008:4) notes, bundles 'offer an important means of differentiating written texts by discipline'. In this chapter, I also showed that bundles can also be an important means of differentiating written texts at the sub-discipline level. However, more comparative analyses at the sub-discipline level is needed across other dissertations to ascertain whether the differences found in areas other than the 'Topic' sub-category of RO bundles are truly meaningful differences. For this reason, as well as the general rule that functions may be realised by numerous different forms, not all of which will be four-word fixed strings, it would be unwise to draw firm conclusions about functional differences observed across the sub-disciplines investigated in this study. Nevertheless, it is clear that there is a common inventory of lexical bundles which fluent writers of MSc dissertations in all these sub-disciplines need to have knowledge of; especially as these lexical bundles can be grouped in clusters that seem to get closer to the phraseology of the genre / discipline and therefore may be of some pedagogical use.

[18] http://rezougfares.coventry.domains/lexical-bundles/

Chapter 7
General Conclusion

7. Introduction

As explained in Chapter One, this thesis aims to shed light on the production of Master of Science (MSc) dissertations, written in English in Algeria, in the discipline of Electrical and Electronic Engineering. As the use of EMI across disciplines could be said to need more investigation than the teaching of English as a discipline, at first, I aimed to explore the writing practices of MSc students from a number of Algerian science and technology institutes that use EMI. However, I found that there is only one EMI institute of science and technology in Algeria, the Institute of Electrical and Electronic Engineering (IEEE). The motivation of this thesis is therefore to provide detailed information about MSc Engineering dissertations written in the only EMI institute of science and technology in Algeria, with the aim of providing Algerian students with a richer understanding of the way MSc dissertations are written, and assuming that other Algerian universities will also adopt EMI in the future.

In this chapter, I will first provide a summary of the main findings of this thesis and how the research questions have been addressed. I also report on research contributions, research implications and recommendation for future research.

7.1 Restatement of research questions

In this thesis, I have explored the organisational structure specific to the Algerian writers of MSc dissertations of Electrical and Electronic Engineering and their preferred formulaic multi-word sequences, referred to as lexical bundles, at the levels of form and structure. To identify what is specific to one group of texts, I created two corpora, one of Algerian MSc dissertations and the other containing dissertations written at US universities, in order to find the structure that applies in MSc dissertations in the Algerian context and investigate the phraseology of these dissertations. The main corpus in this study is the Algerian Corpus of Engineering (ACE) which consists of 70 MSc dissertations across four sub-disciplines: Telecommunication Engineering (15), Power Engineering (23), Control Engineering (15), and Computer Engineering (17). The second corpus is the United State Corpus of Engineering (USCE) which consists of 109 Engineering MSc dissertations collected online from seven universities.

After reviewing the literature regarding prior studies on the structure of research-process genres such as RAs, PhD thesis and MSc dissertations, I noticed that limited research is available on the overall structure of MSc dissertations; most often materials based on findings of structural patterns derived from PhD theses and RAs are the only sources to support Engineering Masters students in their dissertation writing in addition to their supervisory meetings. Furthermore, I also noticed that there is little research on the phraseology specific to the genre of MSc dissertations and how phraseological preferences can vary across different contexts or genres. This is a significant omission since an awareness of phraseology is considered useful ‘for the comprehension and construction of discourse’ (Biber and Barbieri, 2007:284). Therefore, this thesis addressed the following three research questions:

- RQ1: What is the organisation structure of the Engineering MSc dissertations produced in the medium of English in Algeria compared to their American counterparts?

- RQ2: What are the grammatical structures realised by the most frequent lexical bundles in the MSc dissertations produced in the medium of English in Algeria compared to their American counterparts?

- RQ3: What are the rhetorical functions expressed by the most frequent lexical bundles in the MSc dissertations produced in the medium of English in Algeria compared to their American counterparts?

The first research question has been addressed by using a qualitative method which involved reading all 179 Engineering MSc dissertations from both corpora (ACE and USCE) and reflecting on the rhetorical function of every chapter. The term ‘stages’ was used in this thesis instead of ‘sections’ to refer to the different rhetorical functions realised in one or multiple chapters. In deciding on the internal structure of each dissertation, I used the moves and steps method developed by Swales (1990) and applied in other relevant studies (Dudley-Evans, 1986; Bunton, 1998, 2002, 2005; Samraj, 2008; Basturkmen, 2009). Due to the limited number of studies that have investigated the structure of MSc dissertations, I also took into consideration previous studies that addressed the overall structure of other research genres such as RAs (Hill et al., 1982; West, 1980; Heslot, 1982; Swales, 1990; Posteguillo, 1998; Kanoksilapatham, 2005; Peffers et al.'s, 2008; Geerts, 2011; Lin and Evans, 2012) and PhD theses (Bunton, 1998; Dong, 1998; Dudley-Evan, 1999; Thompson, 1999, 2001; Paltridge, 2002) .

This research shows that the MSc dissertations from both corpora were not structured according to the conventional IMRD structure that has frequently been described in the literature, but according to the Design Specification structure (Nesi and Gardner, 2012) of design science research. The different rhetorical stages that were found to make up the Design Specification structure were Abstract, Introduction (with or without the background and Literature review), Theory, System Design, and Conclusion. A summary of the structure of the Algerian MSc dissertations is shown in Figure 7.1. More detail about the individual stages of this structure can be found in Section 5.1.2. The detailed findings shown in Figure 7.1 are in accordance with the supervisors' answers discussed in Chapter Four. The breakdown of the System Design stage, shown in Figure 7.1, might help students better understand how to write this stage, as it is considered the most important stage to students, supervisors and examiners, as discussed in Chapter Four. The overall structure of the American MSc dissertations is also summarised in Figure 7.2. More details about the individual stages that make up each structure can be found in Chapter Five.

Abstract

Aim (100%), Methods (87%), *Evaluation of results (13%)*

Introduction

Claiming centrality (90%), *Literature review (2.8%),* Indicating a real-world problem (83%), Announcing present research (85%%), Overall structure of the project (74%)

Theory

As a single-chapter: TE (40%), PE (30%), CE (67%) and OE (71%)

System Design

As a single-chapter: TE (71%), PE (57%), CE (7%) and OE (6%)

Single-Chapter System Design	**Multiple-Chapter System Design**
Software Design: Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion	**Hardware Design:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion **Software Design and overall testing:** Introduction Design Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion **Or** **Separate Overall testing chapter** Introduction Simulation: *Results & Discussion* Implementation: *Results & Discussion* Conclusion

Conclusion:

Restatement of the work carried out (100%), Restatement of the methods (100%), Evaluation of the main findings (100%), Practical implications (73%), Limitation (38%), Recommendation for future research (21%)

Figure 7.1: Overall organisational model of the Algerian MSc dissertations

<table>
<tr><th colspan="3">Abstract (100%):</th></tr>
<tr><td colspan="3">Introductory statements (Claiming centrality and Making topic generalisation),
What the research is about (Aim), How the research is carried out (Methods).</td></tr>
<tr><th colspan="3">Introduction (98%):</th></tr>
<tr><td>Without the Literature Review
and Background stages (32%)</td><td colspan="2">With Literature review
and background stages (66%)</td></tr>
<tr><td>Chapter One: Introduction
Introduction,
Motivation of the study,
Research objective,
Contribution of the study,
Outline of the study.</td><td colspan="2">Chapter One: Introduction
Introduction and Background (19%), or Literature review (8%), or
Background and Literature review (1%), and Motivation of the study,
Research objective, Contribution of the study, Outline of the study.
With/without
Chapter Two: Background (20%) or
Chapter Two: Literature review (15%) or
Chapter Two: Background and Chapter Three: Literature review (3%)</td></tr>
<tr><th colspan="3">Theory (56%):</th></tr>
<tr><td colspan="3">Single-chapter (38%), Two-chapter (8%), Three-chapter (8%) and Four-chapter (2%)</td></tr>
<tr><th colspan="3">System Design (94%):</th></tr>
<tr><td>Software-driven Research (12%)</td><td colspan="2">Hardware- and Software-driven Research (82%)</td></tr>
<tr><td>Single-Chapter
System Design</td><td>Multiple-Chapter
System Design (Simple, 66%)</td><td>Multiple-Chapter
System Design (Complex, 16%)</td></tr>
<tr><td>Software Design:
Introduction,
System Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.</td><td>Software Design:
Introduction,
System Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

Hardware Design and overall
Testing (39%):
Introduction,
System Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

With/without

Separate Overall Testing
Chapter (27%):
Introduction,
Simulation: Results & Discussion,
Implementation: Results & Discussion.</td><td>Part 1 …etc:
Introduction,
Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

Part 4 (14%):
Introduction,
Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.

With/without

Separate Overall Testing
Chapter (3%):
Introduction,
Design,
Simulation: Results & Discussion,
Implementation: Results & Discussion.</td></tr>
<tr><th colspan="3">Conclusion (100%):</th></tr>
<tr><td colspan="3">Restatement of the problem (18%); Restatement of the proposed work/solution to the problem (72%); Restatement of methods (62%); Evaluation of methods, findings, design (77%); Practical implications (42%); Contributions (10%); Limitations (8%) and Recommendations for future research (85%).</td></tr>
</table>

Figure 7.2: Overall structural model of the MSc dissertations in USCE

As noted in Chapter Five, the Algerian and American MSc dissertations differed in length. American Engineering MSc students write longer dissertations compared to Algerian MSc students. I found that the reason for this is because the Algerian MSc dissertations did not contain the Background and Literature review stages. Due to the pressure on the Algerian Institute of Electrical and Electronic Engineering and the short period often given to MSc students to write their final year project, the Algerian supervisors decided to focus on teaching technical skills required for the workplace. Dedicating a whole chapter to cover the background, which is already well established in the real world, and developing the critical thinking skills required to write literature reviews is of less relevance to the future industrial needs of Algeria. On the other hand, 47% of the American Engineering MSc dissertations contained a background stage (21% of which were realised in a separate section) and 29% contained a Literature review stage (10% of which were realised in a separate section).

There were also other differences at the level of moves and steps (see Figures 7.1 and 7.2). These findings are in accordance with the moves and steps model found in Bunton (1998, 2005), who analysed the structure of the conclusion in PhD theses.

I also found differences in the structure of the Theory and System Design stages cross the four sub-disciplines in the Algerian Corpus of Engineering. While Control and Computer Engineering dissertations contained shorter Theory stages and longer System Design stages explaining the design, simulation and implementation of their project, Telecommunication and Power Engineering dissertations contained shorter System Design stages and longer

Theory stages. Unlike Control and Computer Engineering, the nature of the projects in Telecommunication and Power Engineering made them too expensive for the institute and students to afford, and it was therefore difficult (if not impossible) for students to elaborate on the design and implementation process. This explains some of the students' comments in the interviews regarding lack of resources (see Section 4.5). To balance this lack of resources, Telecommunication and Power Engineering focussed more on the Theory stage of the work to demonstrate a high level of understanding of the theoretical part of the project. These differences in the structure of the dissertations are discussed in more detail in Chapter Five.

Research questions 2 and 3 have been addressed by using a quantitative method, using Anthony's (2011) AntConc software to extract the most frequent four-word lexical bundles. The functional and structural models used are Biber et al. (1999) and Hyland (2008). Overall, both corpora (ACE and USCE) had a high proportion of bundles referring to figures and tables. This is due to the nature of Engineering where students present and discuss their findings with reference to visual data. The proportion of 'NP + of' was higher in ACE compared to USCE, and the proportion of 'Passive + PP' was lower in ACE but higher in USCE. Both types of bundles occurred mostly in the Theory and System Design stages of both corpora. 'NP + of' bundles were descriptive bundles such as 'the size of the', and 'Passive + PP 'bundles referred largely to information presented in figures such as 'is shown in figure'. *Shown* was the most frequent verb in 'Passive + PP' bundles, which shows the importance of discussing findings with reference to figures in both corpora. Although this pattern was also found in the Theory stage of both corpora, it was most common in the System Design stage or in supervisors' terms the 'experimental part'. A high proportion of the bundles identified in ACE did not belong in the most frequent structural categories reported by Hyland (2008).

The reasons for the structural differences and similarities between LBs in ACE and USCE are better explained with reference to their functional classification. Perhaps it is worth recalling that the functional results of the most frequent bundles in ACE matched to a great extent those from Hyland's (2008) sub-corpus of Electrical Engineering, although this sub-corpus also contained PhD theses and RAs. Both corpora had similarly high proportions of Research-Oriented bundles followed by Text-Oriented and lastly Participant-Oriented bundles. The USCE, on the other hand, had a higher proportion of Text-Oriented bundles compared to both ACE and Hyland's sub-corpus followed by Research-Oriented and lastly Participant-Oriented bundles. This suggests that the contributors to ACE and Hyland's Electrical Engineering subcorpus did not make as much effort to guide their readers through the entire text as those who contributed to USCE.

In terms of structure, bundles were very similar in all the four sub-disciplines represented in ACE. For example, the most frequent bundles across all four sub-disciplines were those referring to information presented in figures. Additionally, the most frequent structural bundles are 'NP + of' (*e.g.: 'the output of'*), and 'Passive + PP' (*e.g.: 'is shown in figure'* and *'is defined as the'*).

Bundles across all four sub-disciplines were also found to be broadly comparable in terms of their main functions. All four sub-disciplines had high proportions of Research-Oriented bundles, followed by Text-Oriented and Participant-Oriented bundles. These results broadly match those of Hyland (2008) with slight differences in the proportion of each function.

When examined in greater detail, some slight variations in function were noted across the four sub-disciplines. For example, in the Research-Oriented category, *'Description / Quantification'* bundles (e.g. *is equal to the, the total number of and is the number of*, and *the size/length of the*), which were frequent in all four sub-disciplines, were much more common in Power and especially Telecommunication compared to Control and Computer Engineering. This can largely be attributed to the need to refer to numbers and/or calculations in these subdisciplines.

In the Text-Oriented category, 'Structuring signals' were the most significant functional sub-category. 'Structuring signals' may be divided into two main types; one type consists of parts of phrases which refer the reader to figures or tables; the vast majority of these included the verb *shown* (i.e.: *are/is shown in figure/table*). These 'shown' bundles were prevalent across all the sub-disciplines – in particular in Power and Telecommunication Engineering – and reflect the high quantities of visual materials introduced into the dissertations (Hyland, 2008, 2012). A possible reason why these bundles were particularly prevalent in PE and TE might be related to the fact that students of these disciplines used simulations, as they were not able to construct their projects in the real world. This meant that Power and Telecommunication students discussed their results with reference to visual data, often screen-shots of software programmes.

The second type of ‘Structuring Signal’ bundles were those used to inform the reader about upcoming content (e.g. *in the next/previous chapter/section*), or in order to point out the aims or objectives of the study (*the aim of this, we are going to*). In contrast to the first type, the distribution of this second type of bundles was rather skewed. They were very much more commonly found in Control and Computer Engineering dissertations compared to Telecommunication and Power Engineering. This is quite a surprising finding since there is nothing to suggest that Power or Telecommunications Engineering should, comparatively speaking, avoid such signals, especially as both of these sub-disciplines used bundles referring to figures and tables slightly more often.

In the Participant-Oriented category, which was the least frequent functional category across the four sub-disciplines, Power and Computer Engineering had relatively even distributions of ‘Stance’ and ‘Engagement’ bundles, whereas Control and Telecommunications Engineering had a stronger tendency to use ‘Stance’ bundles. However, both these types of bundles were extremely rare in the data, and students seemed to find it sufficient to use just one or two forms, occasionally, in their dissertations.

Overall, the MSc dissertations of the Algerian Engineering students were found to be different from their American counterparts at two levels. The Algerian Engineering students followed a specific structure, known as the Design Specification structure, whereas the American Engineering students follow a structure with two additional stages, the Background and Literature review. Another point of contrast is that the American dissertations showed more structural variations compared to the Algerian dissertations. The reason for this could be because a larger number of universities were represented in USCE.

There were also differences in the proportions of lexical bundles belonging to different structural and functional categories in ACE and USCE, as well as across the four sub-disciplines represented in ACE.

7.2 Research contributions

The first contribution of this thesis is the establishment of differences between MSc dissertations written in English in Algeria MSc dissertations written in English in the United States. This sort of cross-context comparison of MSc dissertations written in the same language, in the same field, but in different parts of the world, has not been conducted. The closest study in this case, but which took a different approach to explore regional differences is Lee and Casal (2014), as explained in Section 2.4.2.2.

The second contribution of this thesis is the in-depth macro and micro structural analysis of the MSc dissertations, which revealed interesting contrasts with the findings of previous studies of PhD theses and Masters dissertations (e.g.: Dong 1998; Bunton, 1998; Dudley-Evans, 1999; Thompson, 1999, 2001; Paltridge, 2002; Bunton, 2002) and RAs (Swales 1990, Kanoksilapatham, 2005, 2007, 2011, 2012, 2015; Lin and Evans, 2012). In this thesis I have established that not all Masters dissertations follow the conventional IMRD structure, which has long been associated with RAs (e.g. West, 1980; Hill et al., 1982; Heslot, 1982). The MSc dissertations investigated in this thesis, for example, were found to follow the structure of the Design Specification genre which contains two main distinctive stages not found in the IMRD structure (i.e. Theory and System Design). Some studies have already attempted to shed light on the structure of Design Specification texts, for example Geerts (2011), which looked at Information System RAs and George (1989) and Nesi and Gardner (2012), which looked at Engineering students' assignments. In this thesis, I have shown that the Design Specification structure applies to both Algerian and American Engineering dissertations. A summary of the structural models with detail at both macro and micro levels is shown in Figure 5.14 for the Algerian Engineering dissertations, and in Figure 5.18 for the American Engineering dissertations repeated in the previous Section 7.1. The third contribution of this thesis is at the phraseological level.

Overall differences between ACE and USCE at the structural and phraseology levels reinforce the point that while the majority of Electrical and Electronic Engineering students in Algeria are prepared to become engineers in the workplace, those in America appear to be prepared to carry on with their research as PhD students.

The results of this study are not only a contribution to our limited knowledge regarding the language and structure of MSc dissertations, but also have important implications for the Algerian teaching/learning context. The transfer of information about dissertation organisation and language from the Algerian IEEE to other (old or new) institutes in the country would enable students at those other institutes to study Engineering in English, if, as is likely, EMI eventually becomes the norm. For this to happen, there is a need for local teaching materials based on actual students' writing, which the results of this study and other future similar studies might help to fill.

7.3 Research implications

The rich results reported in this thesis at both the structural and phraseology levels have pedagogical implications that apply to IEEE as well as other institutes considering switching to EMI. First, it is worth noting that IEEE does not currently provide sessions to support students who might need help with their MSc dissertation writing process. As stated in Chapter One, this responsibility is left entirely to the subject experts on top of their responsibility to provide subject-related support for their students. As stated in Section 1.2.2, IEEE has language experts. However, their role is largely limited to teaching first year undergraduate students, and does not stretch to the stage where students write their MSc dissertations, even though I learnt from the interview data that they occasionally get enquiries from students asking for dissertation writing tips.

So far, the Algerian supervisors at IEEE have been providing advice about dissertation content, and about the way dissertations should be written, which explains their feeling of being under pressure, expressed in their interviews. In the early of 1980s when IEEE used to operate with smaller number of students, providing guidance on form and content to MSc students was a manageable task. However, with the rising number of students IEEE is receiving yearly, it would probably be better for subject lecturers to focus on providing subject-related help. This would help maintain the institute's current high research standards, or even improve them further. The results reported in this thesis can be used by the Algerian IEEE language experts to inform materials and sessions to care for the needs of their students at the Masters' level. Students could attend such sessions to learn about dissertation structure and phraseology, and receive answers to questions related to dissertation writing.

A key objective of this thesis was to provide guidance on the writing of MSc dissertations to support the implementation of English-medium instruction for engineers in Algerian higher education. The results of this thesis can also be adopted by other institutes considering switching to using EMI, in Algeria and in other countries with similar backgrounds and economic needs. The findings of this thesis are particularly important when we consider the rising interest of the public towards the use English in education in Algeria. As explained in Chapter One, the majority of Algerians want English to replace French and become the first foreign language (Middle East Monitor, 2018). Algerian institutes currently teaching in the medium of French are quite likely to switch to teaching in the medium of English, if the demands of the majority of Algerians are accepted by the government. The Algerian government has already reacted to these demands by sending 500 Algerian students on fully funded scholarships to obtain PhD degrees in English language and literature from the UK. Additionally, some Algerian universities have already started to offer their students the opportunity to write their Masters dissertations and PhD theses in English. This thesis will support this transition to English as the first foreign language, especially as I have shown that the needs of Algerian students are different from the needs of students in the USA, and that this affects the way they write their MSc dissertations. Information regarding the structure and phraseology of dissertations produced in other countries such as the USA might not apply in the Algerian context.

7.4 Recommendations for future research

This thesis has explored Engineering MSc dissertations as products, submitted in their final corrected electronic format to the library of the Institute of Electrical and Electronic Engineering. In future, it could be interesting to supplement the findings from this research with investigations of the writing process, making individual case studies of student writers and tracking the development of their MSc dissertations throughout the entire year. This sort of longitudinal approach could help in providing step-by-step guidelines for writing the dissertation. This sort of thick, ethnographic approach would allow researchers to document the supervisory feedback given to the students as well other types of resource and guidance. Such a study would have to address the difficulty of conducting the research while participants are still studying, as institutes do not hold copies of earlier drafts of MSc students' dissertations.

In addition, the two corpora (ACE and USCE) of Electrical and Electronic Engineering MSc dissertations created in this thesis can also be used in future research. For example, although the first discriminatory analysis conducted in this thesis showed that there are significant linguistic differences between the Algerian and American MSc dissertations, investigating and identifying these linguistic differences beyond those related to the structure and phraseology were not the focus of this thesis. Therefore, a follow up to this thesis could be to explore some or all of the most distinctive linguistic features which set ACE apart from other comparable corpora. This is particularly important, especially in view of the differences established in this thesis regarding MSc dissertations from different regions of the world, and in different Engineering sub-disciplines.

Most previous studies that addressed the structure of research-process genres (e.g. Dong 1998; Bunton, 1998; Dudley-Evans, 1999; Thompson, 1999, 2001; Paltridge, 2002; Bunton, 2002) included only a very limited number of MSc dissertations. However, the two corpora created in this thesis contain 179 dissertations – a total word count of 1,691,554 words with the possibility to increase in size in future studies. For example, dissertations submitted in different points in time can be added to the two corpora or I could create new corpora of MSc dissertations from other countries to be compared with ACE. Although it was not included in this thesis, it is also worth mentioning that I have created a third corpus of Engineering RAs, which I named the Engineering Corpus of Research Articles (ECRA) and was not included in this thesis due to time constrains. ECRA consists of almost six million words (5,913,456 words) of RAs across the same four sub-disciplines of Electrical and Electronic Engineering that make up ACE. All corpora have been tagged and cleaned of formatting, which makes them good resources for future research of students and experts Engineering writing in similar sub-disciplines. The results of such studies could inform the teaching of MSc dissertation and RAs writing.

Furthermore, as IEEE supervisors reported, in Chapter Four Section 4.6., that their Algerian MSc students face difficulties writing certain stages such the

Conclusion and System Design (otherwise known as the experimental part), future research might be conducted to further investigate these two stages. One possible way to help in this regard could be using the findings from this study to see if they can have an impact on facilitating the writing process of the Conclusion and System Design to the students.

LIST OF REFERENCES

Abdullah, F. (2018) ‘Moves within the literature reviews and discussion sections of international postgraduate theses and dissertation on ELT and applied linguistics’. *English Education and Applied Linguistics* 1(2), 174-183

Abu-Haidar, F., (2000). ‘Arabisation in Algeria’. *International Journal of Francophone Studies* 3(3), 151-163

Ädel, A., and Erman, B. (2012) ‘Recurrent word combinations in academic writing by native and non-native speakers of English: a lexical bundles approach’. *English for Specific Purposes* 31 (2), 81-92

Ageron, C., (1991) Modern Algeria: a History from 1830 to the Present, trans M. Brett. London: C. Hurst and Co [This book first appeared in 1964 in French as Histoire de l'Algérie contemporaine 1. La conquête et les débuts de la colonisation 1827-1871, Paris, PUF.]

Aitsiselmi, F., and Marley, D., (2008) ‘The role and status of the French language in North Africa’ (D. Ayoun, Ed.). *Studies in French Applied Linguistics*, 185–222

Al-Jarf, R. (2004) ‘College Students’ Attitudes towards Using English and Arabic as a Medium of Instruction at the university Level’. *World Arabic Translator’s Association* (WATA)

Al-Kahtany, A., Faruk, S., and Zumor, A., (2016) ‘English as the Medium of Instruction in Saudi Higher Education: Necessity or Hegemony?’ *Journal of Language Teaching and Research* 7(1), 49-58

Altbach, P., and Balán, J., (2007) *World class worldwide*. Baltimore: Johns Hopkins University Press

Altenberg, B. (1998) ‘On the phraseology of spoken English: the evidence of recurrent word-combinations’. in Phraseology: theory analysis and applications. ed. Cowie, A. P. Oxford: Oxford University Press, 101-122

Amnuai, W. (2017) ‘The textual organization of the discussion sections of accounting research articles’. *Kasetsart Journal of Social Sciences*, 1-6

Andersson, M., Najafabadi, H., and Wren, J. (2016) Improving Written Communication Skills In Engineering Programs. Proceedings of the 12th International CDIO Conference, Turku University of Applied Sciences, Turku, Finland, June 12-16

Anthony, L. (2011) Antconc (version 3.4.4) [Computer Software], Waseda University, Tokyo, Japan (2011)

Anthony, L. (2015) AntFileConverter (Version 1.2.0) [Computer Software]. Tokyo, Japan: Waseda University. Available from http://www.laurenceanthony.net/

Anthony, L. (2017) AntCorGen (Version 1.1.0) [Computer Software]. Tokyo, Japan: Waseda University. Available from http://www.laurenceanthony.net/

Averett, A., (2015) "Algeria in Perspective: Changing the Understanding of the Modern Algerian State". Unpublished dissertations. USA: Portland State University

Aziz, A., (2015) Al-Arabiyyah, Le Français, And The Soul Of Algeria: The Language Tango Between Arabic And French In Algerian Education Policy And Defining Post-Colonial Algerian National Identity. Unpublished dissertation. USA: The University of Mississippi

Bacha, N., and Bahous, S. (2011) 'Foreign Language Education in Lebanon: A Context of Cultural and Curricular Complexities'. *Journal of Language Teaching and Research*, 2(6): 1320-1328

Basturkmen, H. (2009) 'A genre-based investigation of discussion sections of research articles in Dentistry and disciplinary variation'. *Journal of English for Academic Purposes* 11, 134-144

Basturkmen, H. (2009) 'Commenting on results in published research articles and Masters' dissertations in Language Teaching'. *Journal of English for Academic Purposes* 8, 241-251

Basturkmen, H. (2010) *Developing courses in English for Specific Purposes*. Basingstoke: Palgrave Macmillan

Becher, T. (1989) *Academic Tribes and Territories: Intellectual inquiry and the Culture of Disciplines*. Buckingham, England: Open University press.

Becher, T. (1994) 'The Significance of Disciplinary Differences'. *Studies in Higher Education* 19 (2), 151-161

Becher, T., and Trowler, P. (2001) *Academic Tribes and Territories: Intellectual inquiry and the Culture of Disciplines (2nd ed.)*. Buckingham, England: Open University Press

Belhiah, H., and Abdelatif, A., (2016) 'English as a Medium of Instruction in Moroccan Higher Education'. *Arab World English Journal* 7(3), 211-222

Benjamin, S. (1954) *Algeria: 1830-2000: a Short History*. trans. by Todd, J. M. Ithaca, NY: Cornell University press

Benrabah, M. (2004) ‘Language and politics in Algeria’. *Nationalism and Ethnic Politics* 10(1), 59–78

Benrabah, M. (2005) ‘The language planning situation in Algeria’. *Current Issues in Language Planning* 6(4), 379–502

Benrabah, M. (2007a) ‘Language-in-education Planning in Algeria: Historical Development and Current Issues’. *Language Policy* 6 (2), 225–252

Benrabah, M. (2007b) ‘The Language Situation in Algeria’. in Language Planning and Policy in Africa 2. ed. by Kaplan, R. B. and Balauf, R. B. New York: Multilingual Matters, 25–148

Benstead, J., and Reif., M., (2013) ‘Polarization or Pluralism? Language, Identity, and Attitudes towards American Culture among Algeria’s Youth’. *Middle East Journal of Culture and Communication* 6, 75-106

Bestgen, Y. (2019) ‘Comparing Lexical Bundles across Corpora of Different Sizes: The Zipfian Problem’. *Journal of Quantitative Linguistics*, 1-19

Biber, D & Barbieri, F. (2007) ‘Lexical bundles in university spoken and written register’. *English for Specific Purposes* 26(3), 263-286

Biber, D. (2006) *University language: A corpus-based study of spoken and written registers*. Amsterdam: Benjamin

Biber, D., Conrad, S., & Cortes, V. (2004a) ‘If you look at...: Lexical bundles in university teaching and textbooks’. *Applied Linguistics* 25(3), 371–405

Biber, D., Conrad, S., Reppen, R., Byrd, P., Helt, M., Clark, V., Cortes, V., Csomay, E., & Urzua, A. (2004b) Representing language use in the university: Analysis of the TOEFL 2000 Spoken and Written Academic Language Corpus. TOEFL Monograph Series MS 25. Princeton, New Jersey: Educational Testing Service

Biber, D., Johansson, S., Leech, G., Conrad, S., and Finegan, E., (1999) ‘Longman Grammar of Spoken and Written English’. Harlow: Longman

Biglan, A. (1973) ‘The characteristics of subject matter in different academic areas’. *Journal of Applied Psychology* 57(3), 195-203

Bitchener, J. and Basturkmen, H. (2006) ‘Perceptions of the difficulties of postgraduate L2 thesis students writing the discussion section’. *Journal of English for Academic Purposes* 5, 4-18

Bloor, M., & Bloor, T., (1986) Language for specific purposes: practice and theory. In CLCS occasional papers. Dublin: Centre for Language & Communication Studies, Trinity College

Bouazid, T. & Le Roux, C. (2014) ‘Why Algerian students struggle to achieve in English Literature: an appraisal of possible root causes’. *Teaching in Higher Education* 19(8), 882-894

BouJaoude, S., Sayah, F., (2000) ‘Teaching science in Arabic: Attitudes and solutions’. in Language and Education Beirut: Lebanese Association for Educational Studies. ed. by Shaaban, K. Routledge, 145-169

Brett, P. (1994) ‘A genre analysis of the results section of sociology articles’. *English for Specific Purposes* 13(1), 47-59

Bridgeman, B., & Carlson, S., (1984) ‘Survey of academic writing tasks’. *Written Communication* 1, 247–280

British Council, (2014) Algerian Higher Education delegation visits UK. [Online] available from https://www.britishcouncil.org/organisation/press/algerian-higher-education-delegation-visits-uk [27 March 2018]

Bruce, I. (2008) ‘Cognitive genre structures in Methods sections of research articles: A corpus study’. *Journal of English for Academic Purposes* 7, 38-54

Bruce, I. (2009) ‘Results sections in sociology and organic chemistry articles: A genre analysis’. *English for Specific Purposes* 28, 105–124

Bucciarelli, L., Coyle, E., and McGrath, D. (2009) ‘Engineering Education in the US and the EU’. in Engineering in Context. ed. by Hyldgaard Christensen, S., Delahousse, B. and Meganck, M. Copenhagen: Academica, 105-128

Bunton, D. (1998) Linguistic and textual problems in Ph. D and M. Phil theses. Hong Kong: University of Hong Kong

Bunton, D. (2002) ‘Generic moves in Ph.D. thesis introductions’. In Academic discourse. ed. by Flowerdew, J. Harlow: Longman, 57-75

Bunton, D. (2005) ‘The structure of PhD conclusion chapters’. *Journal of English for Academic Purposes* 4 (3), 207-224

Bureau of Labour Statistics, U.S. Department of Labour, Occupational Outlook Handbook, Electrical and Electronics Engineers, on the Internet at https://www.bls.gov/ooh/architecture-and-Engineering/electrical-and-electronics-engineers.htm (visited February 21, 2019)

Cannell, C., and Kahn, R. (1968) ‘Interviewing’. In the Handbook of Social Psychology: (2nd ed.). ed. by Lindzey, G. and Aronson, E. Reading: Addison-Wesley, 526-595

Cargill, M. and O'Connor, P. (2009) *Writing scientific articles*. Oxford: Wiley-Blackwell

Casanave, C., and Hubbard, P., (1992) ‘The writing assignments and writing problems of doctoral students: faculty perceptions, pedagogical issues and needed research’. *English for Specific Purposes*, 11, 33–49

Cavan, S. (1977) Review of J.D. Douglas’s (1976) ‘Investigative Social Review: Individual and team Field Research’. *American Journal of sociology* 83(3), 809-811

Chaif, R. H., (2015) Algerian Students Are Victims of the Country’s Language Confusion. [Online] available from https://www.al-fanarmedia.org/2015/09/algerian-students-are-victims-of-the-countrys-language-confusion/ [15 May, 2018]

Chen, Y.-H., & Baker, P. (2010) ‘Lexical bundles in L1 and L2 academic writing’. *Language Learning and Technology* 14(2), 30-49

Cohen, L., Manion, L., and Mrrison, K., (2011) *Research methods in Education*. 5th edn. London: Routledge

Cohen, L., Manion, L., and Morrison, K. (2015) *Research Methods in Education*. 7th edn. London: Routledge

Coleman, A., (2006) English-medium teaching in European Higher Education. Language Teaching 39(1), 1-14

Cortes, V. (2004) ‘Lexical bundles in published and student disciplinary writing: Examples from history and biology’. *English for Specific Purposes* 23 (4), 397–423

Cortes, V. (2006) ‘Teaching lexical bundles in the disciplines: An example from a writing intensive history class’. *Linguistics and Education* 17 (4), 391–406

Cortes, V. (2013) ‘The purpose of this study is to: Connecting lexical bundles and moves in research article introductions’. *Journal of English for Academic Purposes* 12, 33-43

Cotos, E., Huffman, S., Link, S. (2017) ‘A move/step model for methods sections: Demonstrating Rigour and Credibility’. *English for Specific Purposes* 46, 90–106

Cotos, E., Huffmana, S., Linkb, S. (2017) ‘A move/step model for methods sections: Demonstrating Rigour and Credibility’. *English for Specific Purposes* 46, 90-106

Cropley, D. (2015) ‘Creativity in Engineering’. Burlington: *Elsevier Science*, 13-34

De Cock, S. (1998) ‘A recurrent word combination approach to the study of formulae in the speech of native and non-native speakers of English’. *International Journal of Corpus Linguistics* 3(1), 59–80

Diener, E. and Crandall, R. (1978) *Ethics in social and behavioural research*. 1st edn. Chicago: University of Chicago Press

Dong, Y, R. (1998) ‘Non-native graduate students' thesis/dissertation writing in Science: Self-reports by students and their supervisors from two U.S. institutions’. *English for Specific Purposes* 17 (4), 369-390

Dörnyei, Z. (2007) *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies*. Oxford: Oxford University Press

Dudley-Evans, A. (1986) ‘Genre Analysis: An Investigation of the Introduction and Discussion sections of MSc dissertations’. in Talking about text, English Language Research. ed. Coulthard, M. University of Birmingham, 128-145

Dudley-Evans, A. (1999) ‘The dissertation - a case of neglect?’. In Issues in EAP writing research and instruction. ed. by Thompson, P. Reading: The University of Reading, 28-36

Durrant, P. (2015) ‘Lexical Bundles and Disciplinary Variation in University Students’ Writing: Mapping the Territories’. *Applied Linguistics*, 38(2), 165- 193

Dyer, G. (1995) *Advertising as communication*. London: Routledge

Edelson, D. (2002) ‘Design Research: What We Learn When We Engage in Design’. *The Journal of the Learning Sciences* 11(1), 105-121

Elbow, P. (1997) ‘High Stakes and Low Stakes in Assigning and Responding to Writing’. *New Directions For Teaching And Learning* 69(1), 5-13

Ellis, N. C., Simpson-Vlach, R. & Maynard, C. (2008) ‘Formulaic language in native and second language speakers: Psycholinguistics, corpus linguistics, and TESOL’. *TESOL Quarterly* 42(3), 375–396

Evans, C. (2012) ‘Precision Engineering: an evolutionary perspective’. *Philosophical Transactions of the Royal Society*, 3835-3851

Firth, J. (1951) *Modes of meaning. In Papers in linguistics: 1934-1951.* ed. by Firth, J. Oxford University Press, 190–215

Flowerdew, J. (2004) *Corpus of PhD literature reviews*. Hong Kong: City University of Hong Kong

Flowerdew, L. (2015) ‘Using corpus-based research and online academic corpora to inform writing of the discussion section of a thesis’. *Journal of English for Academic purposes* 20, 58-68

Ford, C., McNally, D. and Ford, K. (2017) ‘Using design-based research in higher education innovation’. *Online Learning* 21(3), 50-67

Gardner, S., Nesi, H., and Biber, D., (2018) ‘Discipline, Level, Genre: Integrating Situational Perspectives in a New MD Analysis of University Student Writing’. *Applied Linguistics*. 1-30

Gardner, S. and Xu, X. (2019) ‘Engineering Registers in the 21st Century: SFL perspectives on online publications’. *Language, Context and Text: The Social Semiotics Forum* 1(1), 65-101

Geerts, G. (2011) ‘A design science research methodology and its application to accounting information systems research’. *International Journal of Accounting Information Systems*, 142–151

George, B. (1989) ‘Writing in the nature science and Engineering: implications for ESL composition course’ Paper presented at the Annual Meeting of the Teachers of English to Speakers of Other Languages, San Antonio, March 7-11

George, D., & Mallery, P. (2016) IBM SPSS statistics 23 step by step: a simple guide and reference. New York, Routledge

Gindis, E. J. and Kaebisch, R. C. (2019) ‘Spotlight On: Electrical Engineering’. in Up and Running with AutoCAD 2019. ed. by Gindis, E. J. and Kaebisch, R. C., London: Academic Press, 215-217

Gledhill, C. (2000) ‘The discourse function of collocation in research article introductions’. *English for Specific Purposes* 19(2):115-135

Goetschalckx, M. (2011) Supply Chain Engineering. International Series in Operations Research 15 & Management Science, Springer

Cantos Gómez, P. (2013). *Statistical methods in language and linguistic research*. Oakville, CT: Equinox

Gray, D. (2014) *Doing research in the real world*. London: SAGE

Haase, S., Chen, H. L., Sheppard, S., Kolmos, A., and Mejlgaard, N. (2013) ‘What Does It Take to Become a Good Engineer? Identifying Cross-National Engineering Student Profiles According to Perceived

Importance of Skills'. International Journal of Engineering Education 29 (3), 698–713

Hagler, M., Chandler, J., and Fontenot, A. D. (2001) Introducing First Year Engineering Students To Reading And Writing About Engineering Practice. Paper presented at 2001 Annual Conference, Albuquerque, New Mexico, 1-8

Halliday, M. A. K. (1985) *An introduction to functional grammar*. London: Arnold

Hevner, A.R., March, S.T., Park, J., Ram, S. (2004) 'Design science in information systems research'. *Management Information Systems Quarterly*, 28(1):75-105.

Heslot, J. (1982) Tense and other indexical markers in the typology of scientific texts in English. In Pragmatics and LSP. ed. Hoedt, J. Copenhagen: Copenhagen School of Economics, 83–103

Hewitt, E., and Lago, A. (2010) 'Academic style and format of doctoral theses: The case of the disappearing discussion chapter'. *Ibérica*, 119-140

Hill, S., Soppelsa, B., West, G. (1982) 'Teaching ESL Students to Read and Write Experimental-Research Paper'. *TESOL Quarterly* 16(3), 333-347

Hoffman, M., and Zhang, L., (2018) 'The Rising Importance of Precision Engineering. *Engineering* 4(6), 759

Holmes, R. (1997) 'Genre Analysis, and the Social Sciences: An Investigation of the Structure of Research Article Discussion Sections in Three Disciplines'. English for Specific Purposes 16(4), 321-337

Holt, M. (1994) 'Algeria: Language, Nation and State'. In Arabic Sociolinguistics: Issues and Perspectives. ed. by Suleiman, Y. Richmond: Curzon, 25-41

Horenstein, M. (2002) *Design Concepts for Engineers (2nd Ed)*. Upper Saddle River. NJ: Prentice-Hall

Howe, K. and Moses, M (1999) 'Ethics in educational research'. *Review of Research in Education* 24, 21-60

Hsiao, C. (2016) 'Genre Analysis of Low-rated and High-rated Literature Reviews by EFL Postgraduates'. *International Journal of English Language Teaching* 3(1), 1-19

Hsiao, C., & Yu, H. (2012) 'Knowledge Presentation in Thesis Writing-Examining Move Use in Reviewing Literature'. English Teaching and Learning 36(3),1-47

Hunston, S., (2002) *Corpora in Applied Linguistics. Cambridge*: Cambridge University Press

Hyland, K. (2000) ‘Hedges, boosters and lexical invisibility: Noticing modifiers in academic texts’. *Oxford University Press* 44(4), 279-285

Hyland, K., (2002) ‘Specificity revisited: how far should we go now?’ *English for Specific Purposes* 21, 385-395

Hyland, K., (2005) ‘Representing readers in writing: Student and expert practices’. *Linguistics and education* 16(4), 363-377

Hyland, K., (2008) ‘As can be seen: Lexical bundles and disciplinary variation’. *English for Specific Purposes* 27(1), 4–21

Hyland, K. (2012) ‘Bundles in academic discourse’. *Annual Review of Applied Linguistics* 32, 150-169

Hyland, K., and Hamp-Lyons, Liz., (2002) ‘EAP: issues and directions’. *Journal of English for Academic Purposes* 1, 1-12

Järvinen, P. (2007) ‘Action Research is Similar to Design Science’. *Quality & Quantity* 41(1), 37-54

Jian, H. (2010) ‘The Schematic Structure of Literature Review in Research Articles of Applied Linguistics’. *Chinese Journal of Applied Linguistics* 33(5), 15-27

Kanoksilapatham, B. (2005) ‘Rhetorical structure of biochemistry research articles’. *English for Specific Purposes* 24, 269–292

Kanoksilapatham, B. (2007) ‘Rhetorical moves in biochemistry research articles’. in Discourse on the move: Using corpus analysis to describe discourse structure. ed. Biber, D., Connor, U., and Upton, T. A. Amsterdam: John Benjamins, 73-119

Kanoksilapatham, B. (2011) ‘Civil Engineering research article introduction: Textual structure and linguistics characterization’. *Asian ESP Journal Spring* 7(2), 55-84

Kanoksilapatham, B. (2012) ‘Structure of Research Article Introductions in Three Engineering Subdisciplines’. *IEEE Transactions On Professional Communication* 55(4), 294-309

Kanoksilapatham, B. (2013) Generic characterisation of civil Engineering research article abstracts. *The Southeast Asian Journal of English Language Studies*, 19(3), 1-10

Kanoksilapatham, B. (2015) ‘Distinguishing textual features characterizing structural variation in research articles across three Engineering sub-discipline corpora’. *English for Specific Purposes* 37, 74-86

Koen, V. (1985) *Definition of the Engineering Method*. American Society for Engineering Education, Washington, DC

Koutsantoni, D. (2003). Rhetoric and culture in published and unpublished scientific communication: A comparative study of texts produced by Greek and native English speaking engineers. Unpublished doctoral dissertation, University of Birmingham, UK.

Koutsantoni, D. (2006) Rhetorical strategies in Engineering research articles and research theses: Advanced academic literacy and relations of power. *Journal of English for Academic Purposes*, 5, 19-36

Kuhn, T. (1962) *The Structure of Scientific Revolutions*. University of Chicago Press: Chicago

Kuhn, T. (1970) *The structure of scientific revolutions*. University of Chicago Press, London

Krueger, R. and Casey, M. (2000) *Focus groups*. London: Sage Publications

Krishnan, A. (2009). *What are academic disciplines?* (Working Paper Series). Southampton, England: University of Southampton National Centre for Research Methods.

Kwan, B. (2006) ‘The schematic structure of literature reviews in doctoral theses of applied linguistics’. *English for Specific Purposes* 25, 30–55

Lande, M., and Jordan, S. (2015) What is Making? What is Engineering? 122nd American Society for Engineering Education Annual Conference and Exposition

Lax, J (2019) ‘Question regarding Engineering Masters students dissertation writing’ [email] to Rezoug, F. [16 April 2019]

Lin, L., & Evans, S. (2012) ‘Structural patterns in empirical research articles: A cross-disciplinary study’. *English for Specific Purposes* 31(3), 150-160

Liu, Y., and Buckingham, L. (2018) ‘The schematic structure of discussion sections in applied linguistics and the distribution of metadiscourse markers’. *Journal of English for Academic Purposes* 34,97-109

Livari, J. (2007) ‘Nothing is as Clear as Unclear: Iivari’s Response’. *Scandinavian Journal of Information Systems* 19(2), 111-117

Livari, J., and Venable, J. (2009) “Action Research and Design Science Research: Seemingly Similar But Decidedly Dis- similar,” in Proceedings of 17th European Conference on Information Systems, Verona, Italy, June 8-10

Lyons, J. (1977) *Semantics*. Cambridge: Cambridge University Press

Lewis, M. (2000) ‘Learning in the lexical approach’. in Teaching collocation: Further developments in the lexical approach. ed. by Lewis, M. Hove: LTP, 155–185

Maamri, M. R. (2009) “The Syndrome of the French language in Algeria,” *International Journal of Arts and Sciences* 3(3), 77-89

Maccani, G., Donnellan, B., Helfert, M. (2015) ‘Action design research: a comparison with canonical action research and design science’. in At the Vanguard of Design Science: First Impressions and Early Findings from Ongoing Research Research-in-Progress Papers and Poster Presentations’. ed Donnellan, B., Gleasure, R., Helfert, M., Kenneally, J., Rothenberger, M., Chiarini Tremblay, M., Vandermeer, D. & Winter, R. The 10th International Conference. Dublin: Ireland, 69-76 [20-22 May]

Majgaard, G., Misfeldt, M. and Nielsen, J. (2011) ‘How design-based research and action research contribute to the development of a new design for learning’. Designs for Learning 4(2), 8-25

Marco, M.J.L., (2000) ‘Collocational frameworks in medical research papers: a genre-based study’. *English for Specific Purposes*, 19, 63-86

Maswana, S., Kanamaru, T., Tajino, A. (2015) ‘Move analysis of research articles across five Engineering fields: What they share and what they do not’. *Ampersand* 2, 1-11

Mckay, J., and Marshall, P. (2005) A Review of Design Science in Information Systems. 16th Australasian Conference on Information Systems, Sydney, 29 November – 2 December

McNamara, C. (1999) General Guidelines for Conducting Interviews, Authenticity Consulting, LLC, www.managementhelp.org/evaluatn/intrview.htm

Middle East Monitor (2018) “Majority of Algerians want English as their first foreign language”. [online] available from <https://www.middleeastmonitor.com/20180906-majority-of-algerians-want-english-as-their-first-foreign-language/> [12th November 2019]

Milagros del Saz Rubio, M. (2011) ‘A pragmatic approach to the macro-structure and metadiscoursal features of research article introductions in the field of Agricultural Sciences'. *English for Specific Purposes* 30, 258–271

Mogull, S. A. (2018) *Scientific and Medical Communication: A Guide for Effective Practice*. London: Routledge

National Academy of Engineering (2004) The Engineer of 2020: Visions of Engineering in the New Century. Washington, DC: The National Academies Press

Nesi, H. and Gardner, S. (2012) *Genres across the disciplines*. Cambridge: Cambridge University Press

Nesi, H. & Basturkmen, H., (2009) Lexical Cohesion and Corpus Linguistics. in Lexical cohesion and corpus linguistics. ed. by Flowerdew, J. and Mahlberg, M. Amsterdam: John Benjamins, 23-43

Nini, A. (2014) Multidimensional Analysis Tagger 1.2 - Manual. Retrieved from: http://sites.google.com/site/multidimensionaltagger

Nunamaker, J., Chen, M., and Purdin, T. (1991) 'Systems Development in Information Systems Research'. *Journal of Management Information Systems* 7(3), 89-106

Palmer, H. (1933) Second Interim report on English collocations. Tokyo: Kaitakusha

Paltridge, B. (2002) 'Thesis and dissertation writing: An examination of published advice and actual practice'. *English for Specific Purposes* 21(2), 125–143

Paltridge, B. (2019) 'Theses and dissertations in English for specific purposes'. by Chapelle, C. ed. in the concise encyclopedia of applied linguistics. ed. Malden, MA: Wiley

Paltridge, B. and Starfield, S. (2007) *Thesis and Dissertation Writing in a Second Language*. New York: Routledge

Pan, F., Reppen, R., & Biber, D. (2016) 'Comparing Patterns of L1 Versus L2 academic lectures'. *International Journal of Corpus Linguistics* 11(3), 283–304.

Pang, W. (2010) 'Lexical bundles and the construction of an academic voice: A pedagogical perspective'. *Asian EFL Journal* 47, 1–13

Palmer, H. (1933) Second Interim report on English collocations. Tokyo: Kaitakusha

Parker, A. (2010) Introducing a Technical Writing Communication Course into a Canadian School of Engineering. In Design discourse. ed. by Franke, D., Reid, A., and DiRenzo, A. Parlor Press, 203-2018

Peacock, M. (2002) ‘Communicative moves in the discussion section of research articles’. *System* 30, 479-497

Peffers. K., Tuunanen. T., Rothenberger. MA., Chatterjee S. (2008) ‘A design science research methodology for information systems research’. *Journal of Management Information Systems* 24(3), 45-77

Pennycook, A. (2002) *English and the discourses of colonialism*. London: Routledge

Pitt, J. (2001) ‘What Engineers Know’. Techné: Research in Philosophy and Technology 5(3) 116-123

Posteguillo, S. (1990) ‘The Schematic Structure of Computer Science Research Articles’. *English for Specific Purposes* 18(2),139-160

Prochaska, D. (1990) *Making Algeria French: colonialism in Bône, 1870-1920*. Cambridge University Press

Quirk, R., Greenbaum, S., Leech, G. & Svartvik, J. (1985) *A comprehensive grammar of the English language*. Harlow: Longman

Rezoug, F. & Vincent, B. (2018) ‘Exploring lexical bundles in the Algerian Corpus of Engineering’. *Arab Journal of Applied Linguistics* 3(1), 47-77

Richards, L. (2005) *Handling Qualitative Data: A Practical Guide*. London: Sage Publications

Römer, U. (2009) ‘The inseparability of lexis and grammar corpus linguistic perspectives’. *Annual Review of Cognitive Linguistics* 7(1), 140-162

Ryhan, E., (2014) ‘The Role and Impact of English as a Language and a Medium of Instruction in Saudi Higher Education Institutions: Students-Instructors Perspective’. *Study in English Language Teaching* 2(2), 140-148

Samraj, B. (2002) Introductions in research articles: Variations across disciplines. *English for Specific Purposes*, 21, 1–17

Samraj, B. (2005) ‘An exploration of a genre set: Research article abstracts and introductions in two disciplines’. *English for Specific Purposes* 24, 141–156

Samraj, B. (2008) ‘A discourse analysis of Master’s theses across disciplines with a focus on introductions’. *Journal of English for Academic Purposes* 1 (7), 55-67

Schmitt, N., Grandage, S., & Adolphs, S. (2004) Are corpus-derived recurrent clusters psycholinguistically valid?. in Formulaic sequences. ed. by Schmitt, N. Amsterdam: John Benjamins Publishing, 127–152

Scott, M. & Tribble, C. (2006) *Textual patterns*. Amsterdam: John Benjamins Publishing

Sein, M., Henfridsson, O., Purao, S., Rossi, M., Lindgren, R. (2011) ‘Action Design Research’. *Management Information Systems Quarterly* 35(1), 35-56

Sharkey, H. J. (2012) ‘Language and Conflict: The Political History of Arabisation in Sudan and Algeria’. Stud Ethn Nation 12, 427–449

Sheldon, E. (2011) ‘Rhetorical differences in RA introductions written by English L1 and L2 and Castilian Spanish L1 writers’. *Journal of English for Academic Purposes* 10, 238–251

Simpson-Vlach, R. & Ellis, N. (2010) ‘An academic formulas list: New methods in phraseology research’. *Applied Linguistics* 31(4), 487-512

Sinclair, J. (1996) ‘The search for units of meaning’. *TextUs* 9, 75-106

Skapinker, M., (2017) ‘Macron’s global ambitions for the French language will fail’. The Financial Times Limited 21 December 2017

Soler-Monreal, C. (2015) ‘Announcing one’s work in PhD theses in computer science: A comparison of Move 3 in literature reviews written in English L1, English L2 and Spanish L1’. *English for Specific Purposes* 40, 27–41

Soler-Monreal, C., Carbonell-Olivares, M., and Gil-Salom, L. (2011) ‘A contrastive study of the rhetorical organisation of English and Spanish PhD thesis introductions’. *English for Specific Purposes* 30, 4–17

Staples, S., Egbert, J., Biber, D., & McClair, A. (2013) ‘Formulaic sequences in EAP writing development: lexical bundles in TOEFL iBT writing section’. *Journal of English for Academic Purposes* 12(3), 214-225

Starfield, S., and Paltridge, B. (2019) ‘Thesis and dissertation writing in a second language: Context, identity, genre’. *Journal of Second Language Writing* 43,1-3

Stubbs, M. (2002) *Words and phrases*. Oxford: Blackwell. University Press

Swales, J. (1990) *Genre analysis: English in academic and research settings*. Cambridge: Cambridge University Press

Swales, J. (2004) *Research Genre: Exploration and Applications*. Cambridge University Press

Thompson, P. (1999) 'Exploring the contexts of writing: Interviews with PhD supervisors. Issues in EAP writing research and instruction'. Reading, UK, CALS, The University of Reading

Thompson, P. (2001) A pedagogically-motivated corpus-based examination of PhD theses: macrostructure, citation practices and uses of modal verbs. Unpublished PhD thesis, University of Reading

Trowler, P. (2001) *Academic Tribes and Territories: the theoretical trajectory*. Lancaster University Press

Vincent, B. (2013) 'Investigating academic phraseology through combinations of very frequent words: A methodological exploration'. *Journal of English for Academic Purposes* 12(1), 44-56.

Wächter, B., and Maiworm, F., (2014) English-Taught Programmes in European Higher Education. Bonn: Lemmens

Wallace, R., (1995). English for specific purposes in ESL undergraduate composition classes: rationale. Unpublished doctoral dissertation, Illinois State

West, G. (1980) 'That-Nominal Constructions in Traditional Rhetorical Divisions of Scientific Research Papers'. *TESOL Quarterly* 14(4), 483-488

Wheeler, E., and McDonald, R. (2000) 'Writing in Engineering Courses'. *Journal of Engineering Education*, 482-486

Wood, D., and Appel, R. (2014) 'Multiword constructions in first year business and Engineering university textbooks and EAP textbooks'. *Journal of English for Academic Purposes* 15, 1-13

Wray, A. (2002) *Formulaic language and the lexicon*. Cambridge: Cambridge

Xu, Xiaoyu., and Nesi, H. (2017) 'An analysis of the evaluation contexts in academic discourse'. *Functional Linguistics* 4(2), 1-17

Zhang, B., and Wannaruk, A. (2016) 'Rhetorical Structure of Education Research Article Methods Sections'. *PASAA* 51, 155-184

Appendix I: Letter of permission to collect MSc dissertations from IEEE

الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي و البحث العلمي
جامعة العربي بن مهيدي - أم البواقي –

أم البواقي في :2015/04/08

كلية الآداب و اللغات
قسم اللغة الإنجليزية
الرقم :/ ك آ ل / ق ل إ / 2015

**** ترخيص بالدخول الى مكتبة معهد INELEC ****

لنا عظيم الشرف ان نتقدم بطلبنا هذا الى **السيد مدير معهد INELEC** و المتمثل في مساعدة الطالب الباحث **فارس رزوق** المولود بتــاريخ **1990/09/19** - أم البواقـــــــي – و الحاصل على **شهادة الماستر في اللغة** الانجليزية دفعة **2015/2014** و المرفوقة بمنحة التمدرس بالخارج لمدة ثلاث سنوات من وزارة التعليم العالي و البحث العلمي لنيل شهادة الدكتوراه.

- ولذلك نرجوا من سيادتكم المحترمة السماح للطالب المذكور أعلاه بالدخول الى المكتبة للإطلاع على مافيها من مراجع و بحوث و مذكرات التخرج المتعلقة بالبحث العلمي.

Appendix II: Information leaflet for Investigating IEEE MSc dissertations

The researcher who will conduct this study is based at the University of Coventry in the United Kingdom. However, this study is funded by the Algerian Ministry of Higher education and Scientific Research (MHESR).

The collected dissertations from IEEE will be used in a PhD study to investigate how Algerian students write their dissertations in the field of Electronics and Electronical Engineering, tracing possible changes to this genre across two educational systems (*'BMD'* and '*Classic'*) at two points of time (2000 and 2015).

The data will be used by the researcher for linguistic research purposes. No evaluation of any kind will be attributed to the reputation of the institute or the level of the students. Before analysis, the data will be anonymised to make it impossible to trace its original authors. The final corpus will be made available for exploration by IEEE teachers and students, and other interested parties.

If you have any questions about this study, please feel free to contact us:

Prof Hilary Nesi (Director of Studies)
The University of Coventry
Faculty of Arts and Humanities
aa3861@coventry.ac.uk
Dr Benet Vincent (supervisor)
University of Coventry
Faculty of Arts and Humanities
ab6667@coventry.ac.uk
Fares Rezoug (PhD researcher)
University of Coventry
Faculty of Arts and Humanities
rezougf@uni.covnetry.ac.uk

A Corpus-based Investigation of IEEE MSc Dissertations

(Researcher keeps this section)

The INELEC institute agrees to take part in this study by providing the required Masters dissertations as explained above:

Participant Signature....................................... Date.......................
Researcher Signature...................................... Date........................

Are you interested in receiving a report based on this research when the study is complete?
YES........ NO.........

Contact details:

Phone number...
Email...

Appendix III: Participant Information Sheet for The Interviews

The interviewer who is conducting this study is based at Coventry University in the United Kingdom. However, this study is funded by the Algerian Ministry of Higher Education and Scientific Research (MHESR).

The information obtained from this interview will be used in a PhD study to investigate how Algerian students write their dissertations in the field of Electronics and Electronical Engineering in English. The aim of this study is to provide a detailed analysis of Engineering MSc dissertation writing in the medium of English in Algeria to help both teachers and students of IEEE and other future EMI in Algeria to supervise and write MSc dissertations.

The recordings will only be accessed by the researcher and his supervisors. Before analysis, the data will be transcribed and anonymised. The researcher will be responsible for storing and deleting the audio version of the interviews at the end of this study.

If you have any further questions about this study, please feel free to contact us:

Prof Hilary Nesi (Director of Studies)
The University of Coventry
Faculty of Arts and Humanities
aa3861@coventry.ac.uk

Dr Benet Vincent (supervisor)
University of Coventry
Faculty of Arts and Humanities
ab6667@coventry.ac.uk

Fares Rezoug (PhD researcher)
University of Coventry
Faculty of Arts and Humanities
rezougf@uni.covnetry.ac.uk

Appendix IV: Outline of interview questions

Q1. What makes a good MSc dissertation, in you view?

Q2. Is there a conventional structure to an MSc dissertation in your field of study?

Q3**.** Based on your experience, what are the problems students usually face in writing a dissertation, if any?

Q4**.** Based on your experience, what are the problems you faced so far in writing a dissertation, if any?

Q5. Have you any other comments about teaching/studying at IEEE?