GENRE SET OF ABSTRACT, INTRODUCTION, AND CONCLUSION IN SCIENCE AND ENGINEERING PHD DISSERTATIONS: VARIATIONS BETWEEN THE TWO DISCIPLINES

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มหาวิทยาลัยเทคโนโลยีสุรนารี

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ชุดประเภทผลงานของบทคัดย่อ บทนำ และบทสรุปในวิทยานิพนธ์ระดับปริญญาเอกด้านวิทยาศาสตร์ และวิศวกรรมศาสตร์: ความแตกต่างระหว่าง 2 สาขาวิชา

นางสาวยานุมาศ แสงใส

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Suranaree University of Technology has approved this thesis submitted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy.

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การเขียนวิทยานิพนธ์เป็นภาษาอังกฤษ ทำให้เกิดภาระงานที่เพิ่มขึ้นสำหรับนักศึกษาที่ไม่ใช่เจ้าของภาษาในสภาวะแวดล้อมการเรียนการสอนภาษาอังกฤษในฐานะภาษาต่างประเทศ ทั้งนี้ยังถือเป็นข้อกำหนดปฏิบัติสำหรับนักศึกษาปริญญาเอกสาขาวิทยาศาสตร์และวิศวกรรมศาสตร์ ของมหาวิทยาลัยเทคโนโลยีสุรนารีอีกด้วย แม้ว่าเนื้อหาและส่วนประกอบของวิทยานิพนธ์ล้วนมีความแตกต่างกัน แต่มีเพียงสามสิ่งที่ปรากฏอยู่ในวิทยานิพนธ์เหล่านี้คือ บทคัดย่อ (Abstract) บทนำ (Introduction) และ บทสรุป (Conclusion) ดังนั้น สามส่วนประกอบเหล่านี้จึงถือได้ว่าเป็นชุดประเภทผลงาน (genre set) ที่ต้องมีปรากฏไว้ในวิทยานิพนธ์ของทั้งสองสาขาวิชา งานวิจัยฉบับนี้แสดงผลการศึกษาจากการวิเคราะห์โครงสร้างและส่วนย่อยโครงสร้างของแต่ละอัตภาค (move-step) ในชุดประเภทผลงานที่นำมาจากคลังข้อมูลวิทยานิพนธ์ปริญญาเอกระหว่างสาขาวิทยาศาสตร์และวิศวกรรมศาสตร์ซึ่งเขียนไว้โดยนักศึกษาจากมหาวิทยาลัยแห่งนี้ โดยแต่ละคลังข้อมูลประกอบด้วย 25 วิทยานิพนธ์จากการคัดเลือกแบบสุ่มเฉพาะเจาะจง ของทั้งสองสาขาวิชา การวิเคราะห์แต่ละบทยึดตามแนวอัตภาควิเคราะห์ (framework analysis) ที่แตกต่างกันออกไป กล่าวคือ ภาคบทคัดย่อใช้อัตภาควิเคราะห์ของ Hyland (2000) ภาคบทนำใช้อัตภาควิเคราะห์ของ Bunton (2002) และภาคบทสรุปใช้อัตภาควิเคราะห์ของ Bunton (2005) ตามลำดับ ผลการวิเคราะห์ที่ได้ถูกนำมาเปรียบเทียบเพื่อให้เห็นความแตกต่างระหว่างสองสาขาวิชา รวมไปถึงความเชื่อมโยง (relationship) ระหว่างสามส่วนประกอบในชุดประเภทผลงานของทั้งสองสาขาวิชายังได้ถูกวิเคราะห์ด้วย ผลจากการศึกษาพบว่า แม้ผู้เขียนวิทยานิพนธ์ปริญญาเอกเหล่านี้จะมาจากกลุ่มสถานศึกษาของ ผู้ใช้สัมพันธสารเดียวกัน (discourse community) อันได้แก่ มหาวิทยาลัยเทคโนโลยีสุรนารี ผู้เขียนได้แสดงความแตกต่างออกมาทั้งมากและน้อยในงานเขียนวิทยานิพนธ์เป็นภาษาอังกฤษ ทั้งนี้อาจเป็นเพราะความรู้และวัฒนธรรมที่แตกต่างกันของสาขาวิชา ยกตัวอย่างเช่น ในขณะที่วิทยานิพนธ์จากทั้งสองสาขาวิชามีโครงสร้างอัตภาคตามที่ระบุในโครงสร้างอัตภาควิเคราะห์ที่เลือกไว้ แต่มีความแตกต่างเพียงเล็กน้อยในระดับของส่วนย่อยโครงสร้างของอัตภาค นอกจากนั้นแล้ว วิทยานิพนธ์ด้านวิศวกรรมศาสตร์มีความสอดคล้องที่ใกล้เคียงกับแนวอัตภาค

วิเคราะห์ทั้งในด้านของหน้าที่และการเรียบเรียงการเขียนมากกว่าวิทยานิพนธ์ด้านวิทยาศาสตร์ ผลการวิเคราะห์จากความเชื่อมโยงของส่วนประกอบในชุดประเภทผลงานของทั้งสองสาขาวิชาพบดังตัวอย่างต่อไปนี้ว่า โครงสร้างอัตภาคสองส่วนในบทคัดย่อของสาขาวิชาวิศวกรรมศาสตร์มีการปรากฏซ้ำอยู่ในทั้งบทนำ และ บทสรุปทั้งสองส่วนของวิทยานิพนธ์ ในขณะที่ โครงสร้างอัตภาคเพียงหนึ่งส่วนจากบทคัดย่อของสาขาวิชาวิทยาศาสตร์มีการปรากฏอีกครั้งในบทนำและบทสรุป ของวิทยานิพนธ์เท่านั้น ผลการศึกษาจากงานวิจัยชิ้นนี้หวังเป็นอย่างยิ่งว่าจะสามารถแสดงให้เห็นความแตกต่างของกลุ่มผู้ใช้สัมพันธสารเดียวกัน และความเชื่อมโยงกันของบทคัดย่อ บทนำ และ บทสรุปในชุดประเภทผลงานได้มากขึ้น และจะเป็นประโยชน์สำหรับอาจารย์ผู้สอนภาษาอังกฤษในการออกแบบและนำเครื่องมือการสอนไปใช้ สำหรับการเรียนการเขียนวิทยานิพนธ์ให้กับนักศึกษาปริญญาเอกของมหาวิทยาลัยเทคโนโลยีสุรนารี ในสาขาวิชาของตนเองเป็นลำดับต่อไป

มหาวิทยาลัยเทคโนโลยีสุรนารี

สาขาวิชาภาษาต่างประเทศ ลายมือชื่อนักศึกษา_____

ปีการศึกษา 2558 ลายมือชื่ออาจารย์ที่ปรึกษา_____

YANUMART SAENGSAI : GENRE SET OF ABSTRACT, INTRODUCTION, AND CONCLUSION IN SCIENCE AND ENGINEERING PHD DISSERTATIONS: VARIATIONS BETWEEN THE TWO DISCIPLINES. THESIS ADVISOR : ASST. PROF. ISSRA PRAMOOLSOOK, Ph.D., 243 PP.

MOVE/STEP/GENRE/DISCOURSE/PHD DISSERTATIONS/APPLIED LINGUISTICS/GENRE SET

Writing a dissertation in English which places an additional burden on non-native speakers of English in EFL settings is a requirement for science and engineering PhD students in Suranaree University of Technology (SUT). Despite the various and varied textual elements in these dissertations, there are three textual elements that always appear in them, i.e. Abstract, Introduction, and Conclusion chapters. Therefore, these three elements are considered as an obligatory genre set in SUT dissertations in these two disciplines. This present study reports a study that explores the move-step structures of the genre set taken from the PhD dissertation corpus between science and engineering fields written by SUT students. Twenty five dissertations from each of the two disciplines were purposively selected and analyzed using three selected analysis frameworks proposed by Hyland (2000) for Abstracts, and Bunton (2002, 2005) for Introduction, and Conclusion, respectively. The move-step structures of the three elements in the genre set including their relationship in this set of genre from each of the two disciplines were firstly analyzed, then the results of these were compared between the two fields to uncover the disciplinary variations. The findings point out that although the writers of these PhD dissertations were from

the same local academic discourse community, i.e. Suranaree University of Technology, they still create major and minor differences in their writing, possibly due to the different disciplinary knowledge and culture they subscribe to. For example, while the dissertations from the two disciplines have the move structures that can be sufficiently described by the selected models, they bear slight differences in the step level. In addition, the engineering dissertations show a greater similarity in function and composition to those presented in the adopted frameworks than their science counterparts. The result on the relationship among the three elements in the genre set from the two disciplines reveals, for example, that two moves in the engineering abstracts are repeated in the Introductions and Conclusions in the corpus, whereas only one move in the science abstracts is mentioned again in the Introduction and Conclusion chapters. It is hoped that the results from this present study can also shade more light on the disciplinary discourse variations, and the relationship among Abstract, Introduction, and Conclusion chapters in the genre set. Moreover, the results from this study will offer benefits for English teachers in designing pedagogical implications for SUT PhD students to write their dissertations in their fields.

School of Foreign Languages Student's Signature_____

Academic Year 2015 Advisor's Signature_____

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Yanumart Saengsai

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LIST OF ABBREVIATIONS

CARS	Create a Research Space
EAP	English for Academic Purposes
EFL	English as a Foreign Language
EN	Engineering
ESP	English for Specific Purposes
L1	A Speaker's First Language
L2	A Speaker's Second Language
M	Move
NES	Native English Students
NNES	Non-native English Students
PhD	Doctor of Philosophy
RAs	Research Articles
SC	Science
S	Step
SUTIR	Suranaree Technology Intellectual Repository

CHAPTER 1

INTRODUCTION

To provide the context of the current investigation, this chapter presents the introduction concerning the importance of the English language in general as well as in academic and research world, especially for science and engineering students. Then, it identifies the research problems, which lead to the significance of the study. The research objectives, research questions, scope of the study, and definitions of key terms will also be presented in this chapter.

1.1 Background to the Research

English is nowadays firmly established as an international language of science (Brumfit, 1982; McKay, 2003). The bulk of research, publishing, and training in scientific and technical fields make use of the English medium. The development of new technical terms to report new discoveries, processes and inventions developed in western countries where English is used as a language of communication, contains complexities to be translated into Thai. People can communicate to each other all over the world because of the advanced communication and technology systems. Hence, knowledge of appropriate English is essential.

There is a great amount of information communicated through English, especially in academic areas, e.g., science and technology textbooks, and journals. Moreover, English has become the accepted international language of technology and

commerce (Hutchinson & Waters, 1987). Back in 30 years ago, there were about 7,000 scientific journal articles being published every day (Naisbett, 1982, cited in Tardy, 2004), therefore, the amount of articles today is unimaginable. Even in the context of globalization and increasing international research collaborations, the ability to read and/or write research articles in English is crucial for academic and professional success in science and technology (Baldauf & Jernudd, 1983; Gibbs, 1995, cited in Wood, 2001; Kanoksilapatham, 2005). In addition, after science and technology students graduate, the jobs they can do are mostly engineers, mechanics, technicians, or particularly in scientific areas. They have to read a lot of English instruction manuals and sometimes they also have to communicate in English at their workplaces. For higher education especially in the tertiary level, many graduate students have to write their dissertations in English as well. However, it has been found that the students have great difficulties in writing their dissertations (e.g., Paltridge, 2002; Bunton, 2002; Paltridge & Starfield, 2007; Pramoolsook, 2008).

Pramoolsook (2008) conducts a questionnaire survey at Suranaree University of Technology (SUT) with graduate students and their lecturers in order to reveal their needs and the problems that they have when producing written works during and after their study for a postgraduate degree. The survey results indicate that writing in English poses a major difficulty for the students and they expressed a wide range of problems they have for writing caused by a poor background in English and a lack of opportunity to use the language. In a similar study, Pramoolsook et al. (2011) investigate the PhD students' research articles writing difficulties in SUT. The results reveal that organization of RAs, low English proficiency, transfer of dissertation to RA, specific content knowledge, journal and topic selection, and plagiarism are the

six main problems in writing English RAs, which generally corresponds to the results of previous studies in other contexts (e.g., Sowden, 2005; Okamura, 2006; Chang, 2008; Cho, 2009; Cheung, 2010). As for the needs, support such as formal academic writing courses and consultation with native English speakers provided by the university through the English Language Center are reported as desirable ways to help ease their writing difficulties. As a result, knowledge of the proper and effective English language is important especially for English academic writing for science and technology students.

Moreover, the English language has become one of the main channels for distributing an advanced scientific knowledge among scholars world-wide. Hence, there is a large number of non-native English students (NNES) attending universities in United Kingdom, United States of America, Canada, Australia and New Zealand for a degree which requires the writing of a thesis or dissertation in English. There are also many students enrolled in degrees of places where English is not their first or dominant language such as South Africa and Hong Kong, who are required to write a thesis or dissertation in English. These students often have difficulties in meeting the demands of the kind of writing required of them in this particular genre (Paltridge & Starfield, 2007). As for the PhD writing difficulties, Swales (2004) explains that PhD dissertation or thesis is the culminating genre of doctoral education submitted in support for a degree or professional qualification in order to present the author's research. Paltridge & Starfield (2007) also mention that all students writing a research thesis face the new challenge of having to manage a large amount of texts across a lengthy period of time; 80,000 words is the typical length of a doctoral thesis in Britain or Australia. Graduate students writing within their disciplines clearly

demonstrate that even successful students struggle with writing at an advanced level. This challenge is heightened for the second-language speakers as they may struggle simultaneously in several domains, all of which also have been identified as influencing academic writing at an advanced level (Prior, 1998, cited in Paltridge & Starfield, 2007). Similar cases are reported in the studies of Flowerdew (1999a; 1999b) that give such useful information relating to the problem but in the case of the research articles writing for publication. In his survey, 68 percent of 585 respondents who are Cantoneses-L1 Hong Kong academics express their disadvantage when attempting to publish in English. When compared with the native speakers of English, they mention that their main obstacles of getting their RAs published are that they have a less facility of expression; it takes them longer to write; they have a less rich vocabulary; they find it difficult to make claims for their research with the appropriate amount of force; their process of composition may be influenced by their L1; qualitative articles are more problematic than quantitative articles; they are restricted to a simple style; and the Introductions and Discussions of scholarly articles are particularly problematic parts.

In Thailand, another point to take into consideration is the controversial issue in writing dissertations reported by Samabhudhi (1999) that some institutions have been trying to push forward the requirement for writing dissertations in English even in the Thai programs, which causes protest from students and academics nationwide. The case from Mahidol university is one of the examples. The article reports that in the university's postgraduate regulations concerning dissertation writing and defense, the No.9 item states that *"dissertations are to be written in English. In the cases in which the content of the dissertation cannot be conveyed successfully and effectively in English, the*

use of Thai is allowed upon the student's petition to write the dissertation in Thai. The decision shall be made by the Head of the Department or by the director of the program". However, there are two sides of people who agree with or think differently from the ideas. The reasons for those who agree that dissertations should be written in English include; 1) English can promote advantage chances for the students in finding jobs and further their study overseas, 2) English makes the students' dissertations more sophisticated and internationally accepted, and 3) dissertations written in English are almost read by academic people, not the local ones. The rationales for those who disagree with the ideas of having dissertations written in English include; 1) English is not a direct measurement to indicate the university's academic administrations at the international level, 2) English cannot persuade people to gain beneficial knowledge from the dissertations but if the knowledge is required internationally, translation from Thai into English should be considered, and 3) English is an obstacle to learn new knowledge for both science and social science students as they can create their research by using their own native language.

The debate in the case of Mahidol University has shown that the appropriate language for dissertation writing should be English, which can be an example to other universities in Thailand. This is settled with the university's firm determination to have all the dissertations written in English, which is obligatory to all graduate students. The controversial issue has raised the standard of English dissertation writing for universities in Thailand. The needs to upgrade themselves to meet that standard are reflected through offering all study programs in English. From the situation based on the controversial issue at Mahidol University, the difficulties on dissertation writing in English place burden on the students as they are not familiar

with English. Although this issue was brought up nearly two decades ago, this case can inevitably happen to graduate students in other Thai universities as well, where many study programs are offered in English nowadays. Therefore, the present research will focus on the study of English PhD dissertations writing from one of the Thai higher education institutions, Suranaree University of Technology, Nakhon Ratchasima, Thailand.

1.2 Research Problems

In an attempt to find out whether the SUT PhD students are facing the similar situation as stated in the case of both native English students (NES) and non-native English students (NNES) when they have to write their PhD dissertations, the researcher designed a questionnaire survey, the result of which was used as a primary evidence to confirm the actual problems that SUT students have. The questionnaire was designed to ask for SUT graduate students' opinions, knowledge, needs, and problems toward the dissertation writing in English. Their answers were investigated in order to provide information about the students' difficulties, and the needs for support that they think can help them to cope with these problems for more effective PhD dissertation writing. Details of the questionnaire survey are described in Appendix C.

From the survey results, writing dissertations in English has given great challenges to SUT graduate students and perhaps to all graduate students in Thailand especially the PhD ones. In response to this concern, there has been an increasing attention to the studies into research genres to facilitate the students' writing for over decades. The seminal work of Swales (1990) on research articles (RAs) that gives rise

to the CARS (Create A Research Space) model for the Introduction sections has inspired many genre analysts to conduct later studies of research genres, especially the move-step structure in RAs. Studies on either specific sections or the whole RAs have received much attention among the genre analysts since then. For example, one set of studies have investigated a single unit of RAs from one or various disciplines (e.g., Swales, 1981; 1990; 2004; Swales and Najjar, 1987; Bhatia, 1993; Brett, 1994; Hyland, 2000; Lorés, 2004; Peacock, 2002; 2011; Lim, 2006; Kanoksilapatham, 2011). Another set of studies have explored the variations of a single or two units of RAs between two disciplines (e.g., Samraj, 2002a; 2002b; 2005). The third set of studies have conducted move analysis on the whole RAs (e.g., Nwogu, 1997; Posteguillo, 1999; Kanoksilpatham, 2005; Amnoui, 2012). Besides move analysis on RAs which is found the most, the studies on Masters' dissertations are also found quite often as well. These include Rasmeenin (2006) on Discussion chapters of Applied Linguistics; Pramoolsook (2008) on the whole of Biotechnology and Environmental engineering; Samraj (2008) on Introduction chapters across three disciplines of Science, Social Science, and Philosophy; Ren & Li (2011) on a comparison of published RAs and Master theses abstracts, and the most recent studies, Nguyen & Pramoolsook (2014a; 2014b; 2015a; 2015b) on Introduction, Literature Review, Method, and Results-Discussion chapters in TESOL Master's theses.

Based on these previous studies, most are research on move analysis of RAs but a few on Masters' dissertations. Scarce are studies relevant to move analysis of PhD dissertations, which could be accounted for by various factors, such as writing difficulties of this particular genre (Paltridge, 2002), the sheer size of dissertations as

texts for analysis (Atkinson, 1997), variations across disciplines in terms of what a thesis or dissertation should look like (Dudley-Evans, 1993; 1999; Thompson 1999, cited in Paltridge, 2002).

Moreover, dissertations are often found not only in a certain format specified in the universities' regulations but also in various formats. Based on a survey of 50 universities in the U.S. and Canada, the variation in the dissertation format is determined by differences in the nature of research, the structure and expectations of the discipline, and the accepted format for publication in the discipline. This report suggests as follows,

> ''*In engineering and the physical and biological sciences, which are increasingly team disciplines with large groups of investigators working on common problems, dissertation often present, in varied formats, the results of several independent but related experiments*'' (Council of Graduate Schools in the U.S., 1991, p.20, cited in Dong, 1998).

In terms of what influences the students' PhD dissertation writing, Shaw (1991) conducts a study to find out the difficulties with academic writing within discipline specific tasks among native and non-native students and how faculty assists these students in their dissertation writing. The findings suggest that the discipline, genre, and audience specific knowledge, including access to various resources in the disciplinary community, discipline specific vocabulary, and perceptions of the audience of their dissertations influence the students' PhD dissertation writing.

While PhD dissertations have varied formats and the variation of its structure within specific disciplines have been observed, Paltridge (2002) found that there are four main kinds of dissertation: Traditional simple, Traditional complex, Topic-based,

and Compilations of research articles. A dissertation with a simple traditional pattern is one which reports on a single study and has a typical macro-structure of 'Introduction', 'Review of the Literature', 'Materials and Methods', 'Results and Discussion', and 'Conclusion'. A dissertation with a complex structure is one which reports on more than one study. It typically has 'Introduction' and 'Review of the Literature' sections but it might have a 'General Methods' section, which is followed by a series of sections which report on each of the individual studies. Then it concludes with a general overall conclusion section. A topic-based dissertation typically commences with an introductory chapter, which is then followed by a series of chapters that have titles based on sub-topics of the topic under investigation. The dissertation then ends with a 'Conclusion' chapter. The last type of dissertation is based on a compilation of publishable research articles, which is different from the other sorts of dissertations. The research article sections are more concise than typical dissertation chapters with less of the display of knowledge. The dissertation is written more as experts writing for experts than novices writing for admission to the academy (Dong, 1998; Dudley-Evans, 1999; Thompson, 1999, cited in Paltridge, 2002). The traditional simple type is more common at the master's level than at the doctoral level where students carry out more complex types of study. These four dissertation types put burdens for researchers to settle what should be the unit of analysis for a study of a whole dissertation. Biber et al. (2007) also points out that the decision on a unit of analysis to be analyzed of any corpus-based study of discourse structure is one of the major methodological problems to be solved.

To date, there have been a few studies on the PhD dissertation move analysis of a single chapter, for example, Bunton (2002) on Introduction chapters from a range

of disciplines; Bunton (2005) on Conclusions chapters from the same corpus in Bunton (2002); Kwan (2006) on Literature Review chapters from Applied Linguistics; and Monreal et al. (2011) on Introduction chapters from Computing written in Spanish and in English. However, there is a similar move analysis conducted by Samraj (2005) in a genre set of Abstracts and Introductions in research articles between two disciplines but this study is not in the case of PhD dissertations.

According to the preliminary survey of dissertations' macro structures done by the researcher, most SUT PhD dissertations are composed in the traditional complex and compilations of research articles patterns. However, there are two certain chapters found in all SUT PhD dissertations which also appear in all the four types of dissertation in Paltridge (2002), they are Introduction and Conclusion chapters. Although these two chapters contain different types of content due to different communicative purposes, it can be assumed from the survey that Introduction and Conclusion are the compulsory chapters for PhD dissertation writing at this particular discourse community.

Not only the Introduction and Conclusion chapters are typically found from all disciplines, the Abstract always appears at the beginning of the PhD dissertations. Bhatia (1993) points out that abstract is an article synopsis, and it is a brief summary of the academic papers. Following his idea, it can be said that Abstract is a PhD dissertation synopsis as well. Although there are differences among the content inside due to disciplinary variations, Abstract, Introduction, and Conclusion chapters are typically found as the compulsory units for PhD dissertation in SUT. From the preliminary survey, a study on the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations will

be beneficial for SUT PhD students because it will provide them with the knowledge about the writing patterns within the particular genres.

There is very little research comparing the structure of related genres. Devitt (1991) investigates the structure within professional communication of the accountant's genre system. She suggests that a genre set is text that connects to the previous text in a sequential chain of actions, and through investigation of the genre set of the community, community's situations, its recurring of activities, and relationships can be examined. Texts interact within the community and form a complex network of interaction, and a structured set of relationships among texts. Therefore, any text is best understood within the context of other texts. No text is single, as texts refer to one another, draw from one another, create the purpose for one another. However, the focus in her study is on the role and interaction of texts but not on the structure of the various genres.

Bazermen (1994) extends Devitt's concept of a genre set into the notion of systems of genres. He states that studying a genre system involves analyzing interrelated genres by multiple participants belonging to that system. Connor & Mauranen (1999) also point out that groups of related genres and subgenres have not been systematically investigated, and they express their hope that future genre studies will offer greater illumination in generic interrelations.

Research article abstracts and introductions are two genres, which have been studied quite extensively. One example is Samraj's (2005) exploration of a genre set of RA abstracts and introductions between two related fields, Conservation Biology and Wildlife Behavior. Unfortunately, such studies have remained only on RAs but not on PhD dissertations. In this present study, therefore, Abstract, Introduction, and

Conclusion chapters that interact with one another will be the three elements taken from the SUT PhD texts of the science and engineering disciplines. To find out their relationship inside the PhD texts between the two fields, the three genres will be called as a genre set in this research.

There are many studies focusing on a single genre, however, very little research has compared the move-step structures of related genres, especially those produced under the same academic writing convention in a Thai university between science and engineering disciplines. Interestingly, disciplinary variations, and the relationship within the genre set written by the PhD students from science and engineering disciplines in a Thai university (SUT) will be examined in the present research. Moreover, this study can have a considerable pedagogical value for English for Specific Purposes (ESP) / English for Academic Purposes (EAP).

Moreover, the study on similarities and differences of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and the relationship among the three genres in the genre set of PhD dissertations between science and engineering disciplines has not been reported. Therefore, this present study is to gain a better comprehensive knowledge of the move-step structures, the relationship, and the similarities and differences of the three elements in the genre set between the two disciplines, using genre analysis techniques. The findings of this research will respond to the needs and gaps of SUT PhD students as stated earlier. In the next four sections, research objectives and research questions, the significance of this present study, the scope of the study, as well as the definition of key terms of this study will be discussed.

In conclusion, the focus of this study is to investigate the move-step structures of each of the three genres in the genre set of PhD dissertations written by SUT graduate students. This genre set contains three compulsory textual elements under the SUT dissertation writing regulations. Since they are found in all the approved dissertations in SUT, this confirms that giving a brief summary of a piece of research in the Abstract, providing necessary background in the Introduction, and offering overall summary of the study in the Conclusion chapters to readers are crucial rhetorical skills required in all the students. It is beneficial for the students to know how to present the three kinds of information in the three elements appropriately and effectively in their PhD dissertations in their fields.

1.3 Research Objectives and Research Questions

The main aim of this study is to provide knowledge of the science and engineering PhD dissertations through a study on the genre set, namely; Abstract, Introduction, and Conclusion chapters. To conduct the research, move-step structure analysis is one of the points of focus. In short, this study will apply move analysis following Hyland (2000), and Bunton (2002; 2005), and contrastive analysis following Samraj (2002a; 2002b; 2005), and Hyland (2000) in investigating disciplinary variations of the move-step structures between SUT science and engineering PhD dissertations. Therefore, this present study aims to:

1) investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations produced by graduate students in SUT

2) explore the relationship among Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations produced by graduate students in SUT

3) find out the similarities and differences of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and the relationship among the three elements in the genre set between science and engineering PhD dissertations produced by graduate students in SUT.

Specifically, these three objectives translate into the following research questions:

1) What are the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations produced by graduate students in SUT?

2) What is the relationship among Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations produced by graduate students in SUT?

3) What are the similarities and differences of move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and of the relationship among the three elements in the genre set between science and engineering PhD dissertations produced by graduate students in SUT?

1.4 Significance of the Study

The move analysis on science and engineering English PhD dissertations in this present research is expected to benefit not only these two student groups but also to the NNES academic writers and ESP/EAP practitioners in general as well. It serves

as the main analysis technique to find out the move-step structures of the PhD Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering disciplines. The findings from the move-step structure analysis will enable the researcher to understand better about the relationship among the three elements in the genre set in the two disciplines and the ways in which genres within the genre set interact to each other (Samraj, 2005). Another aspect in this study is disciplinary variations of the move-step structures of the PhD Abstract, Introduction, and Conclusion chapters in the genre set, and of the relationship among the three elements in the genre set between the two disciplines. Moreover, discourse-based interview is another technique to help reveal the interviewees' decisions on PhD dissertation move-step structure practices from their own writing experiences. This present study will shed light on the organization of Abstract, Introduction, and Conclusion chapters in the genre set, on the relationship among these three elements in the genre set, and on the disciplinary variations of the three elements in the genre set between science and engineering disciplines. The study will be useful for the students in both fields, with the hope that the proposed pedagogical implications can improve academic writing skills of those students as well as facilitate teaching of dissertation writing for ESP/EAP practitioners in the future.

1.5 Scope of the Study

The study aims to investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations written by science and engineering students. Another aim is to explore the relationship among the three elements in the genre set written by the students from the two disciplines.

Then, the similarities and differences of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and of the relationship among the three elements in the genre set between the two disciplines will be compared. The target corpus will be taken from the completed PhD dissertations written by graduate students from the School of Science and the School of Engineering, Suranaree Univeristy of Technology (SUT), Thailand. Therefore, the valid results and limitations, which will derive from this present research can only imply for those two groups mentioned above.

1.6 Definitions of Key Terms in the Study

The following are the definitions of key terms that are the most referred in the present study

1.6.1 English PhD Dissertations

Although the terms 'thesis' and 'dissertation' are used in different ways in different parts of the world (Paltridge, 2002), these two terms can be used interchangeably whether it is a 'thesis' or a 'dissertation' in this study. The term 'dissertation' will be referred to the research project written for doctoral degree (PhD). The PhD dissertation is important as the rite passage to an academic career, required by universities around the world (Bunton, 2002). In this present study, the PhD dissertations written in English collected in Suranaree University of Technology are the subjects of the research.

1.6.2 Move and Step

A move is a segment of text that is shaped and constrained by a particular communicative function (Holmes, 1997). However, a more rigorous definition offered

by Nwogu (1991) that ‘move’ is a text segment made up of a bundle of linguistic features, which give a segment or uniform orientation and signal the content of discourse in it. Moves may contain multiple elements that together, or in some combination, realize the move. These elements are referred to as ‘steps’ by Swales (1990) or ‘strategies’ by Bhatia (1993). In this present study, a move is a sentence or a combination of sentences that altogether achieve the same communicative purpose. Each move can be either one sentence or more and can continue to the next paragraph as long as they hold the move until a new move is found. A step is the element that has communicative functions to realize the move. In other words, it is a lower level text unit than a move that provides a detailed perspective on the option open to the writers in setting out the moves (Dudley-Evans & St John, 1998) e.g. *In the thirty years since this initial study a large amount of research has been conducted to determine the causes and mechanisms of GRD and to model its effects*. (Step 1: *Claiming centrality* in Move 1 of the Introduction: *Establishing a territory*)

1.6.3 The Genre Set

The concept of the genre set is first originated by Devitt (1991). She posites that texts form networks of interactions of accountants, and a set of genres interacts to each other in order to accomplish the work of the tax department. In this study, the genre set refers to Abstracts, Introductions, and Conclusion chapters that appear in all PhD dissertations produced by science and engineering graduate students. In other words, these three genres of Abstract, Introduction, and Conclusion chapters are called the compulsory elements of SUT PhD dissertations. It can be assumed that they might have the relationship among themselves and they appear to serve serial and strict communicative functions in the texts.

1.6.4 Variations

Variations are the differences of written discourse that students produce and understand within their discourse communities (Samraj, 2002). The variations of the move-step structures in particular contexts between the writers help to locate the writers' membership. Their move-step structure strategies depend on the purposes, setting and audience of writing that vary from their disciplines (Bruffee, 1986, cited in Hyland, 2000). Moreover, the differences of texts written in the discourse communities are considerable variations in the extent to which members identify the texts with their goals, methods, beliefs, and conventions in their diverse activities (Hyland, 2000). In this present study, the variations are the differences of Abstract, Introduction, and Conclusion chapters in the genre set between science and engineering PhD dissertations, and of the relationship among the three elements in the genre set between the two disciplines. Therefore, knowledge on variations of textual norms in different disciplines enables the researcher to provide appropriate instruction, and discipline-specific that can support the students for their PhD dissertations writing.

1.7 Summary

This chapter has offered the background and the research problems pointing out about the pedagogical needs of helping SUT PhD students to write the three elements of Abstract, Introduction, and Conclusion chapters in the genre set, that are always appear in all SUT English PhD dissertations. Then, the actual writing difficulties reported by the PhD students also have helped specify the needs to conduct the research on move-step structure analysis on PhD dissertations. The survey

of previous studies and the existing gaps from the RAs, the Master's, and the PhD dissertations move analyses help narrow down the scope of the present study. Therefore, the research objectives and research questions have been proposed to investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering disciplines, to explore the relationship among the three elements in the genre set in the two disciplines, and to find out the similarities and differences of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and the relationship among the three elements in the genre set between the two disciplines. Moreover, the definitions of research key terms have been provided for some important definitions in the study.

In the next chapter, the background information related to theoretical concepts, analysis frameworks, literature review, and previous studies will be provided for more development and completion of this present study.

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CHAPTER 2

LITERATURE REVIEW

This chapter presents a review of the literature that is relevant and provides a foundation for the present study. The first section reviews the interconnected concepts of discourse community, genre, and genre analysis. The second section reviews the functions and characteristics of PhD dissertations, the target genre under investigation of this current thesis, as well as the definition of the three elements of Abstract, Introduction, and Conclusion that together form a genre set which is the focus of this research. The third section provides details of the frameworks for the move analysis of the genre set. The fourth section is concerned with the disciplinary discourse and its variations that can clarify the differences between science and engineering fields under the present study. This section also comes with the critique of the previous research on disciplinary discourse into PhD dissertations. The last section is the summary of the chapter, leading to the methodology of the present research in the next chapter.

2.1 Discourse Community, Genre, and Genre Analysis

Discourse community and genre are two key concepts in an approach to the teaching of academic and research English. Academic and research English contains a variety of genres that are made and employed as a communicative means for extension of its knowledge and exception of new members into the community.

Discourse communities are socio-rhetorical networks that form in order to work toward sets of common goals. One of the characteristics that established members of these discourse communities possess is familiarity with the particular genres that are used in the communicative furtherance of those sets of goals (Swales, 1990). In a discourse community, language is used in discourse as a form of social behavior and it is the shared communicative purposes among its members that drive its language activities. Their aims serve as the prototypical criteria for genre creation and identity, and also operate as indicators of conventional characteristics included in a genre. Moreover, genres themselves are classes of communicative events, which typically possess features of stability, name recognition and so on. Language is not used to communicate with the whole world, but with groups of people who are interested in the same things or individuals. Hence, genres are the properties of discourse communities, or in other words, genres belong to discourse communities but they do not belong to individuals.

Swales (1990, pp.24-27) proposes six defining characteristics that will be necessary and sufficient for identifying a group of individuals as a discourse community, which are summarized below.

1. *A discourse community has broadly agreed set of common public goals.*
2. *A discourse community has mechanisms of intercommunication among its members.*
3. *A discourse community uses its participatory mechanisms primarily to provide information and feedback.*
4. *A discourse community utilizes and hence possesses one or more genres in the communicative furtherance of its aims.*
5. *In addition to owning genres, a discourse community has acquired some specific lexis.*

6. A discourse community has a threshold level of members with a suitable degree of relevant content and discoursal expertise.

The characteristics of discourse communities mentioned above have been typically cited as one of the important elements within academic contexts. A discourse community has improved discoursal expectations with the form, function, the position of discourse elements. Genres create discoursal expectations that maintain the discourse community operation. As a result, the study of genres can shed light on the various aspects of the text writing processes.

The notion of genre has been described for two decades since Candlin (1993). He describes genre as *'a concept that has found its time'* (Candlin, 1993 cited in Hyland, 2004). Since then, genre has become one of the curiosities and attractive topics among people in Second Language Teaching and Applied Linguistics research, and it is one of the most important and influential concepts in language education (Johns, 2002). Genre analysis is essential for language teachers as it can be applied to language teaching by using the aspects of language use to explore the construction of students' discourse on the texts. The concepts of genre nowadays have extended its use beyond literary texts, into films, music, and computer games and even into professional, academic, and everyday forms of speech and writing (Hyland, 2004). Moreover, in the linguistics field, a genre is considered to be a type of communicative act that is used to convey messages among groups or a network of people. There are several definitions of genre given by researchers from many perspectives that study its ability and manipulate its pedagogical potentials. For example, the well-known and comprehensive definition is given by Swales (1990, p.58) in his book 'Genre Analysis: English in Academic and Research settings' as follows:

> *"A genre comprises a class of communicative events, the members of which share some set of communicative purposes. These purposes are recognized by the expert members of the parent discourse community, and thereby constitute the rationale for the genre. This rationale shapes the schematic structure of the discourse and influences and constrains choice of content and style. Communicative purpose is both a privileged criterion and one that operates to keep the scope of a genre as here conceived narrowly focused on comparable rhetorical action. In addition to purpose, exemplars of a genre exhibit various patterns of similarity in terms of structure, style, content and intended audience".*

Bhatia (1993, p.13) points out that the shared communicative purposes cause genre recognizable and mutually understandable, and that a genre frequently has a highly conventionalized internal structure. Therefore, he summarizes and confirms the genre definition established by Swales (1990) as follows:

> *"A genre is a recognizable communicative event characterized by a set of communicative purpose(s) identified and mutually understood by the members of the professional or academic community in which it regularly occurs. Most often it is highly structured and conventionalized with constraints on allowable contributions in terms of their intent, positioning form and functional value. These constraints, however, are often exploited by the expert members of the discourse community to achieve private intentions within the framework of socially recognized purpose(s)".*

In conclusion, grammatical description and significant form-function correlations can provide a thicker description of discourse analysis model to socio-cultural, institutional and organizational explanations, relevant and useful to language teachers and applied linguists (Bhatia, 1993). However, such model needs to be more

specific, realistic, and desirable to find the pedagogically appropriate form-function correlations of language teaching, especially ESP and EAP practitioners.

Although there is a general agreement on the nature of genre among genre analysts and researchers, differences exist in the emphasis they place on either context or text (Hyland, 2002). Some prefer to focus the study on the roles of texts in social communities, some are interested into the ways the texts are organized to reflect and construct the communities. As these differences, genre analysis has three overlapping approaches, which have been discussed for decades (Hyon, 1996; Johns, 2002; Hyland, 2004). These three approaches are: the Sydney School, the New Rhetoric, and the ESP approach.

First, 'the Sydney School' is an approach to genre influenced by Systemic Functional Linguistics (SFL), which is considered the most clearly articulated and pedagogically successful of the three broad perspectives (Hyland, 2004). This approach is emerged from linguists and teachers in Australia, working to create a genre-based pedagogy consistent with the theoretical work of Michael Halliday (Halliday & Hasan, 1989; Halliday, 1994). The concept is concerned with the ways we use language as a resource for communication rather than with rules for ordering grammatical forms. Language is a system of choices by which writers can communicate certain functions, allowing them to express their experiences of the world, to interact with others, and to create coherent messages (Hyland, 2004). Genres in this tradition are the rhetorical structures fundamental to various forms of communication in a culture. Therefore, Recount, Description, and Report are examples of genres found within a range of communicative events.

The second approach is quite different from the first one in that it questions the value of genre in the writing class. It is called 'the New Rhetoric group' (NR). This approach tends to regard a genre as a rhetorical strategy that has evolved constantly in order to respond to its knowledge which is embedded in communicative activities of daily and professional life**,** and is thus a form of 'situated cognition' that is situated in, and learned through, social processes (Berkenkotter & Huckin, 1993). Hence, this orientation focuses mainly on the rhetorical contexts in which genres are employed rather than detailed analyses of text elements. Social, cultural, and institutional contexts investigation and the way they interact with texts affect the manifestation of a particular genre (Freedman & Medway, 1994). A genre analysis in this approach tends to adopt ethnographic research methods rather than linguistic and textual analysis in order to explore the attitudes, values, and beliefs inside the community. Also, it is concerned with composition studies and professional writing in a native speaker of English (L1) context (Flowerdew, 2005). As this tradition believes that genres are constantly evolving through the dynamic process of interaction in a context, people in this tradition reject the possibility of teaching written genres in classroom, claiming that the classroom is such an inauthentic environment that cannot have the quality of the complex nature of negotiations and audiences that an actual rhetorical event has (Hyland, 2004). Therefore, learning and teaching genres in classroom take the students away from the context in which they have meaning, and they become simply targets rather than means for communication. In reality, people learn to use genres at home, at work, or in a community, without explicit instruction (Adam & Artemeva, 2002).

The last approach is referred to as ‘the English for Specific Purposes’ (ESP). People within this tradition are concerned with genre analysis and teaching English for specific purposes. It emphasizes the communicative purposes and the formal and conventional properties of texts. A genre is seen to consist of a class of structured communicative events that are employed by members of specific discourse communities to achieve their shared communicative purposes. These purposes together constitute the rationale of the genre, which in turn shapes the schematic structure of the discourse and influences and constraints choice of content and style (Swales, 1990). Hence, genre analysis in ESP is often associated with the kind of move analysis studied by Swales (1990) in his seminal description of research article introductions. It involves identifying the series of ‘moves’ that make up the genre from a representative sample of texts. Each move is a distinctive communicative act designed to achieve one main communicative function and can be further subdivided into several ‘steps’ (Hyland, 2004). The steps of a move primarily function to achieve the purpose of the move to which it belongs (Biber et al., 2007). Therefore, the ESP view on genre analysis aims to investigate the relationship between the communicative purposes and the structures and meanings of text. This analysis is very useful in second language writing especially writing texts for specific purposes by raising the writers’ awareness of the ways genres are organized to express certain purposes. Genre analyses and their pedagogical implications based on this approach include works from Swales (1990; 2004); Bhatia (1993); Dudley-Evans (1994); John (1995); Connor & Mauranen (1999); Hyland (2000); Bunton (2002; 2005); Samraj (2002a; 2002b; 2005; 2008); Pramoolsook (2008); Peacock (2002; 2011); Swales &

Feak (2004); Kanoksilapatham (2005; 2007; 2011); Kwan (2006); Cheng (2006); Monreal et al. (2011); Nguyen & Pramoolsook (2014a; 2014b; 2015a; 2015b)

The three broad approaches share their views on language as a central feature of human behavior. Through genres, language helps to construct meaning and social context, rather than being merely a tool for transmitting ideas. Moreover, the three approaches also share the common goal of analyzing the relationship of writing to particular contexts. To separate the ESP approach from the previous two approaches, this approach is more interested in linguistic analysis towards non-native speakers of English (NNSE) writing than the New Rhetoric and more oriented to the role of social discourse communities than the Sydney School (Hyland, 2004).

In summary, the Sydney School focuses on the social purposes of genres and rhetorical structures that serve those purposes. Texts that function to serve the same social purpose will often share the same rhetorical structure within the community. The New Rhetoric is concerned with composition studies and professional writing in an L1 context by using ethnographic (i.e., participant observation and interviews) rather than linguistic or rhetorical methods. On the other hand, the ESP approach is concerned directly with professional composition studies towards NNSE writing rather than in an L1, and focuses both the social function and form of written language in academic and research settings. Central concept of genre in the ESP approach is ‘move structure’ analysis (Flowerdew, 2005). Reviewing these three different approaches helps make decision about the approach this present study will follow in conducting the genre analysis. The intention of this study is to investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of English PhD dissertations produced by Thai science and engineering

students, the findings of which will answer the research questions given earlier in Chapter 1. The study focuses directly on NNSE students. As a result, this present research will adopt the ESP approach as the main research procedure to identify segments of the genre set under this investigation. The results will report the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of the PhD dissertations of the two disciplines in a Thai university. It is believed that, at least this will support the strong evidence to answer the research questions, which will be discussed in Chapter 3.

2.2 PhD Dissertations and the Genre Set of Abstract, Introduction, and Conclusion Chapters

2.2.1 PhD Dissertations

It is very clear now that there can be more than one genre in one discourse community for internal communications among its members. The varieties of genres in one discourse community obviously require the members to possess various rhetorical skills to create literacy genres effectively. The target texts under this study are English PhD dissertations, which will be taken from two different academic research settings within the local discourse community of SUT. In this academic and research settings, the genres the students have to create are quite complex ones. Some genres can be study-related while others can be for professional development purposes. Moreover, they can be written by one student (a single writer), or some of them can be created by a group that consists of ideas from their supervisors or friends (Pramoolsook, 2008).

Genres created by tertiary level students have been categorized into two broad categories, which are academic genres and research genres (Bhatia, 1993). The first group includes texts the students compose for a variety of academic purposes in their study, while the second group includes the texts written for recognition and advancement in the research world, and they occupy a prominent position in research publications (Koutsantoni, 2006). The status of published research articles are accredited academic artifacts. They are proof of completion of professional and institutional rites of passage and used to gain legitimacy in the eyes of research community gatekeepers (Hyland, 2000). According to these previous studies mentioned above, PhD dissertations can be categorized into academic genre as they are the texts the students create for academic purposes. Moreover, it is the rite of passage to an academic career, required by universities around the world (Bunton, 2002). In Bhatia's (1993) opinion, research article introductions, and dissertation introductions are of different types of genre. The length of dissertation introductions is longer and the content is more complex compared with research article introductions (Dudley-Evans, 1986, cited in Bhatia, 1993). These two different genres are created and employed in different communicative contexts.

Regarding the differences between research articles and dissertations in terms of their social and cultural context, Koutsantoni (2006) mentioned that both genres are produced at advanced stages of individuals' enculturation in disciplinary communities. However, research articles go through a complicated process of refereeing and peer review before they reach publication, and claims offered in them are phrased in ways that disciplinary gatekeepers are likely to find persuasive (Myers, 1990). Gatekeepers are people of power in the discipline, who act as evaluators of

what is acceptable or not. They control access to scholarly discourse and have the power to decide which articles can be published (van Dijk, 1996). While dissertations, in their turn, are considered ‘major intellectual enterprises’, they provide the writers with valuable professional credentials and membership in academic discourse communities (Koutsontoni, 2006). In terms of dissertation writing difficulties, Paltridge & Starfield (2007) find the problems among second-language students attending universities overseas. The examples include the setting of the text, the focus and perspective of the text, the purpose(s) of the text, the intended audience for the text, their role and purpose in reading the text, the relationship between writers and readers of the text, expectations, conventions and requirements for the text, the background knowledge, values, and understandings the students shared with their readers, and the relationship the text has with other texts. The situation on these writing difficulties can possibly link to SUT academic discourse community in that most of the SUT graduate students have to write their dissertations in English, so they share the same writing problems with PhD students around the globe.

PhD dissertation is one of the academic genres that can be considered very important. Swales (2004) points out that it is the culminating genre of doctoral education. Moreover, PhD dissertation is also a genre submitted in support for a degree of professional qualification presenting the author’s research and findings. As a result, the PhD dissertation should not sound like an informal essay or an editorial. It has to sound like the writing for scholars, and it has to be created in a special way and follow very specific rules (Glatthorn & Joyner, 2005). The terms of ‘thesis’, and ‘dissertations’ are used in different parts of the world. Paltridge (2002) reports that in the USA, master’s students write ‘theses’, whereas in Britain, they write

‘dissertations’. However, at the PhD level, these two terms are reversed. In Australia, the term ‘thesis’ is used at both the mater’s and doctoral levels. In New Zealand, a dissertation is a smaller piece of work whereas a thesis is larger research project written for a masters or doctoral degree. Although the two terms are used interchangeably, the ‘dissertation’ will be referred to the PhD dissertations following the key term stated by Swales (2004), which will be used to call the target texts in this present research.

PhD dissertations are not often written only in a certain format specified in the universities’ writing regulations but also in various formats. According to a study reported by the Council of Graduate Schools surveying 50 universities in the U.S. and Canada, the variation in the dissertation format was determined by differences in the nature of research, the structure and expectations of the discipline, and the accepted form for publication in the discipline (Council of Graduate Schools in the U.S., 1991, cited in Dong, 1998). Moreover, Dong (1998) identifies three major formats of dissertation. The first type is Traditional Introduction-Literature review-Methodology-Results-Discussion, while the format of the second type is Article-compilation format which is basically an anthology of individual publishable research papers that contains its own Introduction, Methodology, Results and Discussion sections. The last type starts with ‘Introduction’ and ends with a chapter headed ‘Conclusion’, and chapters in-between are titled according to the topics and sub-topics of the writer’s investigation. In addition, Paltridge (2002) finds that there are four main kinds of dissertation: ‘Traditional simple, Traditional complex, Topic-based, and Compilations of research articles’. A dissertation with a simple traditional pattern is one which reports on a single study and has a typical macro-structure of ‘Introduction’, ‘Review

of the literature', 'Materials and methods', 'Results', 'Discussion', and 'Conclusion'. A dissertation with a complex structure is one which reports on more than one study. It typically has 'Introduction' and 'Review of the literature' sections but it might have a 'General methods' section, which is followed by a series of sections which report on each of the individual studies. Then, it concludes with a general overall Conclusion section. A Topic-based dissertation typically begins with an Introduction chapter, which is then followed by a series of chapters that have titles based on sub-topics of the topic under investigation. The dissertation then ends with a Conclusion chapter. The last type of dissertation is based on a compilation of publishable research articles, which is different from the other sorts of dissertations. The research article sections are more concise than typical dissertation chapters with less of the display of knowledge that is often found in a dissertation. This type of dissertation is written more as experts writing for experts than novices writing for admission to the academy (Dong, 1998; Dudley-Evans, 1999; Thompson, 1999, cited in Paltridge, 2002). In Paltridge's (2002) study, he reports that the Traditional simple type is more common at the Master's level than at the doctoral level where students carry out more Traditional complex types of study. The different dissertation types reported in the literature can possibly indicate that PhD dissertations have varied formats and the variations of its structure within specific disciplines have been observed.

From the preliminary survey of the present research corpus by the researcher, most SUT PhD dissertations are composed in traditional complex and compilations of research articles formats. There are one certain textual element and two chapters that appear in all the dissertations, Abstract, Introduction, and Conclusion chapters. However, chapters between the first and the last one are different, which is probably

due to the individual research field and topic. As a result, the subjects for this present study will only be the three elements of Abstract, Introduction, and Conclusion chapters. They will be categorized as a genre set, which exists in all dissertations in the two disciplines. Details of the genre set concept and its explanation will be discussed in the next sub-section.

2.2.2 The Genre Set of PhD Dissertations

The concept of the genre set is first originated by Devitt (1991) in her examination of how accountants get things done. She posits that texts form networks of interactions of accountants. A set of genres interacts to each other in order to accomplish the work of the tax department. Each text connects to the previous text in a sequential chain of actions. The genre set in her study not only reflects the profession's situations but it also helps to determine and maintain those situations. The official genres that were examined in Devitt's (1991) study were official genres such as, memos, correspondence, tax provision reviews. They serve serial and strictly communicative functions in the networks of accountants.

Bazerman (1994) extends Devitt's concept of genre set into the notion of genre system. He points out that genres interact with each other in specific settings. Similar to the notion of genre sets, genre systems are made up of sequences of genre. Each genre is required in order for the next one to be produced and used. Unlike genre sets, genre systems involve the full set of genres that represent the participation of all the parties. Although the concept of a genre set was originated from the accountant professions, which is not related to academic genres, its notion remains very useful in business written texts, e.g., job application letters, job annotation, business notes, and etc. Moreover, the genre set expands from course assignments, term papers, seminar

research papers, posters, texts of conference presentations, research articles, and on to dissertations (Swales, 2004). Therefore, this concept can be extended into the study of relationship among genres in the genre set for doctoral dissertations from other different fields. Also, developing PhD dissertation writing skills for the ever-present chapters in the genre set would provide beneficial support for the students. Abstract, Introduction, and Conclusion chapters are the three genres that are always found in the SUT PhD dissertations. Therefore, in this research, these three elements will be grouped as a genre set, and the comparison between science and engineering genre sets will be conducted to find out the similarities and differences of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and of the relationship among the three genres in the genre set between the two disciplines. As a result, the disciplinary variations on the move-step structures, and the relationship among genres will be employed as a basis of PhD dissertations composition of the two disciplines. The methods to conduct this research will be described in the next section.

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2.3 Move Analysis of PhD Dissertations

Swales' model (1981) is the first original framework based on a move analysis of RA introductions. His model was revised on RA introductions (Swales, 1990; 2004), which has been mostly found as a reference model in numerous research studies on RAs. There were not only the studies on one single section but also on more than one or the whole RAs (e.g., Swales & Najjar, 1987; Bhatia, 1993; Nwogu, 1997; Posteguillo, 1999; Peacock, 2002; 2011; Samraj; 2002; 2005; Kanoksilpatham, 2005, 2011; Lim, 2006; Amnoui, 2012). Moreover, the concept of move analysis on

RAs (Swales, 1981; 1990; 2004) has also penetrated into the dissertations studies (e.g., Bunton, 2002; 2005; Kwan, 2006; Pramoolsook, 2008; Ren & Li, 2011; Nguyen & Pramoolsook, 2014a; 2014b; 2015a; 2015b).

Previous research on RAs, and dissertations have investigated the move-step structures of single sections, single chapters, a few sections as the genre set, and the whole texts. However, to the best of my knowledge, the analysis on Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations has not been conducted. These three genres are the compulsory elements found in the SUT PhD dissertations. Based on Devitt's (1991) concept that a set of genres interacts to each other in order to accomplish the work in specific settings, each genre connects to the previous text in a sequential chain of actions. Since Abstract, Introduction, and Conclusion chapters are the three compulsory elements in the SUT PhD dissertations, they might possibly relate to each other in some certain ways. Hence, this present research will investigate their move-step structures of Abstract, Introduction, and Conclusion chapters as well as the relationship among these three elements written by science and engineering PhD students. The three genres of Abstract, Introduction, and Conclusion chapters of SUT English PhD dissertations will be called the genre set, following Devitt's (1991) and Samraj's (2005) concepts of genre set. The selected frameworks for the analysis of each genre will be discussed in the next subsections.

2.3.1 The Abstract

An abstract is a description or factual summary of the much longer report, and it is meant to give the reader an exact and concise knowledge of the full article (Bhatia, 1993). Moreover, the abstract is expected to be one of the first sections that readers might want to read. After the title or the research topic, the abstract generally

is the readers' first encounter with a text, and often the point at which they decide whether to continue reading, or to ignore it. In other words, readers will determine the value of the research by reading abstracts, and the decision to judge whether the research papers are worth reading or not is often made by readers through reading the abstracts (Hyland, 2000). Therefore, a well-written abstract will promote the text attached to it more effectively (Ren & Li, 2011).

The starting point on move analysis of abstracts is found in the studies of Swales (1990) and Bhatia (1993), and the focus is on RA abstracts from linguistic journals. Since then, there have been a few studies relating to published RA abstracts move analyses (e.g., Hyland, 2000; Lorés, 2004). Although the move analysis on dissertation abstracts is not quite well-known when compared to RA abstracts, the move analysis on dissertation abstracts should not be ignored because one of the first elements that the examiners have to read is Abstract (Ren & Li, 2011). In order to draw impressions from readers, e.g., PhD committees, and people who work in various academic disciplines, a well-written dissertation abstract has to be created.

To understand the communicative purposes of RA abstracts, Bhatia (1993) notes that the abstracts present a faithful and accurate summary, which is representative of the whole article. His notion corresponds to the definition given by The American National Standards Institute (ANSI), that is, *"An abstract is an abbreviated, accurate representation of the contents of a document, preferably prepared by its author(s) for publication with it"* (ANSI, 1979). For the RA abstract framework, Bhatia (1993) identifies four-move structure from his study which contain information relating to 1) what the author did, 2) how the author did it, 3) what the author found, and 4) what the author concluded in a typical abstract. Table 2.1 below summarizes the details of his four-move structure of RA abstracts.

Table 2.1: RA Abstract Framework (Bhatia, 1993, pp. 78-79)

Move	Function
Introducing purpose	*Outlining objectives or goals of the experiment. This move gives a precise indication of the author's intention, thesis or hypothesis which forms the basis of the research being reported.*
Describing methodology	*Providing a good indication of the experiment design, including information on data, procedures and methods. The author gives a good indication of the experimental design, including information on the data, procedures or method(s) in this move.*
Summarizing results	*Offering observations and findings, and suggesting solutions to the problem. This is an important aspect of abstracts where the author mentions his observations and findings.*
Presenting conclusions	*Interpreting results and drawing conclusion. This move is meant to interpret results and draw inferences. It typically includes some indication of the implication and applications of the present findings.*

Moreover, Hyland (2000) analyzes the abstract corpus from various disciplines (philosophy, social science, applied linguistics, marketing, electrical engineer, magnetics, physics, and biology). His study does not suggest a definitive description of the move structure or features of RAs abstracts, but he offers an account of abstract writing that reflects the writers negotiating in the significance of their research internationally. Therefore, the awareness of persuasive communicative purposes of abstract is reflected in writer's actual writing practices. Moreover, he summarizes that the abstract is generally the readers' first encounter with a text, and is often the point at which they decide whether to continue reading and give the accompanying article further attention, or to ignore it. Unlike the previous analyses of

abstracts that have identified a move-step structure, which are broadly corresponding to the organization of the paper itself: Introduction-Methods-Results-Conclusion (e.g., Bhatia, 1993; Brenton, 1996), he separates the writer's purpose from the introduction because it seems to represent a very different role to the introduction's typical purpose. Table 2.2 below is his move classification of RA abstracts.

Table 2.2: RA Abstract Framework (Hyland, 2000, p.67)

Move	Function
Introduction (I)	*Establishes context of the paper and motivates the research or discussion.*
Propose (P)	*Indicates purpose, thesis or hypothesis, outlines the intention behind the paper.*
Method (M)	*Provides information on design, procedures, assumptions, approach, data, etc.*
Product (Pr)	*States main findings or results, the argument, or what was accomplished.*
Conclusion (C)	*Interprets or extends results beyond scope of paper, draws inferences, points to applications or wider implications.*

In sum, move analysis only on abstract dissertations seems to be neglected as seen from only a few studies on this particular genre (e.g., Pramoolsook, 2008; Ren & Li, 2011; Nguyen, 2014). Also, there is no evidence on the similar study of PhD dissertation abstracts. However, Hyland's (2000) framework is quite compatible with the corpus of this study as it covers a wide range of disciplines, including science and engineering disciplines. Moreover, both the studies of Pramoolsook (2008), that conducted the move analysis with science and engineering Master's dissertations, and Ren & Li (2011), which analyze the abstracts in applied linguistics adopt this framework to analyze the dissertation abstracts in their research. This model provides a clear and precise description for the communicative purposes for each move, and it provides a substantial basis for the analysis of a wide range of academic disciplines,

e.g., Biotechnology and Environmental Engineering (Pramoolsook, 2008). Also, in Ren & Li (2011), this framework presents a clearer picture of the rhetorical moves of the collected abstracts. Consequently, Hyland's (2000) model on abstract analysis will be selected to identify move structures of the target corpus in this present study. Details about the Introduction analysis frameworks will be discussed in the next subsection.

2.3.2 The Introduction Chapter

After the readers of dissertations first encounter with Abstract, the first chapter that appears next to it is the Introduction. It plays an important role in providing the significance and values of the study or research that is about to be presented. It introduces the following texts by pointing out the links between what has happened before in the particular or related fields of the study. Moreover, the Introduction has to encourage the readers to the intended study and justify its quality for a degree completion, and this characteristic is usually found in research articles, grant proposals, conference papers, dissertations, and etc. The Introduction is one of the important genres because it shows the relevance of the research about to be reported in the dissertation to previous work in the field (Bhatia, 1993). It also sets up the readers' expectations and can make it easier for them to navigate the following texts. Bearing in mind the specific of communicative purposes of the Introduction, many researchers have analyzed moves and steps either in Introduction section in RAs or Introduction chapter in dissertations to improve both native and non-native graduate students' writing from different disciplines around the globe (e.g., Swales, 1981; 1990; 2004; Dudley-Evans, 1986; Peng, 1987; Bunton, 2002; Samraj, 2002a; 2002b; 2005; 2008; Kanoksilapatham, 2005; 2011; Pramoolsook, 2008; Monreal et al., 2011; Nguyen & Pramoolsook, 2014b).

The origin of Introduction move analysis was the study of Swales (1981). He investigates the Introduction sections of 48 RAs from hard sciences (physics, electronics, and chemical engineering), biology/medical fields, and social sciences. He proposes four common moves with steps across those different fields, and he terms this model the Create-a-Research-Space (CARS). The first move, *Establishing the field*, deals with the field where the research topic is located and its importance for the intended research. The second move, *Summarizing previous research*, and the third, *Preparing for the present research* are the moves which report the previous research areas that have not covered, or indicating a way that the intended research could be extended. The last move, *Introducing the present research*, displays its purposes or presenting the work carried out of the intended study. However, Crookes (1984, cited in Bunton, 2002) comments on this model that the four moves are often not a single progression but occur in cycles, sequenced in various recursive ways, such as: 123, 23, 23, 4. This criticism is also voiced by several researchers (e.g., Hopkins, 1985 & Cooper, 1985, cited in Bunton, 2002). Therefore, this framework is later revised due to the overlap of Moves 2 and 3, and it has received much attention from many researchers, especially the ones that following the framework of Swales' (1990) CARS model (e.g., Nwogu, 1997; Posteguillo, 1999; Bunton, 2002; Samraj, 2002b; 2005).

Swales (1990) proposes the three-move CARS model which has been applied to many related studies. The first move, *Establishing a territory*, the writer situates his or her own work in a broad field of research by following one of these steps: *Claiming centrality* by pointing out the importance of the general subject, *Making topic generalization* by making general statements about the subject, and *Reviewing items*

of previous literature by reviewing the previous works related to the intended study. The second move, *Establishing a niche*, indicates readers about the specific area of the broader subject that the article deals with. This move is accomplished by following these steps: *Counter-claiming* by making an assertion contrary to expectations, *Indicating a gap* by exposing a deficiency of previous research, *Question-raising* by raising a question about existing research, and *Continuing a tradition* by suggesting that the intended study is following the footsteps of previous researchers, or the writer may take a combination of several of those steps. In the last move, *Occupying the niche*, the writer points out exactly what the intended study will accomplish in relation to Move 2, and gives the readers a sense of how the article will continue. The writer follows these steps sequentially: stating the purposes of the article or outlining the main features of the present research, summarizing the major findings/ results of the study, and signaling the organizational structure of the article. Table 2.3 below is the Swales' (1990) three-move CARS model that has received unprecedented attention from many particular move analyses.

Table 2.3: CARS Model for RA Introductions (Swales, 1990, p.141)

Swales'CARS, 1990	
Move 1: Establishing a territory	
Step 1: Claiming centrality	*and/or*
Step 2: Making topic generalization	*and/or*
Step 3: Reviewing items of previous research	
Move 2: Establishing a niche	
Step 1A: Counter-claiming	*or*
Step 1B: Indicating a gap	*or*
Step 1C: Question-raising	*or*
Step 1D: Continuing a tradition	
Move 3: Occupying the niche	
Step 1A: Outlining purposes	*or*
Step 1B: Announcing present research	
Step 2: Announcing principal findings	
Step 3: Indicating RA structure	

In addition, a major revision of CARS was proposed by Swales himself in 2004. Although the current model of Swales' RA Introductions is the 2004 version, a few studies have used it because this model only describes the underlying structure of Swales' (1990), and outlines possible additional steps within the moves rather than modifying them (Del Saz-Rubio, 2011). Moreover, Swales' (1990) model highlights more clearly the communicative purposes suggested by Bhatia (1993).

For PhD dissertation move analysis, it is crucial to explore the research conducted on this particular genre relevant to the study. Fortunately, the researcher has found the study of Bunton (2002), which investigates generic moves in 45 PhD Introductions. This corpus is built as a representative sample from disciplines with the highest output of PhD dissertations at the University of Hong Kong. They come from the Science, Dental, Engineering, Architecture, Social Science, Education, and Arts Faculties and two Schools (or centers not under a faculty). Bunton (2002) refers to the Swales' CARS model (1990) for the analysis of moves in his study. However, at the level of steps, he adopts both the models from Swales' (1990) and Dudley-Evans' (1986). At the end of his investigation, he proposes the model for PhD Introductions, with newly identified steps. He believes that the model is as important for supervisors as it is for the students to be able to see the conventional variations among their fields. Moreover, he suggests that the model could work well as a pedagogical framework for the PhD Introductions. Table 2.4 below presents Bunton's (2002) model.

Table 2.4: Modified CARS model for PhD Introductions (Bunton, 2002, p.74)

Often present	Occasionally present
Move 1: Establishing a Territory	
STEPS	
1: Claiming centrality	
2: Making topic generalizations and giving background information	Research parameters
3: *Defining terms*	
4: Reviewing previous research	
Move 2: Establishing a Niche	
STEPS	
1A: Indicating a gap in research	
1B: *Indicating a problem or need*	
1C: Question-raising	Counter-claiming
1D: Continuing a tradition	
Move 3: Announcing the Present Research (Occupying the Niche)	
STEPS	*Chapter structure*
1: Purposes, *aims, or objectives*	*Research questions/Hypotheses*
2: Work carried out	*Theoretical position*
3: *Method*	*Defining terms*
4: *Materials or Subjects*	Parameters of research
5: Findings or Results	
6: *Product of research/Model proposed*	
7: Significance/Justification	*Application of product*
8: Thesis structure	*Evaluation of product*

NB: The moves in this model may not occur in a single progression, but may well be cyclical. For example, the sequence of move may be: 1-2, 1-2, 1-2-3.
Newly identified steps are in *italics.*

To prove that Bunton's (2002) model can work with the PhD Introductions corpus of this present research, two studies that have used this model to analyze the Introduction chapters can be good examples. Pramoolsook (2008) analyzes Masters' Introduction chapters between two disciplines of Biotechnology and Environmental engineering. The result reveals that the framework works well with the analysis. Secondly, the analysis on the Introduction of PhD theses of computing discipline written in two languages (English and Spanish), Monreal et. al (2011) adopting Bunton's (2002) model to analyze the corpus. The finding shows that this framework helps to identify clearer steps and sub-steps in the texts between the two corpora.

According to the research mentioned above, Bunton's (2002) model can possibly help to analyze the PhD Introduction corpus of this present study. Therefore, the researcher will select this analysis framework to analyze the PhD Introduction's move-step structures of science and engineering disciplines in the present study. Details for the last element in the genre set will be discussed in the next subsection.

2.3.3 The Conclusion Chapter

Previous research has long been negotiating about the distinction between the Discussion and Conclusion sections in research articles (e.g., Dudely-Evans, 1986; Peng, 1987; Swales & Feak, 1994; Peacock, 2002). Swales & Feak (1994) suggest that the distinction between the Discussion and Conclusion is not always made clear ''*since the difference is largely conventional, depending on traditions in particular fields and journals*'' (p.195). Dudley-Evans (1986; 1994) also points out that Conclusion has been considered as a part of the Discussion section of an RA or Master's dissertation. However, one of the outstanding studies is Yang & Allison (2003) on the final sections of RAs in Applied Linguistics, which reveals that 13 out of 20 RAs (65%) contain Conclusion sections and claims that Discussion and Conclusion are not the same. The first one focuses more on commenting on specific results, while the latter concentrates more on highlighting overall results and evaluating the study. They finally present the conventional moves and steps in Conclusion section. Moreover, this framework can be useful for academic writing courses for EFL postgraduates and novice teachers in Applied Linguistics (Yang & Allison, 2003). Table 2.5 below shows the RA Conclusion framework proposed by them.

Table 2.5: RA Conclusion Framework (Yang & Allison, 2003, p.379)

Moves	Steps
Move 1: Summarizing the study (18)	
Move 2: Evaluating the study	Indicating significance (6)
	Indicating limitation (7)
	Evaluating methodology (1)
Move 3: Deductions from the research	Recommending further research (7)
	Drawing pedagogical implications (14)

*Numbers in the parentheses are the number of Moves and Steps in the data.

In PhD dissertations, the Conclusion usually has the status of a separate chapter (Paltridge, 2002), which appears in each of the four thesis types he presents: Traditional-simple, Traditional-complex, Compilation of RAs, and Topic-based. Moreover, the Conclusion chapter is expected to locate as the final chapter in PhD dissertations (Swales, 2004). Although previous studies show more concentration on the RA Discussion than Conclusion, fortunately, Bunton (2005) conducts a study on 45 PhD Conclusion chapters from a wide range of disciplines i.e. Art, Education, Social sciences, Architecture, Engineering, Science, Medicine, Dental, the school of Business, an Urban Planning and Environmental Management to identify their generic structure. The analysis is based on the moves and steps identified by Weissberg & Buker (1990), Dudley-Evans (1994), and Swales & Feak (1994). Finally, he proposes the PhD Conclusion frameworks for both Science and Technology, and Humanities and Social Sciences. However, the disciplinary variations between the two groups are prominent. Also, Pramoolsook (2008) adopts this Bunton's (2005) framework to investigate the move-step structures of Master's Conclusions between two hard applied disciplines, i.e., Biotechnology and Environmental Engineering. The result reveals that this model can be used to identify the move-step structures of the main

textual components of the Conclusion corpus in his study, which is useful for the genre-based approach to teaching scientific writing. This framework might possibly be appropriate to be used with the present study corpus. Therefore, the researcher will select this model as a reference for the PhD Conclusion chapters. Table 2.6 below presents the PhD Conclusion framework for Science and Technology disciplines proposed by Bunton (2005).

Table 2.6: PhD Conclusion Framework for Science and Technology

(Bunton, 2005, p.219)

Usually present (≥ 50%)	**Present (≥ 25%)**
Move 1: Introductory restatement Work carried out	Territory Centrality Gap/niche
Move 2: Consolidation of research space Method Findings/results Claims Reference to previous research Products	Evaluation of method/product Explanation Uncertainty Significance Limitations Recommendations for future research Practical applications or implications
	Move 3: Practical applications and recommendations Applications or implications Recommendations (Optional)
Move 4: Future research(Compulsory) Recommendations	Previous research Limitations

As explored preliminarily by the researcher, the Conclusion chapter is found in all of SUT PhD dissertations, so that it is one of the compulsory elements that SUT graduate students have to write. The communicative purposes of this particular chapter are to summarize dissertation findings, discuss the analysis results, give implications of findings, make recommendations, and suggest areas of future research (Bunton, 2005).

Consequently, some of the contents from the Abstract, and the Introduction chapter can be mentioned again in the Conclusion chapter. In other words, such relationship of Abstract, Introductions, and Conclusion chapters in the genre set should be explored in the present study. The findings on the similarities and differences of the move-step structure and the relationship among genres of Abstract, Introduction, and Conclusion chapters in the genre set between the students' texts from science and engineering disciplines will be very useful for the graduate students in the next generation. Details on disciplinary discourse variations will be discussed in the next section.

2.4 Disciplinary Discourse and Variations

Studying of texts in the disciplinary contexts changes its focus from individual to the collection of forms on practice acknowledged, employed, and recognized by the group members of the disciplines. Academic texts play a more important role than just reporting research because they can also illustrate the findings into academic knowledge, and circulate their wisdom to people in wider public. Texts are thus where readers and writers meet, linguistically and cognitively (Hyland, 2000).

Each discipline might be seen as an academic tribe with its own norms, nomenclature, bodies of knowledge, sets of conventions, and modes of inquiry, all of which constitute a separate practice and culture (Swales, 1990; Becher & Trowler, 2001). The ways in which particular groups of academics organize their professional lives are intimately related to the intellectual tasks on which they are engaged (Becher, 1989 cited in Pramoolsook, 2008). In other words, disciplines are clarified by Hyland (2000) that they are human institutions where actions and understandings are influenced by the personal an interpersonal as well as the institutional and sociocultural. Academic

people make interactional communication to each other within the frameworks of their disciplines and they usually have little difficulty in identifying intellectual knowledge resources in their own fields. However, it depends on each disciplinary culture that the community members obtain specialized discourse competencies, which allow them to achieve tasks and make interactions among themselves. Discourse is a rhetorical product of social interactions of the members in the disciplines. In other words, it is socially essential rather than simply socially shaped. Hence, academic writing is not just an aspect of what is going on in the disciplines but it is rather a producing aspect in the disciplines. Given its socially situated nature, discourse helps to identify and clarify what writers and readers meant to present in a text, emphasizing that both composition and interpretation are dependent on assumptions about others. Therefore, disciplinary discourse involves language users in constructing and displaying their roles, identities, and beliefs as members of social groups. The concept of discourse community is thus worth an investigation here as it helps to place writers in specific contexts to clarify how their rhetorical writing strategies are dependent on the target goals, purposes, setting, and readers of their work. To achieve those goals, they have to locate their writing inside their particular genres, so that they can reflect and criticize through specific knowledgeable discourses supported by the members from the disciplines where they belong.

It is acknowledged that disciplinary discourse is a rich source of information about the social and rhetorical practices of academics, and through understanding their discourse the understanding of the disciplines can be achieved. Hyland (2000) states that this is because texts embody the social interactions and negotiations of disciplinary inquiry, displaying how disciplinary knowledge is constructed, negotiated, made

persuasive, and disseminated. In other words, the disciplines can be identified by their rhetorical writing. The generic activities the writers have created are embedded in the texts, which obviously make the important differences between students' written work in their particular disciplines. Consequently, the study on disciplinary variations is conducted towards textual variations in terms of the texts structure, relationship of the texts, and the rhetorical strategies created by students from the two disciplines. It is hoped that such study can suggest a better understanding of disciplinary variations, which directs the social interactions from different fields.

Although genres are considered as a means for routine information representation that reflects the social contexts of their construction and the conventional practices of the writer, studying them thus can provide insights into the norms, epistemologies, values, and ideologies of particular fields of knowledge (Candlin & Hyland, 1999, cited in Pramoolsook, 2008). Genres are also in a state of constant evolution as members respond to professional and private exigencies in new and innovative ways (Bhatia, 1999, cited in Hyland, 2000). Texts are written and understood among members in their disciplines. With the hope to reach the insights of this knowledge, analysis of key genres can guide the direction to find out about the conventional writing in the specific disciplines because disciplinary collection of norms, beliefs, values, and ideologies.

There is a big scale of genre analysis conducted by Hyland (2000), which includes book reviews, scientific letters, and textbooks in the study. These genres are collected from a range of disciplines of hard and soft, and pure and applied ones. In this research, there are two aspects that should receive particular attention. Firstly, through the citation practices analysis across eight disciplines i.e. philosophy,

sociology, marketing, applied linguistics, biology, physics, electronics engineering, and mechanical engineering, some interesting disciplinary variations are revealed. For instance, based on the traditional distinction between sciences and engineering as hard knowledge and the social sciences and humanities are soft disciplines, the citation amount largely suggests the informal characteristics that softer disciplines have a tendency to employ more citations, whereas the number of citations in engineering and physics is found to be less than average. And, while the first four widely favour discourse activity reporting verbs such as *state*, *suggest*, *discuss*, and *hypothesize* and are more likely to employ integral structures and to place the author in the subject position, science and engineering disciplines display a preference for research type verbs such as *analyze*, *calculate*, and *explore*, and tend to downplay the role of the author. In terms of these differences, Hyland (2000) reveals that they are closely bound to the social activities, cognitive styles and epistemological beliefs of specific disciplinary communities. Secondly, research article abstracts investigation using the move analysis framework of Introduction-Purpose-Method-Product-Conclusion (I-P-M-Pr-C) also reveals the disciplinary variations across the eight disciplines. For example, the abstracts in the soft knowledge domain contain more Introduction moves, probably because the writers have a greater need to locate their work in the existing domain of knowledge, while the writers in the hard disciplines tend to omit such Move and favour the Method move to emphasize the description of the experiment processes. Hyland (2000) also explains that this is because writers in hard knowledge disciplines are often able to draw on background information and understanding required to contextualize their studies and readers are commonly able to access these understandings to determine the theoretical rationale, the research

value and its significance to the knowledge development. The study of Hyland (2000) can explain that although the students come from the same field of hard knowledge, variations in their writing of the same academic genres can be found. Therefore, the three genres of Abstract, Introduction, and Conclusion chapters in the genre set of SUT PhD dissertations of science and engineering disciplines will be investigated to find out the variations between them.

In terms of contrastive studies of the disciplinary variations between two or more related academic disciplines, the studies conducted by Samraj (2002a; 2002b; 2005; 2008) can be examples to show that they are useful for PhD dissertations analysis. First, in her move analysis of twenty RA abstracts (Samraj, 2002a), it is found that the most striking variation between Wildlife Behavior and Conversation Biology disciplines is the significance given to the situating-the-research move. While the move is normally found in Conservation Biology abstracts, it appears much less in Wildlife Behavior. The information presented in this move is also of different kinds. The rhetorical structure variations also exist in the Introductions as well. The Swales' CARS model (1990) was used to explore twelve Introductions from Conservation Biology and Wildlife Behavior (Samraj, 2002b). The findings point out that the most notable difference between the two disciplines is at Move 1: *Establishing a territory*. While in the case of Wildlife Behavior, the claims for centrality are not frequently found and the justification for the research is to fill the gap in the previous research, centrality claims in Conservation Biology are common and well-developed and often concern the real world in order to have persuasive and promotional effects on the research. This study also reveals that the differences can be ascribed to the different nature of the two disciplines. Conservation Biology is regarded as an applied,

interdisciplinary, and younger field of knowledge, whereas Wildlife Behavior is a theoretical, disciplinary field with historical depth. Although the investigations from Samraj (2002a; 2002b) report only findings on research articles, which are different genres from those in this present study corpus, but her recommendations are useful for PhD dissertation analysis. Therefore, the genres of Abstract, Introduction, and Conclusion chapters in the genre set of SUT science and engineering PhD dissertations in this present research will follow the similar directions in an attempt to find out the disciplinary variations that actually exist between the two disciplines.

Another contrastive study on dissertation is an investigation of genre transfer from dissertation to research article conducted by Pramoolsook (2008). This study compares six dissertations written by Thai scientists in Biotechnology and Environmental engineering with six published articles written by the same scientists, based on their dissertation work. The main textual components of the genres in this study i.e. the Abstract, the Introduction, the Literature Review, the Material and Methods, the Results and Discussion, and the Conclusion. Six different frameworks are used to analyze the move-step structures of the genres between the two disciplines. The interesting outcomes in the study are on the disciplinary variations of the two disciplines. Not only the general differences in whole text partitioning but disciplinary variations are also evident in the move-step structures of the main textual components from the two genres. Moreover, the results from this analysis are intended to benefit scientists publishing in English and to be used in the genre-based approach to teaching scientific writing. The above study is the comparative study on academic genres between the two hard applied disciplines from the same local discourse community. However, this present research will focus on the similarities

and differences of move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and on the relationship among these three elements in the genre set between the hard pure and hard applied disciplines. Hence, the mentioned studies have given fruitful ideas on research strategies and beneficial guidelines to conduct the contrastive analysis for the present study.

Genres and textual analyses of the disciplinary discourses in various academic disciplines have been conducted for decades. The particular research can be conducted from within or different disciplines to find out more on their norms, epistemologies, values, ideologies, and move-step structure. Examples of such analysis include the studies on a single discipline, e.g., Sociology (Brett, 1994), Applied Linguistics (Yang & Allison, 2003; 2004; Lorés, 2004; Kwan, 2006; Ozturk, 2007; Amnoui & Wannarak, 2013), Chemical Engineering (Peng, 1987; Koutsantoni, 2006), Biochemistry (Kanoksilapatham, 2005; 2007), Organic chemistry (Bruce, 2009), Medicine (Nwogu, 1997; Li & Ge, 2009), Computer Science (Posteguillo, 1999). Other examples are the analysis on two or more disciplines, such as (Hyland, 2000; Peacock, 2002, 2011; Bunton, 2002; 2005; Samraj, 2002a; 2002b; 2005; 2008; Pramoolsook, 2008). However, a study on disciplinary discourses used in the three genres of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations between science and engineering disciplines has not been conducted. Although the two disciplines are not related in the same way as in the study of Samraj (2005), the methodology used in her study can be very useful for this present research. SUT science and engineering disciplines will be regarded as hard pure and hard applied fields, respectively, following Becher (1994), and Becher & Trowler (2001). The two disciplines are the highest productive study programs, also

they are administered under the same academic discourse community of SUT. Therefore, the findings of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, the relationship among the three elements in the genre set, and the similarities and differences of the three genres in the genre set of SUT PhD dissertations between the two disciplines will be insightful and pedagogically useful for teaching and writing those particular texts.

Last but not least, the increasing demand of writing PhD dissertation in English is unavoidable nowadays. Not only the students have to write it correctly and meaningfully to meet the satisfaction required by their discourse community members, but they also have to write appropriately and effectively along with their own norms. The research methodology in details will be introduced in the next chapter.

2.5 Summary

This chapter has presented the concepts and theories that inform the proposed study, which include 1) Discourse community, Genre, and Genre analysis, 2) PhD dissertations and the Genre set of Abstract, Introduction, and Conclusion chapters, 3) Move analysis with the selected frameworks for the present study, and 4) The disciplinary discourse variations with the related previous studies. The review of theories from the literature has emphasized the benefit of move analysis and pointed out the gaps of related research for PhD dissertations. Moreover, the review topics can also strengthen the directions and the possibility to conduct the contrastive study of the three genres of Abstract, Introduction, and Conclusion chapters in the genre set between the two disciplines appropriately. More details on the research methodology and the pilot study of the current research will be presented in the next chapter.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter aims to describe important aspects of research methodology employed in this study. The first section consists of an overview of research objectives and research questions followed by a summary of research design of this current study in the second section. The third section consists of descriptive details of the research methodology regarding corpus construction and management, which includes data identification, data collection, and selection of the PhD dissertations and corpus management. Then, details about data analysis are elaborated. This section is devoted to move-step structure analysis, which covers the selected analysis frameworks to be used with Abstract, Introduction, and Conclusion chapters in the genre set of SUT science and engineering disciplines. Moreover, the analysis of the relationship among these three elements in the genre set under this current investigation, and the details of discourse-based interviews are described. Also, data interpretation is discussed to find out the similarities and differences of the three genres in the genre set of PhD dissertations between the two disciplines. This description is followed by the pilot study and this chapter ends with the chapter summary and suggestions for the main study.

3.1 Overview of Research Objectives

As stated earlier in Chapters 1 and 2, despite the fact that research on English for Academic Purposes (EAP) writing focusing on research articles or Master's theses have been found extensively, most of such studies have focused on the move analysis on a single section or chapter. While some of these studies have examined the macro-organization and linguistic features of only a single section or the whole of research articles or theses from one or across disciplines, a few of them have systematically studied the relationship among genres. Samraj (2005) is a good example, which focuses on the investigation on RAs set of genre. This study fills up the gap pointed out by Connor & Mauranen (1999) that the study on groups of related genres and subgenres has not been found to be systematically examined. They also expressed their hope that future genre studies will provide greater development in generic interrelations on this particular research area. Hence, this proposed study investigates the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of the PhD dissertations in science and engineering disciplines in a Thai university. The relationship among the three genres in the genre set of the two disciplines is explored during the move-step structure analysis. Another aim is to find out the similarities and differences of Abstract, Introduction and Conclusion chapters in the genre set between the two disciplines. Specifically, the four objectives of this study are: 1) to investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations produced by graduate students in SUT; 2) to explore the relationship among the three genres in the genre set of the two disciplines in SUT; and 3) to find out the similarities

and differences of the move-step structures and find out the relationship of the three genres in the genre set between the two disciplines in SUT.

3.2 Research Design

To achieve the objectives of this study, move-step structure analysis, contrastive analysis, and discourse-based interview are used as methods to answer the present research questions. First, move-step structure analysis is conducted on the three elements of Abstract, Introduction, and Conclusion chapters in the genre set under the investigation, using the selected frameworks reported in the literature i.e. Hyland (2000) for Abstract, Bunton (2002) for Introduction, and Bunton (2005) for Conclusion. The corpus of PhD dissertations of science and engineering disciplines is downloaded from Suranaree University of Technology Intellectual Repository (SUTIR). Second, for the relationship among the three genres in the genre set, an investigation following Samraj (2005) is carried out. During this investigation, overlapping communicative purposes among the three genres as reflected through the move-step structure analysis are the point of focus, therefore, the relationship among them is clarified. Third, the findings about move-step structure analysis and the relationship among the three genres in the genre set from the two disciplines are compared against each other. Through this contrastive analysis following Hyland (2000) and Samraj (2002), the disciplinary variations in PhD dissertation writing between the students from the two disciplines are revealed. Moreover, the discourse-based interview following Hyland (2000) with representatives from supervisors and students is used as a qualitative method to gain in-depth understandings about the actual PhD dissertation writing process of the science and engineering graduate

students. Interesting incidences and findings from the first three analyses inform the formation of interview questions, which aim to uncover the reasons for all the decisions these writers made in their writing. Finally, synthesis of all the findings together with the insights from the interviews sheds light on the pedagogical implications that are shared with students. Figure 3.1 below describes the overall research methodology process under this present study. Details on the corpus construction and management are described in the next section.

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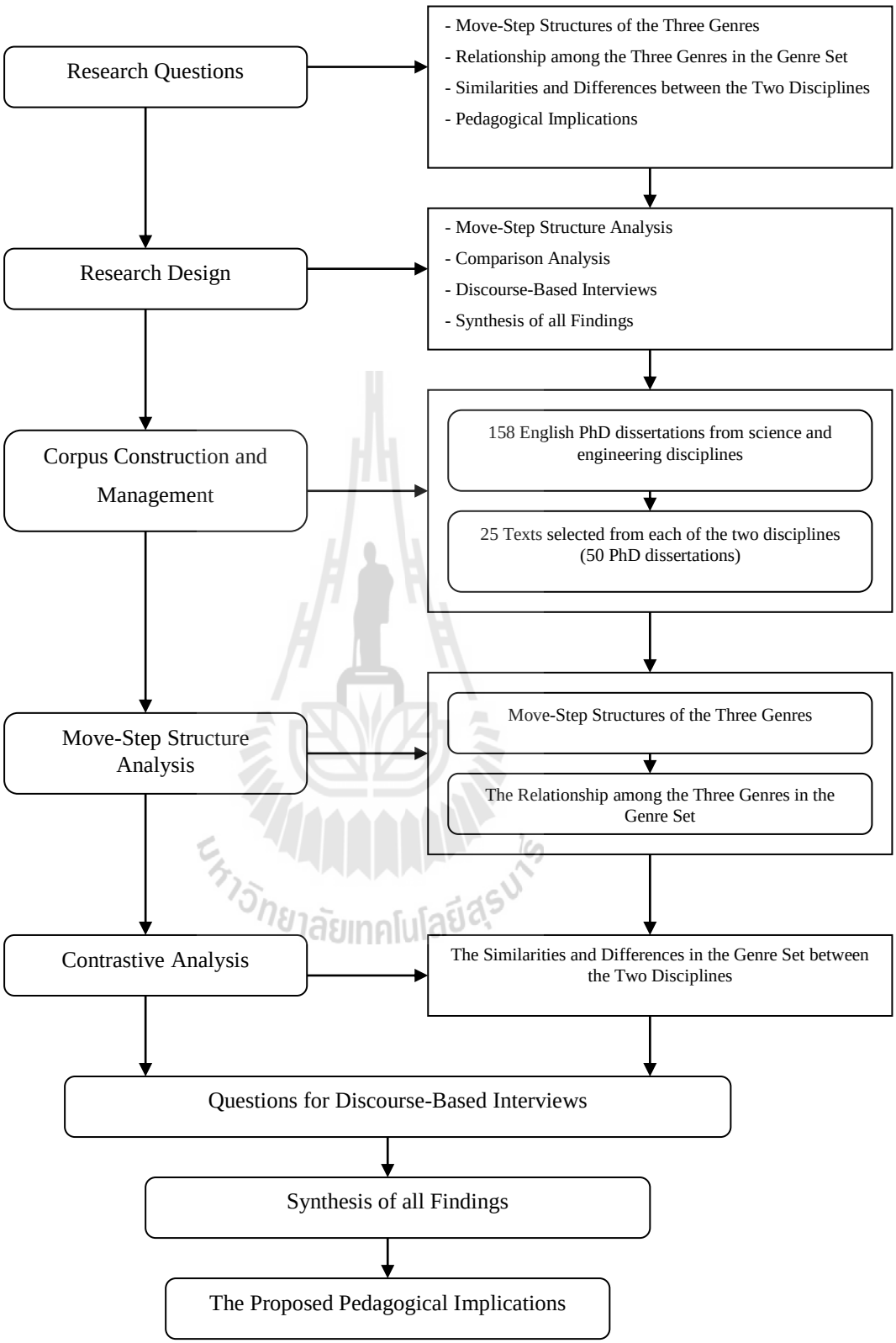

Figure 3.1: Research Methodology Flow Chart

3.3 Corpus Construction and Management

3.3.1 Data Identification

Previous studies related to genre analysis have always been found in the research on discipline-specific, and goal-oriented corpora of texts. The corpus selection has been mostly intuitive and purposive. Also, different corpora sizes have been used in many previous studies. For example, due to the availability of texts, Pramoolsook's (2008) study on the effects of genre transfer from Master's dissertations to research articles includes 6 pairs of texts of Biotechnology and Environmental Engineering dissertations and research articles. Samraj (2008) conducts her discourse analysis on the Introduction Chapter of 24 Master's dissertations across disciplines. Bunton (2002; 2005) study the generic structures of PhD Introduction and Conclusion chapters, respectively from the same 45 dissertations across departments and faculties at the University of Hong Kong. Moreover, Kwan (2006) analyzes 20 PhD dissertations of Applied Linguistics with the focus on the Literature Review chapter. Therefore, a much larger size on PhD dissertation corpus needs to be created for this study. However, a preliminary corpus survey in the data source of PhD dissertations from SUTIR has shown that there is the availability of 133 and 25 items from science and engineering disciplines to be downloaded, respectively. In order to conduct a proper comparative study between the two target disciplines, the corpus from each discipline has to be in the same number. Therefore, to attain the sufficient corpus size, 25 dissertations from each discipline were collected to create two sets of corpus. As a result, a total of 50 successful PhD dissertations were analyzed, exceeding the corpus size reported in the previous studies mentioned earlier. At the end, the word counts in the final corpus were nearly 200,000

words, excluding tables, figures, and graphs, which can be adequate for conducting this present study.

3.3.2 Data Collection

The preliminary step in order to obtain the data legally is to distribute the letters asking for permission to the Deans of Institute of Science and Institute of Engineering, Suranaree University of Technology, Thailand. The two data sources for this study were from Suranaree Technology Intellectual Repository (SUTIR), following the general identification criteria of sources from which texts to be collected by Nwogu (1997) – representativeness, reputation, and accessibility. The English PhD dissertations were stored as electronic files in the database in full texts. All the PhD dissertations were based on research studies and passed for the PhD degrees from various academic years. SUT science and engineering disciplines produce the highest output of the PhD studies, therefore, they are important study programs of the university, which can represent the university and its reputation across the country. These PhD dissertations are easily accessible by requesting the university authorization to download all the files. Next subsection contains the information on how to select the PhD dissertations for the target corpus and how to manage it.

3.3.3 Selection of the PhD Dissertations and Corpus Management

A preliminary survey of this corpus indicated that the PhD dissertations were produced during the period of 1999-2012. They appear separately in Institute of Science and Institute of Engineering databases consisting of 133 and 25 items, respectively, representing 9 sub-disciplines under each Institute. These dissertations to

be analyzed in the present research were drawn from each of nine sub-disciplines. Table 3.1 below lists the PhD dissertations selected from the two disciplines.

Table 3.1: PhD Dissertations Drawn from SUTIR Database

Institute of Science	**Institute of Engineering**
School of Remote Sensing (8)	School of Polymer Engineering (1)
School of Mathematics (29)	School of Environmental Engineering (6)
School of Microbiology (3)	School of Telecommunication Engineering (1)
School of Biology (16)	School of Civil Engineering (1)
School of Environmental Biology (10)	School of Electrical Engineering (3)
School of Biochemistry (8)	School of Chemical Engineering (9)
School of Physics (34)	School of Mechanical Engineering (1)
School of Chemistry (21)	School of Ceramics Engineering (1)
School of Laser Technology (4)	School of Geotechnology Engineering (2)
Total = 133 items	**Total = 25 items**

To conduct a comparative study, the actual collected samples between the two sides have to be in the same sampling number (Jabeen et al., 2011). However, it was found that the number of available PhD dissertations in a corpus of the engineering discipline is only 25 texts. With this corpus availability, therefore, it is necessary for the researcher to select all 25 items from the engineering disciplines, and only 25 items from the science were selected by purposive random sampling, culminating in the 50 completed PhD dissertations to create a sufficient size of corpus.

All the PhD texts from nine sub-disciplines under Institute of Science as well as Institute of Engineering were accessible online. It was found that 133 English PhD texts from the science discipline were available to be downloaded. As listed in Table 3.2 below, 3 PhD dissertations from each of the seven sub-disciplines, and the other 2 from each of microbiology and environmental biology were purposively selected. The rationale behind this unequal sampling number in the science PhD dissertations

selection is that microbiology and environmental biology are the two sub-branches of biology according to its long history. Biology is a study of natural science concerned with the study of life and living organisms, which can be divided into many sub-branches, including Microbiology and Environmental biology. The first one is the study of microscopic organisms (microorganisms) and their interactions with other living things, and the second one is the study of natural world as a whole or in particular area, especially as affected by human activities (Taylor et al., 1997). At the end, 50 PhD dissertations from the two disciplines were analyzed to achieve the objectives and to answer the research questions of this study. The selected dissertations from science discipline were designated as SC1 to SC25, and EN1 to EN25 from engineering discipline, respectively. Table 3.2 below lists the actual sampling numbers of a corpus from the two disciplines.

Table 3.2: Actual PhD Corpus Selected for This Study

Institute of Science	**Institute of Engineering**
School of Remote Sensing (3)	School of Polymer Engineering (1)
School of Mathematics (3)	School of Environmental Engineering (6)
School of Microbiology (2)	School of Telecommunication Engineering (1)
School of Biology (3)	School of Civil Engineering (1)
School of Environmental Biology (2)	School of Electrical Engineering (3)
School of Biochemistry (3)	School of Chemical Engineering (9)
School of Physics (3)	School of Mechanical Engineering (1)
School of Chemistry (3)	School of Ceramics Engineering (1)
School of Laser Technology (3)	School of Geotechnology Engineering (2)
Total = 25 items	**Total = 25 items**

3.4 Data Analysis

As mentioned earlier, the move-step structure analysis of the English PhD dissertations in this study was conducted in two areas including 1) the investigation of move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations in science and engineering disciplines, and 2) the exploration of the relationship among the three genres in the genre set of the two disciplines. In this section, the analysis process to find out the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of the two disciplines, and the relationship among these three genres of the two disciplines are described. The selected frameworks are proposed as the reference models for data analysis. Move-step identification as well as its reliability, data interpretations, and discourse-based interviews to gain the insights for the present study are discussed.

3.4.1 Analysis Process

This study is a part of discourse analysis, which can be placed into three categories: 1) the study of language use; 2) the study of linguistic structure 'beyond the sentence'; and 3) the study of social practices and ideological assumptions that are associated with language and/or communication (Biber et al., 2007). To start, the move analysis method is employed to investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations, and the relationship among the three genres in the target genre set under this study. According to Holmes (1997), a move is "*a segment of text that is shaped and constrained by a specific communicative function*" (p.325). In terms of marking the moves, the standard method for classifying the moves is the four-step procedure suggested by Dudley-Evan (1994, cited in Peacock, 2011) and Holmes

(1997). First, researcher looks for organization, where communicative purposes of the writers will be considered, then moves and steps will be identified. Second, researcher uses sentence-level analysis as some moves can be realized by one sentence or may take more than one sentence or the whole paragraphs to show only one move. Therefore, any sentence or group of sentences will be classified into the same move until the new move occurs in the next sentence or paragraph. Third, researcher assigns all sentences that share the same communicative purpose to a move. Fourth, researcher authenticates the classification by using raters for inter-rater reliability of the pilot findings. In this present research, the moves and steps are marked manually on paper. The criteria for move-step frequency classification of Abstract, Introduction, and Conclusion chapters in the genre set of the main corpus is based on Kanoksilapatham (2005). For example, in the Introduction Chapter, if a particular move occurs in all the 25 Introductions, which accounts for 100%, it is considered as 'obligatory'. The move occurrence from 60-99% is regarded as 'conventional', and the frequency of a move below 60% is considered as 'optional'. Nonetheless, they are not determined as new move(s)-step(s) unless they are found with about 50% in the corpus (Nwogu, 1997). Once the move-step structures of the three genres have been identified, these structures are compared to find out the relationship that these three genres have with one another. Of particular attentions are the overlapping communicative purposes among these three genres. For example, a summary of the research can be reported in Abstract and can be mentioned again in Introduction chapter. Purpose statements of the study in Introduction chapter can be mentioned again either in Abstract or Conclusion chapter. As a result, the relationship among them can be clarified (Samraj, 2005). Then, a comparison analysis of move-step

structures of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations between science and engineering disciplines are conducted to reveal the disciplinary variations between the two disciplines.

Apart from these product-based analyses, a set of qualitative data is included to enrich the move-step findings of this study. To gain such data, discourse-based interviews with some representatives from the target disciplines, who were involved in the process of writing these particular texts, following Hyland (2000), are also employed in this study. In this present study, eight informants (4 from each discipline) were purposively approached and asked questions related to interesting analysis findings from the research. For the science discipline, a PhD supervisor, and a student from chemistry, biology, and physics each were designated as SCI1, SCI2, SCI3, and SCI4. For the engineering discipline, a PhD supervisor, and a student from electrical, telecommunication, and chemical engineering each were designated as ENI1, ENI2, ENI3, and ENI4, respectively. Details of the questions from the two disciplines are listed in the Appendix D.

Discourse-based interview is a method for eliciting interview data, which requires informants to respond to specific features of the corpus, allowing them to recount all possible PhD dissertation writing experiences especially their decisions in move-step structure practices of their own work. The main aim of the interview is to seek out the validation of actual practice of those involved in the writing process. Therefore, the questions are generated from the interesting points such as problematic areas and unconventional writing that are found from the analysis rather than general ones. Hyland (2000) incorporates the results of interviews and focus group discussions with the writers and readers of the texts or other academic specialists into

his study to supplement the move-step analysis. He goes beyond the textual approach by using unstructured interviews, and discourse-based interviews with subject specialists from eight disciplines including electrical engineering, physics, and biology disciplines, although the interviewees were not the writers of the articles in his corpus. In addition to seeking more qualitative data from the specialists besides textual approach, the focus here is to look not only at the products (texts) but also the process surrounding the production and consumption of texts, asking, *"Why are specific discourse-genres written and used by the specialist communities the way they are"*. Therefore, double checking the findings from moves analysis is another way to find out the information from specialists or those who are practicing members of the disciplinary culture in which the genre is routinely used (Bhatia, 1993). Many of the previous studies employed interviews as a way to examine the actual process and difficulties of academic writing, especially dissertation writing and research articles, including Shaw (1991); Dong (1998); Flowerdew (1999a; 1999b); Hyland (2000); Thompson (2005); Li (2006); Okamura (2006); Pramoolsook (2008); Cho (2009); Pramoolsook et al. (2011); Nguyen (2014). In order to obtain such qualitative data, representatives from supervisors and students were selected by purposive sampling from each of the two disciplines for the interviews. They were approached and asked to take part in the interviews. The interviews were conducted in Thai as it facilitated the representatives to express their opinions freely. Moreover, it is found in Okamura (2006) that the use of native language is also helpful when the interviewees speak about their difficulties with writing in English.

The analysis steps described earlier are the attempted methods to find out the answers for the main research questions. Finally, the pedagogical implications were

proposed from the analysis and the interview findings. Altogether, the answers for the three research questions are beneficial for science and engineering disciplines by helping them improve writing of Abstract, Introduction, and Conclusion chapters in the genre set of the PhD dissertations. The selected analysis frameworks for this study are discussed in the next subsection.

3.4.2 Analysis Frameworks of Abstract, Introduction, and Conclusion Chapters

As discussed earlier, this study aims to investigate the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set in science and engineering PhD dissertations, the relationship among the three genres in the genre set of the two disciplines, and the similarities and differences of the three genres in the genre set between the two disciplines. For the Abstract analysis, this study adopted Hyland (2000) as an analysis framework. His framework is a result of the study of 800 article abstracts from 8 disciplines, including electrical engineering, physics, and biology disciplines, which are close to the two disciplines in this present study. He found that the abstracts in his corpus followed a five-move structure with the additional move of Introduction when compared with the four-move model proposed earlier by Bhatia (1993). Moreover, the model was used to analyze abstracts of Master's dissertations and RAs produced by graduate students (Pramoolsook, 2008; Ren & Li, 2011), which offer reasonable findings.

For the Introduction Chapter, this study adopted Bunton (2002) as an analysis framework. His study is the genre analysis of 45 PhD Introductions with the focus on the generic moves. The corpus is a representative sample from the disciplines with the highest output of PhD dissertations at the University of Hong Kong. Bunton (2002)

adopts the Create a Research Space (CARS)' model created by Swales (1990) as the basis for the initial analysis of moves in his study, but at the level of steps, Dudley-Evans' (1986) model is adopted. As a result of his analysis, a new PhD Introduction framework was proposed. This Bunton's framework was adopted for this present study because the corpus in his research is the same PhD genre from the most productive study programs including science and engineering disciplines. Also, there are previous studies that adopt this framework such as Pramoolsook (2008) with the Master's thesis introductions from two disciplines, and Monreal et al. (2011) with the PhD Introductions of computing discipline, which yield interesting results. As a consequence, the researcher adopted this model as an analysis framework for the Introduction Chapter.

In this framework, nearly all Introductions in his corpus had sequences of text identifiable as the three moves in Swales's (1990) CARS model: *Establishing a Territory*, *Establishing a Niche*, and *Occupying the Niche*. For the Steps, the Introductions in his corpus revealed a much greater variety of steps than in the RAs and Masters dissertation Introductions described in Swales's (1981; 1990) and Dudley-Evans's (1986) models. As a result, he proposed 11 more steps, which did not fit any of the descriptions in Swales's or Dudley-Evan's models. Moreover, the differences between the 'often present' and 'occasionally present' move-step in Bunton's (2002) framework are that the 'often present' moves and steps were mostly found in various disciplines from the corpus, while the latter one was only found from a few PhD Introductions especially in engineering disciplines.

For the Conclusion Chapter, this study adopted Bunton (2005) as an analysis framework. Bunton (2005) investigates the corpus of 45 PhD dissertations, the same

as in his 2002 study. He adopts moves and steps identified and described in the literature (particularly Weissberg & Buker, 1990; Dudley-Evans, 1994; Swales & Feak, 1994) as the starting point for his analysis. He finally proposes the PhD Conclusions model for science and technology disciplines. This framework was adopted in this study because, first of all, the corpus in his study is the same PhD genre from the highest productive study programs of Hong Kong University including science and engineering disciplines. The model is also used to analyze the Master's thesis Conclusions produced by graduate students from Biotechnology and Environmental engineering disciplines (Pramoolsook, 2008), from the same academic discourse community as the present study's subjects. Therefore, with these two reasons combined, the researcher adopted Bunton (2005) as the analysis framework for the Conclusion Chapter.

3.4.3 Inter-rater Reliability

Reliability is the extent to which a measuring procedure yields the same repeated results on repeated trials (Neuendorf, 2002). Move analysis, which is naturally qualitative, needs to ensure its reliability as encompassing the validity of research measurement. For a move analysis, inter-rater reliability should be checked to confirm that there is agreement on what the move types are and how they are realized by text segments (Biber et al., 2007). After criticism from Crookes (1986), many analysts employed inter-rater reliability to ensure the degree of agreement if their analyses are valid or not (e.g., Hyland, 2000; Bunton, 2002; Peacock, 2002, 2011; Bunton, 2005; Kwan, 2006). Although a more common statistic measurement for determining inter-rater ability is Cohen's kappa (k), it is important to note that there are no strict 'rules' for doing a move analysis (Biber et al., 2007). In this present

investigation, the researcher used the simple method of reporting inter-rater reliability, that is, 'Percent agreement' proposed by Holsti (1969). The rationale to choose this method is that the criterion for the agreement between two coders who code the same units is concerned with whether they agree to the precise samples assigned to a given variable (Neuendorf, 2002). There are two ways to calculate simple agreement.

Firstly, Percent agreement is a simple percentage, representing number of agreements divided by total number of measures. A conceptual formula for percent agreement could be written as:

$$PA_o = A/n$$

where PA_o stands for 'proportion agreement, observed', A is the number of agreements between two coders, and *n* is the total number of units the two coders have coded for the test (also, the maximum agreement they could achieve). This statistic ranges from .00 (no agreement) to 1.00 (perfect agreement).

Secondly, it is the percent agreement proposed by Holsti (1969), which is used when two coders code the same units recommended by Neuendorf (2002). This calculation is equal to the previous percent agreement. The formula differs only a little:

$$PA_o = 2A/(n_A + n_B)$$

where PA_o stands for 'proportion agreement, observed', A is the number of agreements between two coders, and n_A and n_B are the number of units coded by coders A and B, respectively. This statistics also ranges from .00 (no agreement) to 1.00 (perfect agreement).

The study that uses this reliability coefficient including the reported reliability coefficients in the samples of Marketing RAs written by Marketing PhD students

(Hughes & Garrett, 1990). This study aims to identify the types of inter-coder reliability reported in 68 articles from Journal of Marketing Research, Journal of Marketing, and Journal of Consumer Research that employed content analysis. The result shows that 65% of them report the use of percent agreement reliability in the Marketing RAs. De Wever et al. (2006) also suggest that there is no general consensus on what index should be used to report inter-rater reliability. Percent agreement is one of the coefficients that provide good estimation on the inter-rater reliability. According to the suggestion of De Wever et al. (2006), the writers of those Marketing RAs are PhD students, which are similar to the PhD writers of SUT, therefore, the researcher believes that Holsti's (1969) percent agreement method would be statistically appropriate to be used with the present study.

As proposed by Crookes (1986), raters should be individual with some linguistic sophistication. Two PhD students, i.e. the researcher herself and another one in English Language Studies (ELS) were trained about the move and step identification using the analysis frameworks to ensure the reliability and validity of the results. After that, the two raters independently analyzed the 6 samples for 2 weeks. To insure that the rater has expertise in the focused texts from the two disciplines, a PhD candidate in chemistry was invited to take part in the inter-rating process in order to help confirm the reliability and validity of the analysis results, following Kanoksilapatham (2005). The inter-rater reliability was calculated by using percent agreement (Holsti, 1969), as previously described. Initial analysis results on the move-step structures between the two raters were discussed and compared to fine tune the results on the functional and semantic purposes that are being realized by the text segments (Biber et al., 2007).

Once this study was decided that move-step structure analysis is the main investigation for this research, a pilot study is necessary in order to let the researcher experience the shorter corpus than the actual ones in the main study. Moreover, it serves well as a basis for move analysis practice for the researcher. For a report on the pilot study, details are provided in the next section.

3.5 The Pilot Study

Pilot study is one of the important approaches for managing the qualitative research study. It is to let the researcher experience the smaller corpus than the actual ones in the main study. Moreover, it serves well as a basis for move analysis practice for the researcher. This analysis was conducted to achieve the following objectives.

1. To explore the move-step structures that can be generally found in Abstract, Introduction, and Conclusion chapters in the genre set of the PhD pilot corpus between science and engineering disciplines at Suranaree University of Technology, Nakhon Ratchasima, Thailand, and

2. To try out the three selected analysis frameworks of Abstract, Introduction, and Conclusion chapters, proposed by Hyland (2000), and Bunton (2002; 2005), respectively. The researcher will arrive at the appropriate directions to conduct the main analysis with the main target corpus in the future.

The analysis methods for the pilot study were move-step structure analysis and contrastive analysis on the pilot corpus. These were conducted with two aspects of investigations, to find out move-step structure, and the similarities and differences of the move-step structures of Abstract, Introduction, and Conclusion chapters in the

genre set of PhD dissertations between the two disciplines. The analysis yielded interesting preliminary findings, which are beneficial for the main study.

The pilot corpus of the two disciplines was taken from the main corpus of 50 texts. Six dissertations were randomly selected following the minimum 10% from the main corpus for a pilot study suggested by Hyland (2000). Three texts from each discipline were chosen, starting from the 8th and moving forward to select every 8th dissertation until three were obtained from each field. At the end, one dissertation from chemistry, physics, and biochemistry were selected from the science discipline, i.e., SC8, 16, and 24, and one from chemical engineering, civil engineering, and electrical engineering from the engineering discipline, i.e. EN8, 16, and 24. In each of the text, Abstract, Introduction, and Conclusion chapters were formed as a genre set. The analysis frameworks proposed by Hyland (2000) for Abstract, Bunton (2002) for Introduction, and Bunton (2005) for Conclusion chapters were used as reference frameworks for the analysis of this study. To try out the analysis, the researcher first analyzed the three genres from the science pilot corpus. Then, the researcher conducted another analysis on the engineering pilot corpus. Then, another rater did the same independently. The analyses took two weeks, and then the initial analysis results on the move-step structures between the two disciplines were compared and discussed until the two raters reached a perfect agreement on all move and step identification. Details and the results of the pilot study are described starting from the science, then the engineering disciplines, respectively in the next section.

3.5.1 Initial Findings from the Science Corpus

This section reports the findings from the science PhD pilot corpus. The analysis results will start from the Abstract, the Introduction, and the Conclusion chapters.

3.5.1.1 Analysis of the Science Abstracts

The surface structure of the science Abstracts reveals that two were written in the two-paragraph format, and one was in one paragraph. The average word count is 247 words, pointing out that these science Abstracts are little longer than a maximum length of 200 words of research article abstracts reported in Hyland (2000). This can possibly indicate that different genres have different requirements for the same sub-genre inside. The results of the move-step structure of the science Abstracts reveal that two out of three science Abstracts strictly follow Hyland's (2000) five-move framework. However, SC8 does not show any evidence of the Introduction and the Method moves. The two Abstracts which follow the five-move structure show different move sequences. SC24 follows the move sequence of I-P-M-Pr-C proposed by Hyland (2000), but SC16 exhibits different order in which the *Product* comes before *Method*. Surprisingly, this result can possibly indicate that the actual findings on the unusual sequence should be investigated by using the qualitative interviews in the main study. Moreover, the most noticeable feature of these science Abstracts is that all of them have the commonality of *Purpose*, *Product*, and *Conclusion* moves. This result corresponds to the explanation made by Hyland (2000) that there were a high number of two-move abstracts mainly in the science disciplines, where the writers presented their purpose and product only. Also, the Conclusion move is found

to appear at the end of all abstracts in this pilot corpus, revealing that the Conclusion move might be an obligatory status which will be contrary to Hyland (2000).

3.5.1.2 Analysis of the Science Introductions

The result from surface structure of the science Introductions shows that the average word count of the chapter is 2,928 words. Overall, the three Introductions average 14.6 pages, indicating that the science Introductions have a slight difference in length if compared to the average of 9-10 pages in Bunton (2002). SC16 contains functional headings, SC24 contains topical headings, while only one of them (SC8) contains no section at all. Such differences in terms of chapter heading are accounted for in Bunton (2002). SC8, which contains no section at all, corresponds with his suggestion that most of the Introductions without sections were from the Science Faculty in his corpus. For SC16 that has functional headings, this corresponds with the majority of text in his corpus (20 out of 33 Introductions). For the last one, SC24, the topical headings in the Introduction indicate that the headings might relate to some aspect of the research topic in the particular field. The initial findings of this move-step structure analysis of the science pilot corpus reveal that all the Introductions have all the moves identified in the three-move framework proposed by Bunton (2002). All of them begin with Move 1: *Establishing a Territory* to show that the intended research area is important, central, interesting, problematic, or relevant in some way, and to introduce and review items of previous research in the area. Two of them close the chapter with Move 3: *Announcing the present research* to outline purposes of or the work carried out in the research. In contrast, SC8 closes the chapter with Move 1: *Establishing a territory* to review the previous research relating to the intended study again. The common steps from Move 1: *Establishing a territory*

that these science Introductions have are Steps 2) *Topic generalizations/ Background*, and 4) *Reviewing previous research*, from Move 2: *Establishing a niche* are Steps 1B) *Indicating a problem or need*, and 1D) *Continuing a tradition*, and from Move 3: *Announcing the present research* is Step 2) *Work carried out*. These results confirm that *Topic generalizations/Background*, *Reviewing previous research*, and *Indicating a problem or need* are the obligatory steps that should be found in a majority of Introductions across all faculties (Bunton, 2002). The *Continuing a tradition* Step is found in all the science Introductions, indicating that although the medicine and social science disciplines are the majority texts that employ this step in their PhD introductions (Bunton, 2002), this step can appear in science Introductions as well. Moreover, the *Work carried out* step is found in the majority of the texts of engineering and science disciplines in Bunton's (2002) study, therefore, having this step in this pilot corpus corresponds to his findings.

3.5.1.3 Analysis of the Science Conclusions

All the science Conclusion chapters are located as the last chapter in the PhD dissertations included in this pilot corpus. The information on the surface structure survey reveals that the average word count of the science Conclusions is 820 words. The chapter ranges from 2 to 4 pages, averaging 2.7 pages. These results point out that the average page of this Conclusion pilot corpus is approximately two times shorter than the Conclusion corpus of science and technology disciplines reported by Bunton (2005). In terms of the sections, SC8 is the only dissertation that has sections in the chapter, while the other two dissertations contain none. Containing no section in the science Conclusions also corresponds with the study of Bunton (2005) that more than half of the concluding chapters in his corpus were not divided into sections,

especially in science and technology disciplines. For the move-step structure analysis of the science Conclusion, the initial move-step structure results show that SC8 is the only dissertation that employs all the obligatory moves in the Conclusion chapter as indicated in Bunton's (2005) framework. This is probably because it has the section, containing two headings, i.e. 1) Conclusions, and 2) Suggestion for further studies, which can be separated as distinctive moves from each other, so that the moves can easily be identified. Interestingly, SC16 and SC24 have no evidence of Move 4: *Future Research* to link the results of the intended research to the wider world or to future research. This result is in contrary to Bunton (2005) in that there was a great emphasis on *Future Research* move of science and technology conclusions in his corpus. All of these conclusions begin the chapter with Move 1: *Introductory Restatement* on *Work carried out*. They restate this by reporting about the activities in the research. The *Introductory restatement* move is followed by Move 2: *Consolidation of Research Space*, that summarizes methods, findings/results, and claims, with references to previous research. The common steps of Move 2: *Consolidation of Research Space* shared among these Conclusions are *Method*, *Findings/Results*, and *Claims*. Moreover, this move occupies the largest space in the pilot corpus if compared to the other moves in each of the texts. The largest space of this move points out that this move is probably the most important which is best captured in nature of the Conclusion (Swales & Feak, 1994). In addition, Bunton (2005) found that all 36 PhD dissertations in his corpus employed this move, indicating that this move is probably the main move in a concluding chapter of the science Conclusions.

3.5.2 Initial Findings from the Engineering Corpus

Similar to the report of the science corpus, the findings will respectively begin from the Abstract, Introduction, and Conclusion chapters.

3.5.2.1 Analysis of the Engineering Abstracts

The initial findings from the engineering Abstracts reveal that one abstract (EN24) was written in one paragraph format, and the other two in three and five paragraphs (EN16 and EN8), respectively. The corpus average word count is 516 words, pointing out that its length is approximately two times longer than a maximum length of research article abstracts of 200 words reported in Hyland (2000). This can probably indicate that writing requirement of the engineering pilot corpus needs more content to be added in the text than that of the science discipline at the average of 247 words. The results of the move structure show that all the engineering Abstracts employ the five-move framework proposed by Hyland (2000). Only one of them, EN24, follows the same sequence as in the framework, while the other two were written using different sequences of the move. The result of five-move appearance in the pilot corpus can possibly indicate that the writers in the engineering discipline see an importance of employing I-P-M-Pr-C moves in their Abstracts, providing the completed summary of the research to readers.

3.5.2.2 Analysis of the Engineering Introductions

The finding on the surface structure of the engineering Introductions indicates that they follow a structural pattern that shows a series of sections to provide necessary background for the topic of the intended studies. The use of sections in this corpus is functional as the headings guide the readers through different topics necessary as the fundamental of the research. The average word count of this pilot

corpus is 1,358 words, averaging 6.3 pages, pointing out that the engineering Introduction pilot corpus is shorter than the average length of the science and engineering Introductions reported in Bunton (2002) that averaged 9 to 10 pages. The analysis on move-step structure of the engineering Introductions reveals that the engineering Introductions follow the move structure as proposed by Bunton's (2002) framework. They begin the chapter with Move 1: *Establishing a territory* to persuade that the intended research is important, interesting, or relevant in some way. Moreover, only two dissertations end the chapter with Move 3: *Announcing the present research* to introduce the organization of thesis structure. The common moves and steps among the engineering Introductions are Move 1, Steps 2) *Topic generalization/ background*, and 4) *Reviewing previous research*, Move 2, Steps 1A) *Indicating a gap in research*, and 1D) *Continuing a tradition*, and Move 3, Step 1) *Purposes/aims/ or objectives*. This result points out that the two steps in Move 1: *Establishing a territory* correspond to the obligatory steps in the *Establishing a territory* move that should be found from the Introduction chapters across all disciplines (Bunton, 2002). For the *Establishing a niche* move, the writers in this pilot corpus prefer to employ *Indicating a gap in research* to realize this move, which also corresponds to the major finding across all disciplines in Bunton (2002). *Continuing a tradition* step was found only from medicine and social science disciplines reported in the same study, however, this step can also be seen in the engineering pilot corpus of the present research. Finally, the *Objectives* Step in Move 3: *Announcing the present research* is found in all three engineering Introductions, corresponding to Bunton (2002) that it is the step found mostly in the Introduction chapters reported.

3.5.2.3 Analysis of the Engineering Conclusions

The engineering pilot corpus is found at the final part of the texts similar to the Conclusions from the science discipline. The surface structure survey of these texts reveals that all the engineering Conclusions contain sections with functional headings, referring to the types of information that writers have in mind before writing this chapter (Bunton, 2005). The average word count of the chapter is 1,457 words, averaging 5 pages. This result shows nearly the same number of the science and technology concluding chapters of 4.9 pages reported in Bunton (2005). The initial findings of move-step structure in the engineering conclusion show that all texts in the engineering Conclusion texts employ the compulsory moves, i.e. Move 1: *Introductory restatement*, Move 2: *Consolidation of research space*, and Move 4: *Future Research* as proposed in Bunton's (2005) framework. The three Conclusions begin the chapter with Move 1: *Introductory restatement* that focuses on work carried out of the research. Then, this move is followed by Move 2: *Consolidation of research space* that includes summary of method, and findings/results, but two out of the three include *claims*, *products*, as well as *evaluate products of the research.* Moreover, the three texts end the chapter with a distinctive Move 4: *Future research* that focuses on making recommendations for future studies. These results correspond to the claims made by Bunton (2005) that *Introductory restatement*, *Consolidation of research space*, and *Future research* moves are the main moves that occur in at least half of science and technology PhD conclusions in his corpus. Therefore, his framework might be appropriate to be used as a reference model for the engineering and science Conclusion corpus in the main study.

According to the pilot findings reported earlier, the initial results show interesting outcomes from each of the discipline. More findings on the similarities and differences between the two disciplines are reported and discussed next.

3.5.3 Discourse Variations between the Two Disciplines

Another point of focus of this present research is the disciplinary variations between the pure and applied domains of knowledge as explained in Becher & Trowler (2001). Revealing and understanding the similarities and differences between the two disciplines are important in order to provide the appropriate pedagogical implications for each of the disciplines in the present study. The findings will be reported firstly from the comparison of the surface structure of each of the Abstract, Introduction, and Conclusion chapters in the genre set between science and engineering disciplines, and secondly, the move-step structures as well as the interesting issues to take into consideration for the main study.

3.5.3.1 Surface Structure Variations between the Two Disciplines

For the Abstract, it is found to be located as the first part of each of pilot corpus of the two disciplines. However, the average word count of the science Abstract is approximately two times shorter than the engineering Abstract (i.e., 247 and 516 words). This can probably indicate that the science Abstract requires less content from the research than the engineering Abstract. Such difference might due to the disciplinary variations that the two groups of writers belong to, which hold specific standards and practices of method choice, reasoning and argument that have evolved within a research tradition of each of the discipline (Hyland, 2000).

After the Abstract, the Introduction chapter is usually written next to it. The surface structure analysis of the Introductions in the pilot corpus between the two

disciplines show that the science Introduction (14.6 pages) is longer than the average length of the science and engineering Introductions corpus reported in Bunton (2002) i.e., 9-10 pages, while the engineering Introduction (6.3 pages) is shorter. Moreover, there is a variation in the section headings between the two disciplines. While both functional and topical headings are found in the science Introduction chapters, functional heading is the only type found in all texts in the engineering Introductions. One from the science Introduction contains no section, which corresponds to the findings from Bunton (2002) that most of the Introductions without sections were from the Science Faculty, but the majority introductions in his corpus including these from the Engineering Faculty. They used headings to indicate the focuses on introducing the field, its research approaches, purposes of the research, and previous studies in the particular genre.

The final chapter of each of the dissertation in the pilot corpus between the two disciplines is the Conclusion. Although the chapters are called differently, they perform the same functions of summarizing the main results, summarizing the main claims, and recommending the future work of the intended research. For the sections, two science Conclusion chapters contain either sections or no section at all, while all the engineering Conclusion chapters are found to contain sections. This finding is contrary to Bunton (2005) in that more than half of the concluding chapters in his corpus were not divided into sections, especially in science and technology disciplines. This can possibly indicate that having sections in Conclusion chapters of the two disciplines at SUT should be one of the obligatory elements in writing the PhD dissertations. In terms of the length, the science Conclusion averages 2.7 pages, but it is 5 pages in the engineering Conclusion. This result points out that the length of

science Conclusion is shorter than the average length (4.9 pages) of the science and technology conclusions reported in Bunton (2002), while their engineering counterparts correspond closely to the average length reported in his study. This can possibly indicate that the SUT PhD science Conclusions require less content to be summarized than the engineering Conclusions. Details on the move-step structure of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations between the two disciplines are reported and discussed in the next subsection.

3.5.3.2 Move-Step Structure Variations between the Two Disciplines

The initial findings of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations between science and engineering disciplines provide an insight into the disciplinary variations in writing the genre set in PhD dissertations between the two disciplines under this present research. As for the similarities with regard to the Abstract pilot corpus, although only one abstract from the science discipline does not follow the move structure framework, it is possible to make a point that the majority of the science Abstract follows the five-move framework proposed by Hyland (2000). However, there are some points to take into consideration as for the disciplinary variations between the two disciplines. First, all three texts from the engineering and two from the science discipline employ all the five moves in the framework, while one text from the science discipline has only *Purpose*, *Product*, and *Conclusion* moves. The result of the majority texts with the five moves can possibly indicate that the science and engineering writers see importance to establish context of paper, indicate purposes, provide procedures, state main findings to promote their research

(Berkenkotter & Huckin, 1995), and extend results beyond scope of paper into their PhD Abstracts, whereas the exception from the science discipline corresponds to Hyland's (2000) in that there were a high number of two-move abstracts mainly in the science discipline, where the writers presented their purpose and product only in order to highlight a series of results by presenting them as outcomes of different purposes. For the *Conclusion* move, it seems to be an optional extra in all disciplines (Hyland, 2000), however, this move can possibly become one of the obligatory moves of science and engineering PhD abstracts in the present study because all abstracts from the two disciplines employ this move. In terms of move sequences, one Abstract from the science discipline has a different move order where *Method* comes before *Product*. Moreover, two of the three engineering Abstracts have different move sequences, where the *Introduction* move in one Abstract is written at nearly the end of the text, and another one restates the *Method* move after reporting the product of the study, then it ends with *Conclusion* move.

The initial results of the Introduction move-step structure between the two disciplines unveil that the pilot corpus of the two disciplines follow the three-move framework proposed by Bunton (2002). All of them present the evidence of the three moves of *Establishing a Territory*, *Establishing a Niche*, and *Announcing the Present Research*. The result points out that the Introduction pilot corpus in this study corresponds with nearly all the Introductions in Bunton (2002) that had text identifiable as the three moves in Swale's (1990) CARS model. All the Introductions of the two disciplines begin the chapter with *Establishing a Territory*, and end with *Announcing the Present Research*. The only exception is one text from the science discipline that ends the chapter with *Establishing a Territory* move. The common

steps found in both science and engineering Introductions pilot corpus are Steps 2) *Topic generalization/ Background*, and 4) *Reviewing previous research* in Move 1: *Establishing a Territory*, Step 1D) Continuing a Tradition in Move 2: *Establishing a Niche*, while no common step is found in Move 3: *Announcing the Present Research* in these two disciplines. The differences in steps of the Introductions are that the writers in science discipline prefer to exhibit the niche of the study by indicating a problem in or a need from previous study to strengthen their justification of the intended studies, whereas their engineering counterparts establish the niche by indicating a gap in research to show that the previous research is not complete, so the intended study will further investigate the issue. Moreover, all the science texts employ the *Work Carried Out* step in Move 3: *Announcing the Present Research*, which is in contrast to the engineering writers that exhibit this move with the *Purposes, Aims, or Objectives* step. The result can possibly indicate that the *Topic generalization/ Background*, and *Reviewing the Previous Research* steps in Move 1 to introduce the importance of the research, and *Continuing a Tradition* step to indicate why the intended research in Move 2 needs to be conducted are considered as obligatory steps in writing the PhD Introduction of the two disciplines. In addition, Move 2: *Establishing a Niche*, the science PhD students prefer to indicate problems or needs, which differ from their engineering counterparts that all favor indicating a gap in the research within this move. In terms of Move 3: *Announcing the Present Research*, the science students see the importance of the work carried out in order to exhibit this move which corresponds to the findings of the majority of the science discipline reported in Bunton (2002), while the engineering students prefer to announce this research by introducing the purposes/aims/ or objectives of their

research. This difference in the realization of Moves 2 and 3 between the two disciplines implies that PhD Introductions are clearly discipline-dependent (Samraj, 2002).

After the results of all PhD dissertations are reported and discussed, concluding chapters are always written next. The initial findings of the Conclusions move-step structure between science and engineering dissertations show that only one Conclusion from the science discipline follows the framework proposed by Bunton (2005), whereas all the engineering texts follow this framework. It is possible to indicate that the majority of the dissertations in the pilot corpus (4 out of 6) follow the mentioned framework, pointing out the potential of that framework as an appropriate reference for the main study. The similarities of the Conclusion move-step structure between the two disciplines are that all the Conclusions begin with Move 1: *Introductory Restatement* to report again about the work carried out, which points out that the writers prefer to use the *Work carried out* as the starter step in all the science and engineering PhD Conclusions. This result also corresponds with the findings reported in Dudley-Evans' (1986) and Bunton (2005). For both of the two disciplines, the largest part of all the PhD dissertations is taken up by Move 2: *Consolidation of Research Space* to summarize the research methods, and findings/ results, which are the two common steps shared by the two disciplines. However, the differences are that all science Conclusions contain the *Claims* step to propose the claims made from the research, while two but one from the engineering Conclusion use this step. Though the number of text is not very different, this can possibly indicate that the science writers always employ this move not only to summarize the methods and the findings, but also to propose the claims made from the research, while their

engineering counterparts do not always write this move in their conclusions. To end the Conclusions, Move 4: *Future Research* with *Recommendations* is used in all the three engineering texts, while it is found in only one from the science Conclusion. The identification of this move is from the notice of the sections such as '*Suggestion for Further Studies*' from the science Conclusion, and '*Recommendation for Future Work*' from the engineering Conclusion. This finding corresponds with the results in Peacock (2002), Bunton (2005), and Pramoolsook (2008) that the science and technology conclusions often make *Recommendation for Future Research* as a distinctive move. They exhibit this move when the results indicate further avenues for research but the results do not suggest implication for real-world situations, which is different from Move 3: *Practical Applications, Implications or Recommendations*. Although the missing of Move 4: *Future Research* in the other two science Conclusions does not correspond with the previous literature, discourse-based interviews will be crucial for finding the actual reasons in the main study to find out how and why different move-step structure between the two disciplines is employed by the writers, which will yield actual interesting outcomes in the main study.

3.6 Summary

The preliminary findings from the three genres of Abstract, Introduction, and Conclusion chapters in the genre set of English PhD dissertations between science and engineering disciplines yield interesting points to take into consideration. Not only the surface structure, but also move-step structure in the genre set between the two disciplines can be important issues to be studied in the future. Although the writers of these PhD dissertations are from the same local academic discourse community, they

create major and minor differences still in their writing. The differences of surface structure and move-step structure in this pilot study obviously result from the disciplinary variations between the two disciplines. Moreover, reasons for these differences, and the relationship among the Abstract, Introduction, and Conclusion chapters in the genre set between the two disciplines are worth investigating through discourse-based interview in the main study. This can also shed more light as part of the genre analysis methodology. It is to seek out the validation from those involved in the writing process, unconventional practice and problematic areas of writing that arose from the analysis results. In all, the methodology used in this pilot study has yielded satisfactory results which indicate that the three selected frameworks are appropriate as a direction to conduct the analysis in the main study. The present study results are respectively reported in Chapter 4, Chapter 5, Chapter 6, and Chapter 7 to find out 1) the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations in science and engineering disciplines, 2) the relationship among the three genres in the genre set in the two disciplines, and 3) the variations from (1) and (2) between the two disciplines to uncover the disciplinary variations. The three areas of analysis will altogether yield (4) ideas for proposing the pedagogical implications to produce benefits for the SUT PhD students of the two disciplines.

CHAPTER 4

MOVE-STEP STRUCTURES OF ABSTRACT, INTRODUCTION, AND CONCLUSION CHAPTERS

This chapter presents the move-step structures findings from the two corpora of science and engineering disciplines, respectively. The analysis results will start from the Abstract, the Introduction, and the Conclusion chapters in the PhD dissertations from each discipline to answer the Research Question 1. Then the similarities and differences of the move-step structures among these three elements in the genre set between the two disciplines will be reported to answer the Research Question 3 at the end of the chapter.

4.1 Findings on Move-Step Structures from the Science Discipline

4.1.1 Analysis of the Science Abstracts

The information from the surface structure of the science Abstracts reveals that they were written in the two-paragraph format. The average word count is 232 words, pointing out that the science abstracts are slightly longer than a maximum length of 200 words of research article (RA) abstracts reported in Hyland (2000). This can possibly imply that different genres can have different word limit or length for the same sub-genre inside.

For the move structure of the science Abstracts, the researcher adopted the five-move framework proposed by Hyland (2000) based on the rationale given earlier to analyze the corpus. Table 4.1 summarizes the findings from the science Abstracts.

Table 4.1: Move Structure of the Science Abstracts

Move / Text	Introduction	Purpose	Method	Product	Conclusion	Sequence of Moves	Number of Move types
SC 1		✓		✓	✓	P-Pr-P-Pr-C	3
SC 2	✓	✓	✓	✓	✓	I-P-Pr-M-C	5
SC 3	✓	✓	✓	✓	✓	I-P-M-Pr-C	5
SC 4		✓	✓	✓	✓	P-M-Pr-C	4
SC 5		✓	✓	✓		P-M-Pr	3
SC 6		✓	✓	✓		P-M-Pr	3
SC 7		✓	✓	✓		P-M-P-M-Pr	3
SC 8		✓	✓	✓		P-M-Pr	3
SC 9		✓	✓	✓		P-M-Pr	3
SC 10		✓	✓	✓	✓	P-M-Pr-C	4
SC 11			✓	✓	✓	M-Pr-C	3
SC 12			✓	✓		M-Pr	2
SC 13		✓	✓	✓	✓	P-M-Pr-M-Pr-C	4
SC 14				✓		Pr	1
SC 15	✓	✓	✓	✓	✓	I-P-M-Pr-C	5
SC 16		✓		✓	✓	P-Pr-C	3
SC 17		✓		✓	✓	P-Pr-C	3
SC 18		✓	✓	✓		P-M-Pr	3
SC 19		✓	✓	✓		P-M-Pr	3
SC 20	✓	✓				I-P	2
SC 21		✓	✓	✓		P-M-Pr	3
SC 22		✓	✓	✓		P-M-Pr	3
SC 23		✓		✓		P-Pr	2
SC 24		✓	✓	✓	✓	P-M-Pr-C	4
SC 25		✓	✓	✓	✓	P-M-Pr-C	4
Total	**4=16%**	**22=88%**	**19=76%**	**24=96%**	**12=48%**		

**** I = Introduction, P = Purpose, M = Method, Pr = Product, C = Conclusion**

Based on Kanoksilapatham's (2005) criteria on move frequency classification, the *Purpose* (88%), *Method* (76%), and *Product* (96%) moves are conventional, and the *Introduction* (16%) and *Conclusion* (48%) moves are optional. None of these moves are obligatory in the science PhD abstracts.

The results reveal that the majority of the SUT science abstracts were written by using a three-move structure (52%), which appears in 13 out of 25 abstracts. The most frequent move structure in the corpus was written in the sequence of *Purpose*, *Method*, and *Product* (P-M-Pr) moves (9 from 13 abstracts), which are also found to be conventional in this Abstract corpus. The result on the three-move structure of P-M-Pr in SUT science abstract corpus corresponds to the study of science and engineering RA abstracts in Hyland's (2000), which suggested that these three moves were the dominant sequences in his corpus. He also explained that the hard science writers which include physics students can anticipate that readers will be able to access the writers' understandings to determine the value of the research, the productivity of the procedures, the theoretical rationale of the study, and its significance to the incremental development of knowledge. Therefore, the writers usually open the abstract with a *Purpose* move, then *Method* move, and *Product* move, respectively. In addition, the science writers see importance to establish context of paper, indicate purposes, provide procedures, state main findings to promote their research (Berkenkotter & Huckin, 1995), and extend results beyond scope of paper into their PhD Abstracts. However, *Introduction* and *Conclusion* seem to be the optional moves in the SUT science abstracts, as they were found only 16% and 48%, respectively. The result on the *Conclusion* move occurrence is similar to Hyland's (2000) study in that it was called an optional move for the science abstracts in his corpus.

As pointed in Bhatia (1993), the Abstract is meant to give the reader an exact and concise knowledge of the full article. The researcher found in the SUT science corpus that almost all Abstracts (24 out of 25) concentrate on the product of their research, and nearly 90% (22 out of 25) of them focus on the purpose of the research. Again, this issue corresponds to Hyland (2000) in that there was a high number of two-move abstracts mainly in science discipline, where the writers presented their purpose and product only in order to highlight a series of results by presenting them as outcomes of different purposes.

Not only the three-move structure in SUT science abstracts was found, the followings are the other sets of SUT abstract sequences which were found less than 50% occurrence. Therefore, the following moves in other sequences are not prominent characteristics of SUT science abstracts but the findings cannot be left out.

The first set revealed that there are also five abstracts using four-move structure (20%) in the corpus. Four of them were written with *Purpose, Method, Product,* and *Conclusion* sequence (P-M-Pr-C), whereas the last abstract was written with *Introduction, Purpose, Product,* and *Conclusion* sequence (I-P-Pr-C).

Surprisingly, only three science abstracts (12%) follow the five-move framework. Two of them strictly follow the sequence of *Introduction, Purpose, Method, Product,* and *Conclusion* moves (I-P-M-Pr-C). However, only one abstract exhibits a different order in which *Product* comes before *Method*. This can possibly indicate that the five-move framework is not popular among the SUT science PhD students.

Another three abstracts (12%) contain only two moves in the texts. Each of the three exhibits different move sequences. The first one has only *Purpose* and *Product*

moves (P-Pr). The second one has *Method* and *Product* moves (M-Pr) and the last one contains only *Introduction* and *Purpose* moves *(I-P)*.

Last but not the least, the only one abstract of the corpus (4%) was written with only the *Product* move in the text. The finding of these insignificant phenomena mentioned earlier is explained by the former science PhD student (SCI3) as in the following excerpt.

"*…I think the PhD supervisors play a big role in designing the organization of his/her students' abstracts. Because, they know what contents should be placed inside the genre that relate in the study fields. Therefore, having the uncommon abstract patterns is not the students' insufficient knowledge, everything depends on the supervisors' decisions…".* (SCI3)

It is learnt from the interview that this occurrence is not considered uncommon in the SUT PhD science discourse community. This information, moreover, is similar to the suggestion in Bunton's (2002) in that supervisors are more able than their students to see what types of information should be put into the student's thesis. Hence, seeing abstract composed with one move is possible in this discipline, however, the decision depends on the thesis supervisor. In the next section, analysis of the SUT science Introductions will be reported.

4.1.2 Analysis of the Science Introduction Chapters

4.1.2.1 Surface Structure

This section reports the findings on length and sectional headings identified in the corpus of SUT science Introduction chapters. For the report on length of the Introduction, the finding reveals that the average word count of the chapter is 1,677 words. Overall the 25 Introductions average 8.2 pages, indicating that the science Introductions length is quite similar to the average of 9-10 pages in

Bunton (2002). The chapter is named Introduction in all the 25 texts. Twenty of them have section headings while the other five have none. The headings can be categorized mainly into topical (topic-specific) and functional headings (generic). The first indicates a particular topic related to research being reported e.g. "*Classification of chitinases*" (SC24) and "*Classical Risk Model*" (SC7). Since there are many different topical headings in the corpus, the researcher will use "topic-specific" heading to refer to any particular topic found in the science Introduction chapters. The second one indicates the field, the objective(s) of the study, and the announcement of current study related to an Introduction on any topic, for instance, *Background of the Study*, and *Significance of the Study*.

Table 4.2 summarizes the section headings of SUT science Introduction chapters with the number of occurrences indicated in the last column. The headings are sequenced in the table in approximately the order they appear in the chapter from SC1-SC25. The table also shows the number of the sections that each Introduction has with the number given in the last row.

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Table 4.2: Section Headings of the Science Introductions

No.	Section headings	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15	SC 16	SC 17	SC 18	SC 19	SC 20	SC 21	SC 22	SC 23	SC 24	SC 25	Total
1	Rational of the Study /Research rationale		✓														✓										2
2	**Research Objective(s) / Objective**		✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	**17**
3	Scope and Limitation of the Study		✓		✓						✓				✓	✓	✓					✓			✓	✓	9
4	Scope of the study					✓	✓																				2
5	Limitation of the study					✓																					1
6	References		✓			✓										✓						✓					4
7	Introduction to this study /Background /General/General background				✓	✓									✓	✓								✓	✓		6
8	Study Area				✓	✓																					2
9	Characteristic of the Problem/ Significance of the problem				✓		✓																				2
10	Expected Result(s)				✓	✓					✓	✓		✓			✓										6
11	Conceptual Framework / Theoretical Framework					✓																					1
12	Topic-specific			✓(x6)				✓					✓(x3)					✓(x5)	✓(x7)				✓(x2)			✓	7

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Table 4.2: Section Headings of the Science Introductions (Contd.)

No.	Section headings	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15	SC 16	SC 17	SC 18	SC 19	SC 20	SC 21	SC 22	SC 23	SC 24	SC 25	Total
13	Research Hypothesis										✓																1
14	Significance of the study/ Benefits of the study										✓					✓								✓	✓	✓	5
15	Overview of…./ Literature review of…..											✓		✓					✓			✓		✓			5
16	Synopsis/Structure of the thesis/Organization/Outline of this thesis							✓					✓											✓	✓	✓	5
17	Research questions																✓										1
18	Definition of key terms																✓										1
Total		0	4	7	6	8	3	2	0	0	5	3	5	3	3	5	6	6	9	0	0	4	2	4	5	5	

**The bold section headings are those that occurred 50% or more in the SUT PhD science Introduction corpus.*

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Section headings are of interest because they tell us how the writer sees the structure of his/her text. However, 5 of the 25 Introductions are not divided into sections, therefore, they have no section headings. It is surprising that they are not the shortest Introductions of the corpus. The longest Introduction with no section headings is 13 pages with 2,676 words (SC1), while the other four Introductions in this group are 4-6 pages. Almost all of the section headings in the other 20 Introductions (19 of 20) are both "generic" and topic-specific headings. However, there is an Introduction that has only topic-specific headings, and the minimum number of the section headings in these 20 Introductions is two.

Although the headings in these science Introductions include all suggested parts of the Introduction chapter (e.g. *Introduction to this study, Rationale of the study, Research Objective, Scope of this study, Scope and limitation of the study, Research Hypothesis, and Research questions*), only one heading (*Research Objective(s)*) has a high frequency (more than 65%), and it is more prominent than research questions or hypotheses (Bunton, 2002), while the other headings' frequencies are lower than 50%. One interesting point is that the *topic-specific* heading has a higher frequency (28%) than the *Background* (24%) and the *Significance of the study* (20%). This also corresponds to Bunton's (2002) study that the topic-specific headings are usually found rather than the generic ones in science PhD Introductions. The finding is confirmed through the similar explanations of all interviewees (SCI1-4) as following,

"*……actually the topic-specific headings inside the science Introduction chapters are the background under each particular study areas. The writers might possibly write for the people from their related fields. Sometimes, when we write deeply into the research, readers in the same fields are primarily focused*"….(SCI-4)

The researcher has learnt from the interviews with all the four informants from the science discipline that despite various generic headings to choose as an outline for the Introduction writing, SUT science PhD students prefer to use the topic-specific headings to the generic ones in order to show general background of their research. As a result, the generic sections in the Introductions suggested by Dudley-Evan (1986), Swales (1990), or Bunton (2002) might not be necessary for the SUT PhD science writers.

In addition, the heading most frequently found even though less than 50% occurrence is *Synopsis/Structure of the thesis/Organization/Outline of this thesis*, and it is nearly always at the end of the SUT science Introductions, indicating that these sections are usually found at the end of the chapter.

The generic section headings in these science Introductions indicate the field, the niche their study would occupy, and the announcement of their current study, which reflects the three-move structure of Swales' CARS models (1990; 2004). The section headings also present many aspects of the current research (Bunton, 2002). The five most frequently found headings in the science discipline are *Research Objective(s)/Objective*, *Scope and Limitation of the Study*, *Topic-Specific*, *Background*, *Expected Results*, *Significance of the Study*, *Literature Review of the Study*, and *Structure of the Thesis*. As a result, the overall focus of these generic section headings is on announcing the present study in Move 3 (16 out of 18 sections, excluding *Background* and *Rationale of the study*). Move-Step structures of the science PhD Introductions are described next.

4.1.2.2 Moves of the Science Introduction Chapters

Table 4.3 shows the moves and steps found in the SUT science PhD Introductions. Each check (✓) indicates one occurrence of a certain step in each Introduction, and the last column shows the total number of Introductions in which a particular step was found.

Table 4.3: Move-Step Structure of the Science Introductions

Moves & Steps	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15	SC 16	SC 17	SC 18	SC 19	SC 20	SC 21	SC 22	SC 23	SC 24	SC 25	Total	Freq. (%)
Move 1: Establishing a territory																										**25**	**100**
Step 1: Claiming centrality	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓			19	76
Step 2: Topic generalizations/ Background	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25	100
Step 3: Defining terms **												✓														1	4
Step 4: Reviewing previous research	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	17	68
Move 2: Establishing a niche																										**21**	**84**
Step 1A: Indicating a gap in research		✓		✓	✓			✓	✓			✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	15	60
Step 1B: Indicating a problem or need	✓	✓								✓		✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	15	60
Step 1C: Question-raising												✓					✓	✓				✓				4	16
Step 1D: Continuing a tradition	✓	✓		✓						✓				✓	✓						✓	✓	✓	✓	✓	11	44
Counter-claiming			✓																							1	4
Move 3: Announcing the present research																										**25**	**100**
Step 1: Purposes, aims, or objectives		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	20	80
Step 2: Work carried out	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	21	84
Step 3: Method	✓	✓		✓					✓										✓	✓		✓	✓			8	32
Step 4: Materials or subjects	✓									✓							✓									3	12
Step 5: Findings or result				✓	✓					✓	✓		✓			✓							✓			7	28
Step 6: Product or research/ Model proposed						✓			✓			✓							✓				✓			5	20
Step 7: Significance/ justification					✓						✓	✓	✓	✓	✓			✓	✓				✓	✓		10	40
Step 8: Thesis structure							✓	✓	✓			✓								✓			✓	✓	✓	8	32
Research questions/ hypotheses										✓																1	4
Defining terms **															✓	✓										2	8
Figure explanation * **																	✓	✓					✓	✓	✓	5	20

**The newly identified steps occasionally present in Bunton (2002) are in italics. Ones with double asterisk (**) are found in either M1 or M3. The last final step with (***) is the newly identified one in the SUT science Introduction chapters. However, it is not considered as a new step because it was not found more than 50% of the corpus (Nwogu, 1997).*

Table 4.3: Move-Step Structure of the Science Introductions

Moves & Steps	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15	SC 16	SC 17
Move 1: Establishing a territory																	
Step 1: Claiming centrality	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	
Step 2: Topic generalizations/Background	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Step 3: Defining terms **												✓					
Step 4: Reviewing previous research	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓		✓
Move 2: Establishing a niche																	
Step 1A: Indicating a gap in research		✓		✓	✓			✓	✓			✓	✓	✓	✓	✓	✓
Step 1B: Indicating a problem or need	✓	✓								✓		✓	✓	✓	✓		✓
Step 1C: Question-raising												✓					✓
Step 1D: Continuing a tradition	✓	✓		✓						✓				✓	✓		
Counter-claiming			✓														
Move 3: Announcing the present research																	
Step 1: Purposes, aims, or objectives		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	
Step 2: Work carried out	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓
Step 3: Method	✓	✓		✓					✓								
Step 4: Materials or subjects	✓									✓							✓
Step 5: Findings or result				✓	✓					✓	✓		✓			✓	
Step 6: Product or research /Model proposed						✓			✓			✓					
Step 7: Significance / justification					✓						✓	✓	✓	✓	✓		
Step 8: Thesis structure							✓	✓	✓			✓					
Research questions/hypotheses										✓							
Defining terms **															✓	✓	
Figure explanation * **																	✓

**The newly identified steps occasionally present in Bunton (2002) are in italics. Ones with double asterisk (**) are found in either M1 or M3. The last final step with (***) is the newly identified one in the SUT science Introduction chapters. However, it is not considered as a new step because it was not found more than 50% of the corpus (Nwogu, 1997).*

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Nearly all science Introductions (84%) have all the three moves as suggested in Bunton's (2002) framework: *Establishing a Territory* (T), *Establishing a Niche* (N), and *Announcing the Present Research* (A). This can explain that these SUT science PhD writers have commonality in writing dissertation with the group of PhD students in the University of Hong Kong reported in Bunton (2002). However, only four of them (16%) have no evidence of *Establishing a Niche*.

Twenty three Introductions (92%) begin the chapter with Move 1: *Establishing a Territory* (T), whereas two of them begin with Move 2: *Establishing a Niche (*N*)* to indicate a problem or a claim that there has been little research in the field. In both cases, the opening *N* move is followed by a move to establish the territory (T). The beginning T move in the Introductions is employed to show that the intended research area is important, central, interesting, problematic, or relevant in some way, and to introduce and review items of previous research in the area. For example:

> **M1S1** "*The flow of fluids and forced convection across a heated bluff body has been the subject of considerable research interest because of its relevance in many engineering applications.*." (SC8)

Moreover, the moves are cyclical in nearly half of the Introductions corpus (12 of 25). Only six of them have a single progression of (T-N-A). The other four Introductions contain only two moves with a single progression of (T-A), and three of them are neither written in a single progression nor cyclical. There are two, three, four, or many more cycles of moves in the corpus, the highest number being 9, and the average being 3.3.

The practice of move cycles in this present corpus corresponds to the findings in Bunton (2002), and Crookes (1986). The most frequently used cycle in the

SUT science Introductions is not T-N-A, but T-N. This usually occurs as writers are reviewing previous research and pointing out gaps or problems or raising questions as they review the literature, however, the writers do not announce their own study until later. This emphasizes the study of PhD Introduction chapters in Bunton (2002) that the most frequently used cycle in his corpus was also T-N.

When the SUT science writers come to the end of the chapter, twenty four of them (96%) close the chapter with Move 3: *Announcing the present research* (A) to outline purposes of or the work carried out in the research. This conformity to the model in writing PhD Introduction is likely to reflect the similarity of science PhD students in a Thai university and the PhD students from the science discipline at the University of Hong Kong reported in Bunton (2002). The only exception is one Introduction, which ends with reviewing previous research (a T move). For example:

> **M1S4** "*Burgi, Dunitz, and Shefter (1974) established the short O=C•••O contacts in crystals with structure correlation, they established the importance of dipolar interactions between...*" (SC1)

The finding that the only one science Introduction closes the chapter with the first move (*T*) is answered by the science PhD supervisor (SCI4) as shown in the following excerpt,

> "*….In my opinion, this is not a norm in writing the SUT science PhD Introduction. The author should be blamed or maybe this is partly because his/her supervisor's writing style. However, actual finding from this student must give a better answer. I personally always tell my students to create good pieces of Introduction and Conclusion chapters*"*….*(SCI4)

From this interview data, it can be seen that the writer of this Introduction was not fully aware of the conventions in composing the PhD Introduction because

closing the chapter with reviewing previous research is not a conventional pattern of the Introduction in the field. This uncommon phenomenon might be partly because the supervisor of this dissertation trusts his/her supervisee, and the revised Introduction might not be checked carefully. According to this, explicit instructions should be provided to the science PhD students with the aim of familiarizing them with the appropriate conventions of the PhD Introduction structures.

The first Move in these Introductions contains the largest space of the chapter (23 of 25), while the second and the third Moves have the biggest part in each of the other two Introductions. The way to introduce the field of study and the background information related to the topic in the first Move in these Introduction chapters is similar to the three-move progression described by Dudley-Evans (1986) due to the fact that the writers of the Introductions seemed to lead their readers from the general to specific topics in a narrative style. The length of Move 1 (T) in 23 of these Introductions is at least half of the whole chapter. This result corresponds to what Bhatia (1993) mentioned in his study that the possible reason for the Introductions in the students theses to be generally long is due to the well-established convention of including reviewing previous studies.

Finally, Move 1: *Establishing a Territory* (T), and Move 3: *Announcing the Present Research* (A) are the obligatory Moves, and Move 2: *Establishing a Niche* (N) is considered as a conventional Move in the SUT science PhD Introductions, based on the criteria on move frequency classification of Kanoksilapatham (2005).

4.1.2.3 Steps of the Science Introduction Chapters

The 25 SUT science PhD Introductions reveal a variety of the sixteen often-present steps described in Bunton's (2002) model (Table 4.3 above), and also a much greater variety of steps than the research articles and Masters dissertation

Introductions. The most highly used step appearing in all the Introductions (100%) is Step 2*: Topic generalizations/ Background* of Move 1: *Establishing a Territory* (T). This step is the obligatory step in the corpus of the SUT science PhD Introductions as well, while Step 1 : *Claiming centrality* (76%) and Step 4: *Reviewing previous research* (68%) from the same Move (T) are those highly frequently used steps, and they can be called the conventional steps in the corpus. The occurrence of both obligatory and conventional steps in this present study is slightly different from Bunton (2002) that the *Topic generalization*/*Background* step was found 83%, the *Claming centrality* step was 100%, and the *Reviewing previous research* was found 75% in his science corpus. Moreover, the similarity of the finding from the same study is Step 3: *Defining terms* of the T Move, which has the least frequency (1 occurrence) in the science discipline.

Another similar finding to Bunton (2002) found in the present study is the frequent use of the steps *Indicating a gap in research* (60%) and *Indicating a problem or need* (60%) for Move 2: *Establishing a niche*. This can indicate that these two steps are most preferred by the SUT science writers and they can be identified as the conventional steps in the current corpus. Moreover, the last two steps *Question-raising* (16%) and *Continuing a tradition* (44%) are considered as the optional steps for the SUT PhD science Introductions.

Move 3: *Announcing the present research* (A) is found at the end of the Introduction chapters. This move presents many more aspects of the research, since the PhD dissertation is a much longer document and PhD research extends over a considerable period of time (Bunton, 2002; Swales, 2004). Therefore, some variations in the steps of this move used in the science Introductions are found. Firstly, *Work carried out* (84%) and *Purposes, aims,* or *objectives* (80%) are the most highly used steps in the

corpus. In this study, the occurrence of the *Work carried out* step is much greater than what reported in Bunton's (2002) study. This can possibly indicate that the SUT science writers see the importance of providing a brief account of methodology of the study to the readers in the Introduction chapter before the same account is fully elaborated again in the Methodology chapter.

Secondly, the frequency of Step 8: *Thesis structure* used in this corpus (32%) is almost two times lower than Bunton's (2002) finding (68%). The mentioned step was found 9 out of 12 from the science Introductions in his corpus but it is found only 8 out of 25 in the current study. This can point out that the practice on providing details of the chapter structure inside SUT science PhD Introductions is not crucial compared to the University of Hong Kong's PhD science students. This finding is explained through the answer from the former science PhD student (SCI2) as in the following excerpt,

"……*I think this writer might want to ease the readers by not writing too much information inside the Introduction chapter. Moreover, there's table of contents showing the structure of the dissertation, so that indicating the thesis chapter again may not be necessarily needed for the science PhD writers*…." (SCI 2)

Although the part of providing an organizational structure plays an important role for the thesis (Bunton, 1999) and it is considered obligatory in Swales and Feaks' (1994) study, it is learnt by this explanation that the preview of the overall structure of the SUT science PhD Introductions is not highly expected. This information suggests that rules and regulations of PhD Introduction writing based on some international educational organizations might not always be necessary for writers in the same field but from different universities.

In the next section, the analysis of the last chapter in the science genre set is described.

4.1.3 Analysis of the Science Conclusion Chapters

4.1.3.1 Surface Structure

This section reports the findings on names of the chapter, length, and section headings identified in the SUT science concluding chapters.

For the names of the chapter, they are important because they give some indication of the role that the author sees a chapter or section is playing (Bunton, 2005). The names of concluding chapters of the SUT science PhD corpus are not considerably varied. Eighteen (72%) are called either "Conclusion" or "Conclusions". Two (8%) are called "Conclusion and Recommendation", and the other two (8%) are called "Conclusion and Future Perspective". Each (4%) of the last three dissertations is "Conclusions and Discussion", "Conclusion, Discussion, and Recommendation", and "Conclusion and Future work", respectively. Moreover, these varied names indicate that the communicative purposes of this particular chapter are to summarize dissertation findings, discuss the analysis results, give implications of findings, make recommendations, and suggest areas of future research (Bunton, 2005). They are all set out in Table 4.4 below.

Table 4.4: Names of the Concluding Chapters in 25 SUT Science Dissertations

Names of the chapter	Total
Conclusion / Conclusions	8/10 (18)
Conclusion and Recommendation	2
Conclusion and Future Perspective	2
Conclusions and Discussion	1
Conclusion, Discussion, and Recommendation	1
Conclusion and Future Work	1

The lengths of the 25 SUT science PhD Conclusions range from 2 to 11 pages, averaging 4.16 pages. In addition, the average word count of this particular chapter is 915.8 words. These results point out that the average page of this Conclusion corpus is approximately the same number as found in the science and technology corpus (4.9 pages) of Bunton's (2005) study.

Section headings are of interest because they show what the writer is hoping to accomplish in different parts of the chapter, the moves the writer has in mind. Table 4.5 below summarizes the section headings of SUT science Conclusion chapters. The headings are grouped according to their shared communicative purposes and they are sequenced in the table in approximately the order they appeared in the chapter.

Table 4.5: Section Headings in 25 SUT Science Conclusions

Section Heading	Total	Section Heading	Total
Conclusion (s)	6	Suggestions for further study(ies)	2
Thesis summary	1	Recommendation	3
On the results of the study	1	Recommendation for further studies	1
		Future research and suggestion	1
Discussions	1	Future work	1
Conclusion and Discussion	1		
Topical Headings	2		

More than half of the science Conclusion chapters (15 of 25) are not divided into sections. This result corresponds to Bunton (2005) that this case was found especially in the Science and Technology disciplines. The other 10 that are sectioned have between two and three sections, averaging 0.8 sections. This result is also drawn from the former science PhD writer (SCI1) according to the following excerpt,

"*…. I think that the reason why the science writers don't have sections in the last chapter is partly because he/she wants to offer a flat reading for the readers. And sometimes, it is hard to separate sections in this chapter as all the study results are related to each other. Therefore, having sections in the chapter might give confusion to the readers*" (SCI1)

It is clear that the majority of section headings are generic ones, which are used to indicate the functions of the sections. However, only one Conclusion (SC12) has two topical headings and a functional heading. The topical ones are headed as "*Taxonomic identification of fossil pollen*" and "*Ecological Interpretation from pollen assemblages*", respectively. Inside these headings are the summary of the findings under the mentioned topics, then followed by the functional heading, titled "*Suggestion for future research*". The "Conclusion(s)" is the most used heading in the science concluding chapters, whose functions are to summarize the main findings of the reported study and make an overall summary of the whole study which is usually seen as the first part of the chapter. Moreover, the headings "*Recommendation*", "*Suggestion for further study(ies)*", "*Recommendation for further studies*", "*Future research and suggestion*", and "*Future work*" are found to refer to future research/work/study as suggested by Dudley-Evans (1994; 1996) and Weissberg and Buker (1990), and these are found at the end of the chapter. The results also correspond to Bunton's (2005) that science and technology writers seemed to have two main moves in mind: one presenting conclusions about the present study and the other concerning future work.

4.1.3.2 Moves of the Science Conclusion Chapters

Although 15 of 25 concluding chapters are not divided into sections, nearly all of the SUT science Conclusions (88%) begin the chapter with Move 1: *Introductory Restatement* to offer again an account of the work carried out of the current

studies. However, only three of them (12%) begin the chapter with Move 2: *Consolidation of research space* by focusing on the results of the study at the very first. The beginning with the work carried out in concluding chapters corresponds to Bunton's (2005) study that the science and technology (ST) Conclusions in his examined corpus tended to restate the work carried out to emphasize the overall issue being researched. This move is easy to be identified as it appears at the beginning. For example:

M1S1 "*This research describes structural studies of Vibrio chitinase A and its hydrolytic function in order to understand the mode of action of the enzyme…*" (SC3)

M1S1 "*Throughout this study, mushroom surveys were conducted during the rainy season August-October, 2002 and June-August, 2003 from a variety of natural habitats, natural forests, and local markets in the Northeasten, Central, and Western Thailand*." (SC11)

More than half of the science Conclusions (18 of 25) have only two Moves in the chapter. Sixteen of these are composed with a set of Move 1: *Introductory restatement*, and Move 2: *Consolidation of research space.* The other two of them are written with Move 2, then Move 4: *Future Research* (separated section). This result also resembles Bunton's (2005) that the ST thesis writers were found to have two main moves in mind: one presenting conclusions about the present study and the other concerning future work. However, in this case, the two main moves of the SUT science PhD Conclusions are *Introductory restatement* and *Consolidation of research space.* Surprisingly, only one conclusion in the corpus is composed by using one move in the chapter (Move 2), which focuses only on the findings and their evaluation.

In terms of move frequency, Move 2: *Consolidation of research space* is identified as an obligatory move (100%) in this SUT science Conclusion chapter because all of the twenty five conclusions contain the move. The first move (*Introductory Restatement*) is conventional (88%) and the fourth move (*Future Research*) is optional

(32%). Identifying the *Consolidation of Research Space* as an obligatory move is similar to what Bunton (2005) found that this move occurred in all 36 Conclusions in his study. In addition, this move occupies the largest space in the present study corpus if compared to the other moves in each of the texts. The largest space of this move points out that this move is probably the most important for Conclusion chapter (Swales & Feak, 1994). This practice is confirmed in the interviews with all the representatives (SCI1-4) from the science disciplines as can be seen in the excerpt below.

"*...In the Conclusion chapter, the study result is the most important part because it is where the overall summary of everything about the long-term research written. Moreover, we expected that the readers reading our dissertations already have some information from the Introduction chapter. Therefore, focusing on the results and the necessary parts seems to be the most crucial function*"… (SCI1-4)

In terms of move cycles, the result of this study reveals all of these SUT science Conclusions (100%) have a linear structure appearing in a single progression of either *Introductory restatement > Consolidation of research space > Future research*, or *Consolidation of research > Future research*. This finding is slightly different from Bunton's (2005) study in that the straightforward structure of *Introductory restatement > Consolidation of research space > Practical application >Future research*, which was found in 30 of 36 Conclusions (83%). Table 4.6 below summarizes the findings on move-step structure of the Conclusion chapters.

Table 4.6: Move-Step Structure of the Science Conclusions

Moves & Steps	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15	SC 16	SC 17	SC 18	SC 19	SC 20	SC 21	SC 22	SC 23	SC 24	SC 25	Total	Freq. (%)
Move 1: Introductory restatement																										**22**	**88**
Work carried out	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	22	88
Territory																											
Centrality																											
Gap/niche																				✓						1	
Move 2: Consolidate of research space																										**25**	**100**
Method	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	19	76
Finding / Results	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	24	96
Claims	✓	✓		✓							✓								✓							5	20
Reference to previous research						✓					✓															2	8
Products																											
Evaluation of method/product				✓	✓	✓				✓	✓		✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	15	60
Explanation													✓					✓							✓	3	12
Uncertainty																		✓								1	4
Significance		✓									✓		✓													3	12
Limitations				✓	✓	✓							✓							✓						5	20
Recommendations for future research				✓			✓	✓		✓	✓		✓				✓	✓	✓	✓	✓					11	44
Practical applications or implications													✓														
Move 3: Practical applications and recommendations																											
Move 4:Future Research																										**8**	**32**
Recommendations	✓				✓	✓				✓		✓		✓		✓							✓			8	32
Previous research																											
Limitations																											

***Note: the steps occasionally present in Bunton (2005) are in italics.**

Table 4.6: Move-Step Structure of the Science Conclusions

Moves & Steps	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15	SC 16	SC 17
Move 1: Introductory restatement																	
Work carried out	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓
Territory																	
Centrality																	
Gap/niche																	
Move 2: Consolidate of research space																	
Method	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓						✓
Finding / Results	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Claims	✓	✓		✓							✓						
Reference to previous research						✓					✓						
Products																	
Evaluation of method/product				✓	✓	✓				✓	✓		✓		✓		✓
Explanation													✓				
Uncertainty																	
Significance		✓									✓		✓				
Limitations				✓	✓	✓							✓				
Recommendations for future research				✓			✓	✓		✓	✓		✓				✓
Practical applications or implications													✓				
Move 3: Practical applications and recommendations																	
Move 4:Future Research																	
Recommendations	✓				✓	✓				✓		✓		✓		✓	
Previous research																	
Limitations																	

Note: the steps occasionally present in Bunton (2005) are in italics.

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4.1.3.3 Steps of the Science Conclusion Chapters

The 25 SUT science PhD Conclusions show a variety of the seven often-present steps described in Bunton's (2005) framework. This can also possibly be a much greater variety of steps than in the RAs and Master dissertation Conclusions. Frequency analysis of steps reveals that *Finding/Result* in Move 2, *Work carried out* in Move 1, *Method*, *Evaluation of method/product*, and *Recommendations for future research* in Move 2 are the five most frequent steps. The first four steps have more than 50% frequency (conventional) while the last one has 44 % (optional). However, none of these steps are obligatory for the SUT science PhD conclusions.

Similar to Bunton's (2005) study, the science Conclusions reveal 88% on the *Work carried out* step in Move 1: *Introductory Restatement* of the corpus. This step appears at the beginning of the SUT science concluding chapter as well. When the science students start writing the chapter with the *Work carried out* step, then *Summarizing of methods*, *Results*, and *Evaluation of method/ product* steps are followed. Surprisingly, the finding on *Evaluation of method/product* identified as the conventional step in this corpus is in contrary to Bunton (2005) in that it was identified as a present one (≤25%). This can possibly indicate that the SUT science PhD students usually evaluate the study methods or products in their Conclusions rather than the University of Hong Kong ST students. For example:

M2S6 "*The fatty acid analysis by the MIDI system can be useful supplement and reference method, but cannot be recommended at this time for routine identification……*" (SC 13)

M2S6 "*Nevertheless, it was observed that this fourth water molecule is not strongly shared in a local tetrahedral network of water, e.g., it weakly bound in the lone pair direction of the …*" (SC 22)

Moreover, this finding is expressed through one of the science informants according to the following excerpt,

"*...It is necessary for the science PhD writers to evaluate his/her methods or products of the study because it is to confirm that his/her results are significantly reliable comparing to the carefully reading of the related previous studies…*" (SCI3)

It is learnt from the interview that the Conclusion chapter is a final part of the science PhD dissertation. It is where students both summarize and wrap up their work (Paltridge & Starfield, 2007). Although the adopted Conclusion framework of Bunton (2005) covers PhD conclusion writing in science and technology disciplines, the result of SUT PhD science conclusions indicate that there is more than one way in which the Conclusions can be written. The students not only summarize their research but also evaluate the study methods and products in the chapter as well.

Finally, the *Recommendations for future research* step in Move 2: *Consolidation of research space* is identified as an optional step in this corpus (44%). The frequency of this step is higher than the *Recommendations* step (32%) in Move 4: *Future Research* (distinctive Move), and this step usually appears before Move 4 (if any). It also appears as a step embedded in the *Consolidation of research space* Move, which corresponds to Bunton's (2005) study. This result can possibly suggest that having the recommendation step in Move 4 as a distinctive section is not necessary for the SUT science PhD conclusions. Hence, the students have only two moves in mind in writing the chapter (M1 & M2) and this rhetorical structure does not follow Bunton's (2005) model according to the concluding chapter steps analysis.

4.2 Findings on Move-Step Structures from the Engineering Discipline

4.2.1 Analysis of the Engineering Abstracts

The information from the surface structure of the engineering Abstracts shows that they were written in the three-paragraph format. The average word count is 447 words, pointing out that the engineering abstracts are approximately two times longer than a maximum length of 200 words of research article (RA) abstracts reported in Hyland (2000). This can possibly imply that writing requirement of the engineering abstracts needs more contents to be added in the texts than that in the science discipline (232 words). Moreover, the result can possibly indicate as the similar finding from the science discipline that different genres can have different word limit or length for the same sub-genre inside.

For the move structure of the engineering Abstracts, the researcher also adopted the five-move framework proposed by Hyland (2000) based on the rationale given earlier to analyze the corpus. Table 4.7 summarizes the findings from the engineering Abstracts.

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Table 4.7: Move Structure of the Engineering Abstracts

Move / Text	Introduction	Purpose	Method	Product	Conclusion	Sequence of Moves	Number of Moves Types
EN 1	✓	✓	✓	✓	✓	P-Pr-C-Pr-M-I-Pr-C	5
EN 2	✓	✓	✓	✓	✓	I-P-M-Pr-M-Pr-M-C	5
EN 3	✓	✓	✓	✓	✓	I-P-M-Pr-C	5
EN 4		✓	✓	✓	✓	P-M-Pr-(P-Pr) x3-(P-M-Pr) x2-C	4
EN 5	✓	✓	✓	✓		I-P-M-Pr-M-Pr	4
EN 6		✓	✓	✓		P-M-Pr	3
EN 7		✓	✓	✓	✓	M-P-Pr-C	4
EN 8		✓	✓	✓	✓	P-M-Pr-P-M-C	4
EN 9		✓	✓	✓	✓	P-M-Pr-C	4
EN 10		✓	✓	✓		P-M-Pr	3
EN 11	✓	✓	✓	✓	✓	I-M-P-Pr-C-P	5
EN 12	✓	✓	✓			I-P-M	3
EN 13		✓	✓	✓		P-M-Pr	3
EN 14	✓	✓	✓	✓		I-P-M-Pr	4
EN 15		✓	✓	✓	✓	P-M-Pr-M-Pr-C	4
EN 16		✓	✓	✓		P-M-Pr	3
EN 17		✓	✓	✓		P-M-Pr-M-Pr	3
EN 18		✓	✓	✓		P-M-Pr	3
EN 19	✓	✓	✓	✓	✓	I-P-M-Pr-C	5
EN 20	✓	✓	✓	✓		I-P-M-P-M-Pr	4
EN 21		✓	✓	✓		P-M-Pr	3
EN 22		✓	✓	✓		(P-M-Pr) x 4	3
EN 23		✓	✓	✓	✓	P-M-Pr-C	4
EN 24	✓	✓	✓	✓	✓	P-I-M-Pr-M-Pr-C	5
EN 25	✓	✓	✓	✓		I-P-M-Pr	4
Total	**11=44%**	**25=100%**	**25=100%**	**24=96%**	**12=48%**		

**** I = Introduction, P = Purpose, M = Method, Pr = Product, C = Conclusion**

Based on Kanoksilapatham's (2005) criteria on move frequency classification, the *Purpose* and *Method* moves are obligatory (100% each), the *Product* move is conventional (96%) , and the *Introduction* and *Conclusion* moves are the optional in the SUT engineering PhD abstracts, which were found only 44% and 48%, respectively.

The results reveal that the majority of the SUT engineering abstracts were written by using a four-move structure (40%), which appears in 10 out of 25 abstracts. The most frequent move structure in the corpus was written in the sequence of *Purpose*, *Method*, *Product*, and *Conclusion* (P-M-Pr-C) moves (5 from 10 abstracts), which are also found to be obligatory, conventional, and optional in this Abstract corpus, accounting for 100%, 100%, 96%, and 48%, respectively. The *Introduction* move (44%), however, was found less than the *Conclusion* and failed to be present in this four-move structure category. Therefore, the I move was not mentioned in this engineering corpus. The result on the four-move structure of P-M-Pr-C in SUT engineering abstract corpus does not follow Hyland's (2000) framework but it corresponds to the study of medical RAs in Salager-Meyer (1992) and Bhatia (1993), which suggest that this four-move structure is one of the well structured of RA abstracts. However, this is the case of PhD abstracts and the finding is described through the answers from both the former SUT engineering PhD student and the engineering supervisor shown in the following excerpt,

"*….Due to the limitation of word counts in our engineering abstracts, which approximately is 2 pages limitation, and we normally have to begin writing the abstract by simplifying the overall studies with purposes of the research. Therefore, having the Introduction even only 2-3 lines inside the abstracts takes up space of the abstract page…*" (ENI1 & ENI4)

According to these informants, even though the length of writing the engineering Abstract is limited, this is an important piece of text. The PhD supervisors and students have to know exactly what is contained in the body of the text. In many engineering research studies, writing the general background of the study to begin the Abstract might not always be necessary. This result can possibly point out that the Abstract writing guideline for the engineering students should follow the four-move structure of P-M-Pr-C.

Moreover, most abstracts in the corpus begin with the *Purposes* move. This emphasizes the result of Berkenkotter & Huckin's (1995) study in that the writers usually open the abstract with this move. They see an importance to establish context of paper, indicate purposes, then provide procedures, state main findings to promote their research, and indicate implications and applications of the present findings (Bhatia, 1993). Although the mentioned target groups in Berkenkotter & Huckin's (1995) study were the science writers, the engineering writers can possibly open the abstract by beginning with *Purpose* move as well.

According to Bhatia (1993), the indication of the purposes of the research in the abstract is necessary and quite logical because the abstract not only always precedes the introduction but can also occur on its own, outside the research article. The RA Introduction, on the other hand, only introduces the article without giving out everything reported in the text. He also noted that the RA abstract is meant to tell all the important aspects of the very much lengthier research report, whereas the RA Introduction is meant to 'motivate' the present research and to 'justify' its publication (Swales, 1990). As a result, there is no *Introduction* move indicated in Bhatia's (1993) abstract framework.

While the characteristics of this engineering abstract corpus resemble the description of the five-move framework in Hyland (2000), only 6 abstracts (24%) contain all the five moves. Therefore, despite the suggestions of some researchers (e.g., Salager-Meyer, 1990; Bhatia, 1993), these engineering writers obviously presented their work in ways that do not conform to a universal 'ideal' of information structuring (Hyland, 2000). Hence, the finding on the four-move structure of P-M-Pr-C as a majority pattern in the SUT PhD engineering abstracts is acceptable. In the next section, analysis of the SUT engineering Introductions will be reported.

4.2.2 Analysis of the Engineering Introduction Chapters

4.2.2.1 Surface Structure

This section shows the findings on length and section headings identified in the corpus of SUT engineering Introduction chapters.

For the report on length of the Introduction, the finding reveals that the average word count of the chapter is 1,511 words. Overall the 25 Introductions average 8.0 pages, indicating that the engineering Introductions length is quite similar to the average of 9-10 pages in Bunton (2002). The chapter is named Introduction in all the 25 texts. All of them have section headings. The headings can be categorized mainly into topical (topic-specific) and functional headings (generic). The first one indicates a particular topic related to the research being reported, e.g., "*Natural fibers and natural fibers-composites*" (EN 4) and "*Sugar Manufacturing and Dextran Contamination*" (EN 16). Since there are many topical headings varying in the corpus, the researcher uses "topic-specific" heading to refer to any particular topic found in the engineering Introduction chapters. The second one indicates the field, the niche, the problem, and the announcement of the writers' current study related to an

Introduction on any topic, e.g., "*Aims of the study*" (EN 2), "*Thesis organization*" (EN 13), and "*Expected results*" (EN 24).

Table 4.8 summarizes the section headings of SUT PhD engineering Introduction chapters with the number of occurrences indicated in the last column. The headings are sequenced in the table in approximately the order they appear in the chapter from EN1-EN25. The table also shows the number of the sections that each Introduction has with the number given in the last row.

Table 4.8: Section Headings of the Engineering Introductions

No.	Section headings	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17	EN 18	EN 19	EN 20	EN 21	EN 22	EN 23	EN 24	EN 25	Total
1	Background/ Introduction	✓	✓			✓				✓		✓	✓		✓												7
2	**Objectives/Aims of study/Research objective / Objective of the study**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	**23**
3	Scope of work/Scope of research/Scope of study/Scope of the study /Area of study	✓				✓	✓	✓	✓	✓	✓							✓								✓	9
4	Output / Expected results / Expected results from the study / Outcome of the research/ Expectation	✓				✓					✓						✓	✓	✓	✓	✓		✓	✓	✓		11
5	Structure of presentation/Thesis organization / Organization of thesis /Thesis contents		✓	✓								✓	✓	✓									✓		✓		7
6	Definition of ……		✓																								1
7	References		✓												✓	✓	✓	✓	✓		✓	✓	✓				9
8	**Problem and rationale / Statement of problem /Significance of problem / rationale of the study /Background problem /Rationale and background**			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓		✓		**16**
9	**Scope and limitation**			✓	✓	✓						✓	✓		✓	✓			✓	✓		✓		✓	✓	✓	**13**
10	Benefit of the study / Expected benefits			✓								✓	✓	✓													4

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Table 4.8: Section Headings of the Engineering Introductions (Cont.)

No.	Section headings	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17	EN 18	EN 19	EN 20	EN 21	EN 22	EN 23	EN 24	EN 25	Total
11	Topic specific				✓(x2)		✓										✓				✓					✓(x 3)	5
12	Research Hypothesis/Hypothesis of…/Research assumption					✓					✓		✓														3
13	Research Motivation												✓														1
14	Methodology /Research Methodology /Research Method												✓												✓	✓	3
15	Study motivation and Research Objective																✓				✓						2
16	Research Development																✓	✓	✓		✓						4
Total		4	5	5	4	6	4	3	3	4	5	5	9	4	5	4	6	6	6	4	5	4	5	3	6	7	

The bold section headings are those that occurred 50% or more in the engineering Introduction corpus.

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Table 4.8: Section Headings of the Engineering Introductions

No.	Section headings	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17
1	Background/ Introduction	✓	✓			✓				✓		✓	✓		✓			
2	**Objectives/Aims of study/Research objective / Objective of the study**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
3	Scope of work/Scope of research/Scope of study/Scope of the study /Area of study	✓				✓	✓	✓	✓	✓	✓							✓
4	Output / Expected results / Expected results from the study / Outcome of the research/ Expectation	✓				✓					✓						✓	✓
5	Structure of presentation/Thesis organization / Organization of thesis /Thesis contents		✓	✓								✓	✓	✓				
6	Definition of ……		✓															
7	References		✓												✓	✓	✓	✓
8	**Problem and rationale / Statement of problem /Significance of problem / rationale of the study /Background problem /Rationale and background**			✓			✓	✓	✓	✓	✓		✓	✓	✓	✓		✓
9	**Scope and limitation**			✓	✓	✓						✓	✓		✓	✓		
10	Benefit of the study / Expected benefits			✓								✓	✓	✓				
11	Topic specific				✓(x2)		✓										✓	
12	Research Hypothesis/Hypothesis of…/Research assumption					✓					✓		✓					
13	Research Motivation												✓					
14	Methodology /Research Methodology /Research Method												✓					
15	Study motivation and Research Objective																✓	
16	Research Development																✓	✓
Total		4	5	5	4	6	4	3	3	4	5	5	9	4	5	4	6	6

***The bold section headings are those that occurred** 50% or more in the engineering Introduction corpus.*

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Studying about section headings is interesting because the sections tell us how the writer sees the structure of his/her text. All the engineering Introductions are divided into sections, and both generic and topic-specific headings are also found in the corpus. The majority of the Introductions (20 out of 25) use generic headings, and the other five Introductions employ generic and topic-specific headings. The longest Introduction is 15 pages with 2,418 words (EN25) containing two types of the section headings. The maximum (EN 12) and minimum (EN 7, 8, 23) numbers of the section headings in the corpus are 9 and 3, respectively. Moreover, the variations of these section headings in structuring the texts of the engineering discipline resembles Bunton's (2002) finding in PhD dissertation Introductions that section headings present many aspects of the current research. In the Introduction, the headings are generic when they are employed in order to help writers present and organize content in the chapter. Their variations reveal how writers view the structure of the Introduction.

Although the headings in these engineering Introductions include all suggested parts by Bunton (2005) of the Introduction chapter (e.g., *Introduction to this study, Rationale of the study, Research Objective, Scope of this study, Scope and limitation of the study, Research Hypothesis, and Research questions*), three headings (*Research Objectives, Statement of problems, and Scope and limitation*) have a high frequency (more than 50%). The overall focus of these generic section headings is on announcing the present research (12 out of 16 sections; except *Background/Introduction, Rationale of the study, Research Motivation,* and *Research development*). However, this is not to say that the engineering writers do not indicate territories or niches in the Introduction chapters. More findings on the move-step analysis are explained in the next section.

4.2.2.2 Moves of the Engineering Introduction Chapters

Table 4.9 shows the moves and steps found in the SUT engineering Introductions. Each check (✓) indicates one occurrence of a certain step in each Introduction, and the last column shows the total number of Introductions in which a particular step was found. Two final steps with (***) are the newly identified ones in the SUT engineering Introductions. However, they are not considered as the new steps because they were not found more than 50% of the corpus according to the criteria set by Nwogu (1997).

Table 4.9: Move-Step Structure of the Engineering Introductions

Moves & Steps	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17	EN 18	EN 19	EN 20	EN 21	EN 22	EN 23	EN 24	EN 25	Total	Freq. (%)
Move 1: Establishing a territory																										**25**	**100**
Step 1: Claiming centrality	✓				✓	✓	✓			✓	✓		✓	✓		✓	✓	✓		✓	✓	✓	✓			15	60
Step 2: Topic generalizations/Background	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25	100
Step 3: Defining terms**																										0	0
Step 4: Reviewing previous research	✓	✓	✓	✓		✓	✓	✓	✓		✓			✓	✓		✓		✓		✓	✓	✓	✓	✓	18	72
Research parameter																											
Move 2: Establishing a niche																										**25**	**100**
Step 1A: Indicating a gap in research	✓			✓	✓		✓							✓		✓	✓	✓	✓	✓		✓	✓		✓	13	52
Step 1B: Indicating a problem or need	✓	✓			✓	✓	✓	✓		✓		✓	✓	✓	✓	✓		✓				✓		✓		15	60
Step 1C: Question-raising									✓					✓					✓							3	12
Step 1D: Continuing a tradition	✓	✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		18	72
Counter-claiming	✓	✓	✓			✓			✓	✓	✓	✓			✓				✓	✓		✓				12	48
Move 3: Announcing the present research																										**25**	**100**
Step 1: Purposes, aims, or objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	25	100
Step 2: Work carried out	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	23	92
Step 3: Method			✓					✓	✓	✓		✓			✓	✓					✓	✓		✓	✓	11	44
Step 4: Materials or subjects								✓	✓						✓	✓	✓				✓					6	24
Step 5: Findings or result					✓		✓			✓					✓	✓	✓		✓	✓			✓	✓		10	40
Step 6: Product or research /Model proposed	✓						✓																			2	8
Step 7: Significance / justification	✓		✓				✓					✓	✓					✓	✓							7	28
Step 8: Thesis structure		✓	✓								✓	✓	✓				✓	✓				✓		✓		9	36
Chapter structure												✓	✓			✓				✓						4	16
Research questions/hypotheses					✓					✓		✓														3	12
*Defining terms **		✓																								1	4
Research motivation* **												✓				✓				✓						3	12
Research development * **																✓	✓	✓		✓						4	16

**The newly identified steps occasionally present in Bunton (2002) are in italics. Ones with double asterisk (**) are found in either M1 or M3. The last two final steps with (***) are the newly identified one in the SUT science Introduction chapters. However, it is not considered as a new step because it was not found more than 50% of the corpus (Nwogu, 1997)*

Table 4.9: Move-Step Structure of the Engineering Introductions

Moves & Steps	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17
Move 1: Establishing a territory																	
Step 1: Claiming centrality	✓				✓	✓	✓			✓	✓		✓	✓		✓	✓
Step 2: Topic generalizations/Background	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Step 3: Defining terms**																	
Step 4: Reviewing previous research	✓	✓	✓	✓		✓	✓	✓	✓		✓			✓	✓		✓
Research parameter																	
Move 2: Establishing a niche																	
Step 1A: Indicating a gap in research	✓			✓	✓		✓							✓		✓	✓
Step 1B: Indicating a problem or need	✓	✓			✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	
Step 1C: Question-raising									✓					✓			
Step 1D: Continuing a tradition	✓	✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓
Counter-claiming	✓	✓	✓			✓			✓	✓	✓	✓			✓		
Move 3: Announcing the present research																	
Step 1: Purposes, aims, or objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Step 2: Work carried out	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Step 3: Method			✓					✓	✓	✓		✓			✓	✓	
Step 4: Materials or subjects								✓	✓						✓	✓	✓
Step 5: Findings or result					✓		✓			✓					✓	✓	✓
Step 6: Product or research /Model proposed	✓						✓										
Step 7: Significance / justification	✓		✓				✓					✓	✓				
Step 8: Thesis structure		✓	✓								✓	✓	✓				✓
Chapter structure												✓	✓			✓	
Research questions/hypotheses					✓					✓		✓					
Defining terms **		✓															
Research motivation* **												✓				✓	
Research development * **																✓	✓

**The newly identified steps occasionally present in Bunton (2002) are in italics. Ones with double asterisk (**) are found in either M1 or M3. The last two final steps with (***) are the newly identified one in the SUT science Introduction chapters. However, it is not considered as a new step because it was not found more than 50% of the corpus (Nwogu, 1997).*

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All engineering Introductions (100%) have all the three moves as suggested in Bunton's (2002) framework: *Establishing a Territory* (T), *Establishing a Niche* (N), and *Announcing the Present Research* (A). This can be explained that these SUT PhD engineering writers have commonality in writing dissertation with the group of PhD students in the University of Hong Kong reported in Bunton (2002).

Nearly all of them (96%) begin the chapter with Move 1: *Establishing a Territory* (T). However, only one Introduction (EN 22) begins the chapter with Move 2: *Establishing a Niche* (N). For instance:

M2S1B "*The production from fossil is damaging environment and stress the limitation that relies upon nonrenewable energy sources……..The need for an environmentally friendly and cost effective electricity generating scheme is thus clearly indicated and will become more pronounced in the future*"..... (EN 22)

To find out the reason why one Introduction in this corpus is written with the N move, this result is expressed by the excerpt below from an engineering supervisor, which can shed light on this.

"*….This must be the author's style in order to raise an interesting feature of his/her work making it to look better than other Introductions in the same field…*" (ENI4)

From this informant, it is learnt that although the Introduction is where the writer makes claims for the centrality or significance of the research and begins to outline the overall argument of the thesis (Swales & Feak, 1994) which makes *Establishing a Territory* be the most crucial element in the chapter, sometimes, opening the Introduction with *Establishing a Niche* to attract the readers by pointing the gaps from previous related studies is possible.

The beginning *T* move in the Introductions is employed to show that the intended research area is important, central, interesting, problematic, or relevant in some way, and to introduce and review items of previous research in the area. For example:

M1S1 "The use of synthetic antioxidants in food industry is severely restricted to both application and level. Hence there is a wide interest to natural antioxidant extracted from plants… (EN 5)

M1S2 "*Surfactant is short form of surface active agent, which indicates a chemical species which is active at a surface. Surfactants can be found in many detergency products and various other applications*". (EN 14)

Moreover, the Introduction moves are cyclical in more than half of the corpus (17 of 25). Only six of them have a single progression of (*T-N-A*), and two of them are neither written in a single progression nor cyclical, e.g., (*T-A-T-N-A*), and (*T-N-T-A*). There are two, three, or more cycles of moves in the corpus, the highest number being 6, and the average being 3.05.

The practice of move cycles in this present corpus corresponds to the findings in Crookes (1986) and Bunton (2002). The most frequently used cycle in the SUT engineering Introductions is not T-N-A, but T-N. This usually occurs as writers are reviewing previous research and pointing out gaps or problems or raising questions as they review the literature, nonetheless, the writers do not announce their own research until later. In addition, this also conforms with the study of PhD Introduction chapters in Bunton (2002) and Chiu (2012) that the most frequently used cycle in their corpus was also T-N.

When the SUT engineering writers come to the end of the chapter, all of them (100%) end the chapter with Move 3: *Announcing the present research* (A) to outline purposes of or the work carried out in the research. This conformity to the model in writing PhD theses is also likely to reflect the similarity of engineering PhD students

in a Thai university and the PhD students from the science discipline at the University of Hong Kong reported in Bunton (2002).

The appearance of the three moves in this present study also emphasizes what Paltridge & Starfield (2007) mentioned about the Introduction that its key role is to create a research space for the writer. It is in the Introduction that the writer makes claims for the centrality or significance of the research in question and begins to outline the overall argument of the thesis. Moreover, the organizational structure of the Introduction can be said to move from a fairly general overview of the research terrain to the particular issues under investigation through three key moves which capture the communicative purposes of the Introduction (Swales & Feak, 1994): to establish a research territory; to identify a niche or gap in the territory; and then to signal how the topic in question occupies that niche.

The first move (T) in these Introductions contains the largest space of the chapter (13 of 25). However, the third move (A) is the biggest part in the other 12 Introductions. This can possibly indicate that the SUT PhD engineering writers realize the important of establishing both Move 1 and Move 3 in the chapter. The way to introduce the field of the study and the background information related to the topic in the first move is similar to the three-move progression described by Dudley-Evan (1986) due to the fact that the writers of the Introductions seemed to lead their readers from the general to specific topics in a narrative style. The length of Move 1 in the thirteen Introductions is at least half of the whole chapter. This result also resembles what Bhatia (1993) has suggested in his study that the possible reason for the Introductions in the students theses to be generally long is due to the well-established convention of including reviewing previous studies.

In addition, the authors of these Introductions seem to lead their readers from the general to specific topics in a narrative style which made the first move in the Introductions the longest (Dudley-Evans, 1986). Moreover, the length of Move 3 in the 12 Introductions is also found at least fifty per cent of the whole chapter. This move is where "*Statement of purpose*, *Research questions/Hypotheses*, *Significance of the study*, and *Overview of thesis chapters* are expected to be presented. However, the texts in this move are not written with a narrative style compared to the first and the second moves. They tend to be more distinctive and are found separately with the section heading titled "*Research Objectives*, *Scope and Limitation*, *Thesis organization*, and *Expected results*.

Finally, all the three moves are the obligatory Moves as they are found 100% in the SUT PhD engineering Introductions, based on the criteria on move frequency classification set by Kanoksilapatham (2005).

4.2.2.3 Steps of the Engineering Introduction Chapters

All of the SUT PhD engineering Introductions show a variety of the sixteen often-present steps reported in Bunton's (2002) model (Table 4.9 above), and also reveal a much greater variety of steps than the research articles and Masters dissertation Introductions.

In Move 1: *Establishing a Territory* (T), the most highly used step is Step 2: *Topic generalizations/ Background* (100%) and this step is the obligatory step in the SUT PhD engineering corpus. Meanwhile, Step 1: *Claiming centrality* (60%), and Step 4: *Reviewing previous research* (72%) tend to be the conventional steps in the corpus, and no writers use the *Definition of terms* step in this first move. The occurrence of both obligatory and conventional steps in the present study is slightly different from Bunton's (2002) in that the *Topic generalizations/ Background* step was found 80%, while the

Claiming centrality and *Reviewing previous research* steps were found 90% each in his engineering corpus. The results can possibly indicate that all the SUT PhD engineering students have to write down the general information under their research topics in the dissertation, and this step could possibly be worth finding at one of the dissertation guidelines provided by the university. Nonetheless, this step might not always be necessary for the engineering students elsewhere. This finding is confirmed by the informants' answers that all of them as the former PhD engineering students realize the importance of beginning their PhD Introductions with *Topic generalizations/ Background* step according to the following excerpt,

"…*This part is very crucial for writing the Introduction chapter because we firstly need to tell the readers about the typical background under our research topics, then we can move on the writing to the other parts of the chapter*.." (ENI1-4)

According to this information, it is obvious to my understanding that *Topic generalizations / Background* step in the first move from the previous models both in RA and the PhD Introductions suggested by Swales (1990), Swales & Feak (1994), and Bunton (2002) is considered important as it has maintained its outstanding status since then. As a result, explicit instruction for writing the engineering PhD Introduction chapter should be extremely focused for teaching the students.

In Move 2: *Establishing a Niche* (N), the highly frequently used steps are Step 1D: *Continuing a tradition (72%)*, and Step 1B: *Indicating a problem or need* (60%). These two steps are considered as the conventional ones, while Step 1A: *Indicating a gap in research* (52%), and Step 1C: *Question-raising* (12%) are the optional steps in the corpus. The finding on the occurrence of the *Continuing a tradition* step reveals a significant difference from the result reported in Bunton (2002) that this

step was found only 10% in his corpus. It can point out that the SUT PhD engineering writers prefer to claim a niche for their research by showing that there are aspects of the research field still needing further investigation. Although Step1B: *Indicating a gap* is the most salient part to identify Move 2: *Establishing a niche*, a possible alternative would be to identify the move by using Step1D: *Continuing a tradition* (Swales, 1990). For example:

M2S1D "*…….Therefore, search for some low cost but reasonable efficiency treatment methods for heavy metal removal from waste water is needed more than ever before*". (EN 6)

M2S1D "*...A full-scale solar chimney is a capital-intensive undertaking, hence before building one, a good understanding of plant operation is required*". (EN 22)

There are many more aspects of the research in the last move (Move 3), *Announcing the present research* (A). The role of this move is to turn the niche established in Move 2 into the research space that justifies the present article. The link between Move 2 and Move 3 is a strong one. The ensuing Move 3 variously offers to substantiate the particular counter-claim that has been made, fill the created gap, answer the specific question or continue the rhetorically established tradition (Swales, 1990). Hence, there are some variations in the steps of this move used in the SUT PhD engineering Introductions reported. Firstly, *Purposes, aims, or objectives* (100%) is the most highly used step, which was found in all the Introductions. The step is considered an obligatory step in the corpus, which resembles the occurrence of the same step (90%) reported in Bunton (2002). Also, the purpose statement is an obligatory element in Move 3: *Occupying the niche* in Swales' (1990) study. This finding is, therefore, can indicate that stating the research purposes is what SUT PhD engineering students have to write in the Introduction chapter.

Secondly, the frequency of Step 2: *Work carried out* (92%) is almost two times higher than Bunton's (2002) finding (50%), and it is considered as a conventional step in the present study. The result can point out that the SUT engineering writers realize the importance of giving a brief account of methodology in the Introduction chapter to their readers before the same account is fully described again in the Methodology chapter.

Finally, other steps in Move 3 are considered optional steps, as they were found less than 60%, for instance, *Method*, *Findings or result*, and *Thesis structure* steps. However, seven Introductions showed different statements to establish the last move which was neither indicated in the model of Bunton (2002) nor in the guidelines of the SUT university. Three of them (12%) have a section headed *Research motivation*, and the other four Introductions (16%) have a section headed *Research development* in the chapter. Nonetheless, these two steps are not identified as the new steps because they were found less than 50%, and this is also considered as an exception in the SUT engineering corpus. The result can point out that the students who are studying under the same discipline but studying in the different university can have variations in composing the PhD Introductions.

4.2.3 Analysis of the Engineering Conclusion Chapter

4.2.3.1 Surface Structure

This section reports the findings on names of the chapter, length, and section headings identified in the SUT engineering concluding chapters.

Titles of the Conclusion chapter are crucial because they give some idea of the role that the author sees a chapter or section is playing (Bunton, 2005). The names of the concluding chapters of the SUT engineering PhD corpus are not considered varied.

Seventeen (68%) are called “Conclusion and Recommendation”, four of them (16%) are called either “Conclusion” or “Conclusions”, and the other two (8%) are “Conclusion and Future Studies”. The last two concluding chapters are called “Conclusion and Future Work”, and “Conclusions and Recommendation for Future Studies”, respectively. Summarizing dissertation findings, discussing the analysis results, giving implications of findings, making recommendations, and suggesting areas of future research are the names to point out their communicative purposes in this chapter. They are all set out in Table 4.10 below.

Table 4.10: Names of the Concluding Chapters in 25 SUT Engineering Dissertations

Names of the chapters	Total
Conclusion and Recommendation	17
Conclusion / Conclusions	2/2 (4)
Conclusion and Future Studies	2
Conclusion and Future Work	1
Conclusions and Recommendation for Future Studies	1

The lengths of the 25 SUT engineering PhD Conclusions range from 2-17 pages, averaging 5.32 pages. Moreover, the average word count of this particular chapter is 1,276 words. These results point out that the average of this corpus is slightly different from the number as found in the science and technology corpus (4.9 pages) of Bunton’s (2005) study.

It is interesting to study about section headings because they indicate what the writer is hoping to perform in different parts of the chapter, the moves the writer has in mind. Table 4.11 below summarizes the section headings of SUT engineering Conclusion chapters. The headings in this table are grouped according to their shared

communicative purposes and they are sequenced in the table in approximately the order they appear in the chapter.

Table 4.11: Section Headings in 25 SUT Engineering Conclusions

Section Heading	**Total**	**Section Heading**	**Total**
Conclusion(s) Summary and Conclusions Thesis Concluding Remarks	18 1 1	Topic-specific headings	4
Recommendations	15		
Recommendations for Future Work	1		
Future Studies	1		
Future Work	1		
Recommendations for Future Studies	1		

The survey on the SUT engineering Conclusion chapters shows that 4 of 25 conclusions are not divided into sections. The 21 of them have between two and four sections with the average of 2.19 sections. This is approximately the same number as found in the science and technology corpus (2.5 sections) of Bunton's (2005) study.

The majority of section headings in this corpus are generic ones indicating the function of the section, but topic-specific headings are also found as well in 2 out of 25 dissertations with four headings altogether. The topical ones are headed as "*Outlooks of Gasification and Pyrolysis and a Note on Potential Biomasses in Thailand*" and "*Effect of Melting temperature: Bi-containing borate glasses*", respectively. The "Conclusion(s)" is the most used heading in the engineering concluding chapter, whose functions are to summarize the main findings of the reported study and make an overall summary of the whole study which is usually seen as the first part of the chapter. In addition, the headings "*Recommendation*", "*Recommendation for Future Work*", "*Future*

Studies", "*Future Work*", and "*Recommendations for Future Studies*" are found to refer to future research/work/study as suggested by Dudley-Evans (1994, 1996) and Weissberg and Buker (1990), and these are located at the end of the chapter. The findings also resemble Bunton's (2005) study that the science and technology writers in his corpus appeared to have two main moves in mind, the first one presents conclusions about the current study and the last one concerns about future work.

4.2.3.2 Moves of the Engineering Conclusion Chapters

Nineteen SUT engineering Conclusions (76%) begin the chapter with Move 1: *Introductory Restatement* to offer again an account of the work carried out of the current studies. However, the other six (24%) of them start the chapter with Move 2: *Consolidation of research space* by focusing on the results of the study at the very first part of the chapter. Beginning the chapter with the work carried out in the concluding chapters is similar to what Bunton (2005) suggested in his study that the science and technology (ST) Conclusions in his examined corpus seemed to restate the work carried out by accentuating the overall issue being researched. This includes purpose, research questions or hypothesis of their study. The example excerpts are as following,

M1S1 "*This study investigated both of fungal and bacterial downflow hanging sponge systems as a post treatment of UASB effluent of a tapioca starch wastewater by experimental study and mathematical modeling for evaluated the on biofilm composition and density dynamics*" (EN 9)

M1S1 "*This work involved a systematic study of activated carbons from eucalyptus wood and a new precursor, wattle wood….The two hypotheses that that, the oxidized carbons derived from activated carbons prepared by using different activation methods (i.e. chemical and physical activation) and activated carbons with varying porous structure should affect the amount and distribution of functional groups on the carbon surface was proposed and tested*"….(EN 17)

For the move structures in the Conclusion chapters, more than half of the engineering Conclusions (16 of 25) have all the obligatory three moves as described in Bunton's (2005) model for Science and Technology thesis-oriented PhD Conclusions. The three moves are Move 1: *Introductory restatement*, Move 2: *Consolidation of research space*, and Move 4: *Future research*. However, Move 3: *Practical applications and recommendations* is found as a step embedded in the second move and appears earlier than the fourth move, which cannot be identified separately as section or move of the chapter.

The three-move structure is considered as a conventional pattern in the engineering Conclusions as this structure was found 64% in the corpus. The other seven concluding chapters are composed with two moves, three of these are established with Move 1 and Move 2 while four of them have Move 2 and Move 4 in the chapter. The last two conclusions are composed with only Move 2.

The finding on the majority moves of the SUT PhD engineering Conclusion chapters is contrary to the study of Bunton's (2005) in that having only two main moves written in the concluding chapter is preferred by the ST thesis writers in his corpus: one presenting conclusions about the present study and the other concerning about the future work. However, the SUT PhD engineering students seemed to have three moves in mind: the first one, restating the Introduction of the study, the second one, presenting conclusions about the study, and the last one, presenting about the future work.

In terms of move frequency, Move 2: *Consolidation of research space* is identified as an obligatory move (100%) in this SUT PhD engineering Conclusion chapter because all of the twenty five conclusions contain this move. The first (*Introductory Restatement*) and the fourth moves (*Future Research*) are conventional with the frequency of 76% and 80%, respectively. Identifying the *Consolidation of*

Research Space as an obligatory move is similar to what Bunton (2005) mentioned in his study that this move occurred in all 36 Conclusions. Moreover, this move also occupies the largest space in the present study corpus. This largest size of this move indicates that the move is probably the most crucial for the SUT engineering conclusions. The space of this move points out that this move is probably the most important for Conclusion chapter (Swales & Feak, 1994).

In terms of move cycles, the finding of this study shows that all of these SUT PhD engineering Conclusions (100%) have a linear structure appearing in a single progression of either *Introductory restatement > Consolidation of research space > Future research,* or *Introductory restatement > Consolidation of research space*, and *Consolidation of research space > Future research*. This finding is revealed by an informant shown in the following excerpt,

"…..*I think that the pattern of* ***Introductory restatement > Consolidation of research space > Future research*** is *appropriate to follow when I have to write summary about my research study. Because this structure is easy to collect everything about my study orderly, and the structure is also based from the Institute of Engineering's dissertation format. So I think that this sequence is ok…..*" (ENI3)

From the above answer from one of the PhD engineering students, it is learnt that the linear structure in the Conclusion chapter is very important for the writers to follow. Moreover, providing this structure as a basic guideline to the engineering students can be set as instructions for the writers in the discipline.

However, the result is slightly different from Bunton's (2005) study which found the straightforward structure of *Introductory restatement > Consolidation of research space > Practical application > Future research* , which was found in 30 of 36 (83%). Table 4.12 below summarizes the findings from move-step structure of the SUT PhD engineering Conclusion chapters.

Table 4.12: Move-Step Structure of the Engineering Conclusions

Moves & Steps	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17	EN 18	EN 19	EN 20	EN 21	EN 22	EN 23	EN 24	EN 25	Total	Freq. (%)
Move 1: Introductory restatement		✓	✓		✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		**19**	**76**
Work carried out		✓	✓		✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		19	76
Territory														✓		✓				✓						3	12
Centrality																✓										1	4
Gap/niche																✓			✓							2	8
Move 2: Consolidate of research space	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	**25**	**100**
Method		✓	✓		✓	✓		✓					✓			✓	✓	✓				✓	✓	✓		12	48
Finding / Results	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	24	96
Claims																	✓						✓			2	8
Reference to previous research		✓																								1	4
Products	✓	✓	✓			✓		✓							✓	✓	✓	✓	✓	✓			✓	✓		13	52
Evaluation of method/product		✓	✓		✓	✓		✓				✓			✓	✓	✓	✓	✓	✓				✓		13	52
Explanation	✓		✓																✓			✓				4	16
Uncertainty																											
Significance																											
Limitations																											
Recommendations for future research					✓																				✓	2	8
Practical applications or implications			✓			✓									✓	✓			✓			✓			✓	7	28
Move 3: Practical applications and recommendations																											
Move 4:Future Research	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		**20**	**80**
Recommendations	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		20	80
Previous research																											
Limitations																											

***Note: the steps occasionally present in Bunton (2005) are in italics.**

Table 4.12: Move-Step Structure of the Engineering Conclusions

Moves & Steps	EN 1	EN 2	EN 3	EN 4	EN 5	EN 6	EN 7	EN 8	EN 9	EN 10	EN 11	EN 12	EN 13	EN 14	EN 15	EN 16	EN 17
Move 1: Introductory restatement		✓	✓		✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
Work carried out		✓	✓		✓		✓		✓		✓	✓	✓	✓	✓	✓	✓
Territory														✓		✓	
Centrality																✓	
Gap/niche																✓	
Move 2: Consolidate of research space	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Method		✓	✓		✓	✓		✓					✓			✓	✓
Finding / Results	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Claims																	✓
Reference to previous research		✓															
Products	✓	✓	✓			✓		✓							✓	✓	✓
Evaluation of method/product		✓	✓		✓	✓		✓				✓			✓	✓	✓
Explanation	✓		✓														
Uncertainty																	
Significance																	
Limitations																	
Recommendations for future research					✓												
Practical applications or implications			✓			✓									✓	✓	
Move 3: Practical applications and recommendations																	
Move 4:Future Research	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recommendations	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Previous research																	
Limitations																	

*****Note: the steps occasionally present in Bunton (2005) are in italics.***

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4.2.3.3 Steps of the Engineering Conclusion Chapters

There is a variety of the seven often-present steps as described in Bunton's (2005) framework in the 25 SUT engineering PhD Conclusions. In other words, this can be a much greater type of steps than in the RAs and Master dissertation Conclusions. Frequency analysis of steps unveils that *Finding/Result* (96%) in Move 2: *Consolidation of research space*, *Recommendations* (80%) in Move 4: *Future research*, *Work carried out* (76%) in Move 1: *Introductory restatement*, *Products* (52%), and *Evaluation of method/product* (52%) in Move 2 are the five most frequent steps. Moreover, these five steps have more than 50% frequency (conventional). However, none of these steps are obligatory for the SUT PhD engineering conclusions.

In the first move, the engineering students tend to restate the *Work carried out* by making the statement about the overall issue being researched. This step is easy to identify because it is at the opening of the chapter. The result is slightly different from Bunton's (2005) study in that the step occurred in his corpus 94% (34 of 36 thesis-oriented Conclusions), while the step occurred 76% in this present study. After the *Work carried out* step is mentioned in the first part of the chapter, the engineering writers then usually summarize thesis findings, discuss about the products and evaluate the products of their research, and finally make recommendations, as well as suggest areas of future research at the very end of the chapter. The result on *Products* and *Evaluation of method/product* (52%) identified as the conventional steps in this corpus is in contrary to Bunton (2005) in that they occurred only 16.4% and 14.4% in his corpus. This can possibly indicate that the SUT engineering students tend to mention about the methods or products and evaluate them in the chapter. For example:

M2S6 "*In order to achieve the research goal, it is necessary to have an accurate method to determine dextran content in a sample. A new technique of dextran determination was developed using the application of C NMR. It was seen that it can be used for quantitative dextran analysis but the detection limit of the NMR method is about 0.2% dextran content in the initial solution sample, which is not suitable to use in further study concerns dextran reduction samples containing very low dextran content, in the level of ppm*"…..(EN 16)

M2S6 "*For both activation methods, eucalyptus woods gave better pore development than wattle wood under the same preparation conditions. For both woods, chemical activation with H3PO4 gave activated carbons with higher surface area and total pore volume than that obtained by physical activation with CO2*." (EN 17)

M2S6 "*A mathematical model has been constructed by using measured kinetics for the mutarotation reaction of glucose, crystallization kinetics of a-glucose monohydrate.The model shows reasonable predicted results*."(EN 20)

This above finding is also explained by the engineering supervisor according to the following excerpt,

"…..*To evaluate the methods or products in our study, we usually assess our work in each related chapter. In the Conclusion, however, the students should evaluate his/her work again whether the results reasonably follow the chosen theories or not, as well as making discussion inside the chapter. In order to do this, the writers have to write the communicative purposes in the statements of evaluations concisely*….." (ENI4)

After the explanation of the above issue is revealed, I have learnt that although the framework from Bunton (2005) covers inclusively the PhD conclusion chapter written by both science and technology students in his corpus and can be used as a guideline for move-step structure analysis of the same chapter in the SUT engineering PhD corpus, there can be a variety of step used in order to summarize or wrap up the research. This can possibly indicate that studying in the same discipline but different universities has variations in composing the PhD concluding chapter.

The *Recommendations* step in Move 4: *Future research* is also identified as a conventional step in the corpus (80%). In addition, this step is almost found in a separate section apart from the *Conclusions*, *Summary and Conclusions*, or *Thesis concluding remarks* headings. Interestingly, the frequency of *Recommendation* step is also similar to what Bunton's (2005) reported on the finding of the same step that appeared in science and technology corpus (80%). This result can possibly suggest that having the *Recommendation* step in Move 4: *Future research* as a distinctive section is important and necessary for the SUT PhD engineering conclusions. Therefore, the students have three moves in mind to write their research studies in the chapter (Move 1, Move 2, and Move 4), and this three-move structure corresponds to Bunton's (2005) framework (obligatory ones) according to the steps analysis of the concluding chapters.

In the next section, the variations of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set between the science and engineering PhD dissertations will be reported.

4.3 Findings on the Similarities and Differences of the Move-Step Structures of Abstract, Introduction, and Conclusion Chapters between the Two Disciplines

This section presents the variations of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set between science and engineering PhD dissertations. The presentation will start from the results on surface structure, and end with the move-step structure among the genre set of these two disciplines.

4.3.1 Surface Structure Variations between the Two Disciplines

For the Abstract, it is found to be located as the first part of each corpus of the two disciplines. However, the average word count of the science Abstract is approximately two times shorter than the engineering Abstract (i.e., 232 and 447 words). This can probably indicate that the SUT PhD science students require less content to write in their abstracts than the PhD engineering students. Such difference might be due to the different nature of the disciplines that the two groups of writers belong to, which hold specific standards and practices of method choice, reasoning and argument that have evolved with a research tradition of each of the disciplines (Hyland, 2000). Moreover, the result can point out that different genres can have variations on word limit or length for the same sub-genre inside.

For the Introduction chapter, it is found to be located next to the Abstract by the students from the two disciplines. The surface structure analysis of the Introductions from the two corpora shows that the average word count and page number inside SUT PhD science Introductions (1,677 words / 8.2 pages) is slightly longer than that of the engineering Introductions (1,511 words / 8.0 pages). However, the results from the two disciplines show that their Introductions are slightly shorter than the average length of the science and engineering corpora reported in Bunton (2002) i.e. 9-10 pages. This can imply that SUT science and engineering PhD Introductions have quite a similar standard length to the same genre from the PhD science and engineering corpus in the University of Hong Kong, composed and employed in a different discourse community.

For the section headings in the Introduction chapters, all Introduction chapters from the two disciplines use both generic and topic-specific headings. However,

twenty of the science Introductions have section headings (both generic, and topic-specific) while the other five have none. In contrast, all the engineering Introductions have section headings. Twenty of them use only generic headings, and the other five contain both generic and topic-specific ones. This is similar to what Bunton (2002) reported that most of the Introductions without section headings were from the Science Faculty. The headings in these two disciplines include all suggested parts in Bunton (2002) of the Introduction chapter (e.g., *Introduction to This Study, Rationale of The Study, Research Objective(s), Scope of This Study, Scope and Limitation of The Study, Research Hypothesis*, and *Research Questions*). Only *Research Objective(s)* heading in the science discipline has a high frequency (≥ 65%), while the other headings are found less than 50% (e.g., *Scope and Limitation of The Study, Introduction to This Study, Expected Results*). Inside the SUT PhD engineering corpus, there are three headings (*Research Objective(s), Statement of Problems*, and *Scope and Limitation*) that reach the high frequency (≥ 50%), while the other sections are found to have less frequency than this (e.g., *Expected Results, Scope of The Study, Thesis Organization*). The overall focus of these generic headings from the two disciplines is on *Announcing the Present Research* in Bunton (2002) which is most frequently found at the end of the Introductions. However, one of the prominent section headings from the engineering discipline that resembles Swales's (1990) niche move or Dudley-Evans's (1986) *Preparing for Present Research* move is *Statement of Problems* in the Introductions, which is frequently found early in the Introductions. This is not to say that the writers from the two disciplines do not indicate niches in the chapter. They mentioned niches somewhere, only they are not notably shown in the texts. The focus of these generic section headings from SUT PhD science and

engineering Introductions shows a similarity to Bunton's (2002) findings in PhD dissertation Introductions, where section headings present many aspects of the current research. The students used headings to indicate focuses on introducing the field, its research approaches, purposes of the research, and previous studies in the field.

The final chapter of each of the dissertation in the corpus between the two disciplines is the Conclusion. Although the chapters are called differently, they perform the same functions of summarizing the main results, summarizing the main claims, and recommending the future work of the research being reported. For the length, SUT PhD science Conclusions range from 2 to 11 pages, averaging 4.1 pages, where those from their engineering counterparts range from 2-17 pages, averaging 5.3 pages. The findings also reveal that the science Conclusion's average length (4.1 pages) is approximately the same number as found in the science and technology corpus (4.9 pages) of Bunton's (2005) study, where the engineering Conclusion corpus is slightly different from the same referred study.

For the section, more than half of the science Conclusions (15 of 25) are not divided into sections, however, only 4 from the engineering conclusions contain no sections. The result from SUT PhD science concluding chapters corresponds to Bunton (2005) that this case was found especially in the Science and Technology disciplines. The other 10 conclusions that are sectioned from the SUT science discipline have two and three sections, when the other 21 from the engineering field contain two and four sections, which is approximately the same number as the engineering writers in Bunton's (2005) study as well. This can possibly indicate that the science Conclusions require less content to be summarized as sections than the engineering Conclusions.

The majority of section headings from both science and engineering disciplines are generic, which indicate the function of the section. However, only one science conclusion was two topical headings, and two engineering conclusions contain four topical headings altogether. The case that there are topical headings ranging between two and five were more often found in Humanities and Social Sciences discipline rather than in the case of Science and Technology (Bunton, 2005).

The most used heading in the SUT PhD science and engineering concluding chapters is "Conclusion(s)", whose functions are to summarize the main findings of the reported study and make an overall summary of the whole study which is usually seen at the first part of the chapter (Move 2, *Consolidation of Research Space*). At the very end of the chapter, the engineering students prefer to have section headings (19) of "*Recommendation*", "*Suggestion for Further study(ies)*", "*Future Studies*", and "*Future Work*" (Move 4, *Future Research*)more frequently than the science students (8). These headings are used to refer to future research/work/study as suggested by Dudley-Evans (1994; 1996) and Weissberg & Buker (1990). The results on the two moves embedded (Move 2, and Move 4) in either the first or the last part of the chapter resemble Bunton's (2005) that the science and technology writers in his corpus seemed to have two main moves in mind: one presenting conclusions about the present study and the other concerning future work.

4.3.2 Move-Step Structure Variations between the Two Disciplines

The findings of the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of PhD dissertations between science and engineering disciplines provide an insight into the disciplinary variations in writing this genre set in PhD dissertations between the two disciplines under this present

research. The following sections are the variation results from Abstracts, Introduction, and Conclusion chapters, respectively.

4.3.2.1 Abstracts

As can be seen in Table 4.13, none of the abstract moves from the science discipline are obligatory. However, two moves (*Purpose* and *Methodology*) are compulsory for the engineering discipline. The move found the least from both of two disciplines is the *Introduction*, while the *Conclusion* move is found to have the same frequency.

Table 4.13: Abstract Move Structures between SUT Science and Engineering PhD Dissertations

Corpus	Total	Introduction move	Purpose move	Method move	Product move	Conclusion move
Science	25	4(16%)	22(88%)	19(76%)	24(96%)	12(48%)
Engineering	25	11(44%)	25(100%)	25(100%)	24(96%)	12(48%)

The abstract analysis from the two disciplines reveals that the majority of the SUT science abstracts were written with a three-move structure (*Purpose-Method-Product*). The findings from the SUT science corpus correspond to Hyland's (2000), which suggested that the three-move pattern was the dominant sequence in his corpus (physics students included). He explained that the hard science writers can anticipate that readers will be able to access the writers' understandings to determine the value of the research, the productivity of the procedures, the theoretical rationale of the study, and its significance to the incremental development of knowledge. Therefore, the writers usually open the abstract with a *Purpose*, then *Method*, and *Product* moves, respectively. In contrast, the majority of the SUT engineering abstracts were written with a four-move structure (*Purpose-Method-Product-*

Conclusion). The first two moves (*P* and *M*) are obligatory. Although the frequency of the *Introduction*(*I*) and *Conclusion*(*C*) move is slightly different, the *I* move was not categorized in the majority move structure of the corpus. The four-move structure of *P-M-Pr-C* in the SUT engineering abstract corpus does not actually correspond to Hyland's (2000) five-move framework, however, it seemingly resembles the study of RA medical abstract structure in Salager-Meyer (1992), which suggested that this four-move pattern is one of the well structured patterns of RA abstracts. Bhatia (1993), also revealed a four-move framework for a typical abstract which indicated the same four-move structure in his study corpus as well.

Although the four-move structure of *P-M-Pr-C* in the SUT engineering corpus seems to correspond with Salager-Meyer (1992) and Bhatia's (1993) findings in this present study, it can be pointed out that the engineering abstracts show a greater similarity in function and composition to those presented in Hyland's (2000) framework than their science counterparts.

Most abstracts from the two corpora begin with the *Purpose* move. This emphasizes the result of Berkenkotter & Huckin's (1995) study in that the writers usually open the abstract with this move. The writers see importance to establish context of paper; indicate purposes, then provide procedures; state main finding to promote their research, and indicate implications and applications of the present findings (Bhatia, 1993). As pointed out in Hyland (2000), the abstract is a selective rather than exact presentation. Moreover, the researchers from the two disciplines tend to concentrate on the purposes and products of their study as these moves share the same frequency between the two disciplines (96%) for the *Product*, and (22% and 25%) for the *Purpose*. Again, this issue corresponds to Hyland (2000)

in that there was a high number of two-move abstracts, where the writers presented their purpose and product only in order to highlight a series of results by presenting them as outcomes of different purposes.

While the overall Abstract characteristics from the two disciplines can be sufficiently described by the selected five-move framework by Hyland (2000), they bear slight differences in some missing moves (*I* and *C*). However, three abstracts from the science and six from its counterpart contain all the five moves that can support the selected model. Unfortunately, this abstract structure is categorized as an optional in both of the disciplines.

According to the results on the majority Abstract structure from the two disciplines that differ from the five-move framework of Hyland (2000), this can be suggested that despite the suggestions of some researchers (e.g., Salager-Meyer, 1990, and Bhatia, 1993), these writers obviously chose to present their work in ways that fail to conform to a universal 'ideal' of information structuring (Hyland, 2000). Therefore, having a different structure from the framework of the two disciplines is possibly acceptable.

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4.3.2.2 Introduction Chapters

Table 4.14 below shows the moves and steps found in the SUT PhD science and engineering Introductions using Bunton's framework (2002) for the analysis. The column from each discipline shows the total number with percentage of the Introduction Moves in which particular steps were found.

Table 4.14: Introductions Move-Step Structures between the Two Disciplines

Moves & Steps	SUT PhD Science (25)	SUT PhD Engineering (25)
Move 1: Establishing a territory	**25 (100%)**	**25 (100%)**
Step 1: Claiming centrality	19 (76%)	15 (60%)
Step 2: Topic generalizations/Background	25 (100%)	25 (100%)
Step 3: Defining terms **	1 (4%)	-
Step 4: Reviewing previous research	17 (68%)	18 (72%)
Move 2: Establishing a niche	**21 (84%)**	**25 (100%)**
Step 1A: Indicating a gap in research	15 (60%)	13 (52%)
Step 1B: Indicating a problem or need	15 (60%)	15 (60%)
Step 1C: Question-raising (So, A)	4 (16%)	3 (12%)
Step 1D: Continuing a tradition	11 (44%)	18 (72%)
Counter-claiming	1 (4%)	12 (48%)
Move 3: Announcing the present research	**25 (100%)**	**25 (100%)**
Step 1: Purposes, aims, or objectives	20 (80%)	25 (100%)
Step 2: Work carried out	21 (84%)	23 (92%)
Step 3: Method	8 (32%)	11 (44%)
Step 4: Materials or subjects	3 (12%)	6 (24%)
Step 5: Findings or result	7 (28%)	10 (40%)
Step 6: Product or research /Model proposed	5 (20%)	2 (8%)
Step 7: Significance / justification	10 (40%)	7 (28%)
Step 8: Thesis structure	8 (32%)	9 (36%)
Chapter structure	-	4 (16%)
Research questions/hypotheses	1 (4%)	3 (12%)
*Defining terms **	2 (8%)	1 (4%)
Figure explanation * **	5 (20%)	-
Research motivation* **	-	3 (12%)
Research development * **	-	4 (16%)

**The newly identified steps occasionally present in Bunton (2002) are in italics. Ones with double asterisk(**) are found in either M1 or M3. The last three final steps with asterisk (***) are the newly identified ones in the two disciplines. However, they are not considered as new steps because they were found less than 50% from the two corpora (Nwogun, 1997).*

Nearly all science Introductions (84%) have all the three moves, while all engineering Introductions (100%) have three moves as suggested in Bunton's (2002) framework: *Establishing a Territory* (T), *Establishing a Niche* (N), and *Announcing the Present Research* (A). The results from these two disciplines can explain that the

Introduction chapters from these writers have commonality with the group of PhD students in the University of Hong Kong reported in Bunton (2002). Hence, these three Introduction moves are considered crucial for science and technology PhD students.

Twenty three science Introductions (92%) begin the chapter with Move 1: *Establishing a Territory* (T), which is employed to show that the intended research area is important, central, interesting, problematic, or relevant in some way, and to introduce and review items of previous research in the area. Also, nearly all of the engineering Introductions (96%) start the chapter with this move. Both of the two disciplines usually begin the chapter with Step 2: *Topic generalizations/ Background* which is found to be the obligatory step in the chapter as well. For the conventional steps, SUT PhD science Introductions are found to have Step 1: *Claming centrality* more than the engineering Introductions, but this step has approximately the same frequency as Step 4: *Reviewing previous research*. However, two of the science and one engineering Introductions begin the chapter with Move 2: *Establishing a Niche* (N). This move is to indicate a problem statement or a claim that there has been little research in the field. The results of having all the three moves (Move 1, 2, and 3) and the beginning of Move 1 in the SUT PhD Introduction chapters can possibly indicate that the PhD writers of the two disciplines have the commonality in writing the PhD Introductions with the group of PhD students in the University of Hong Kong reported in Bunton (2002). This can also illustrate that there in an interaction among members in the same disciplinary discourse through academic texts. The collection of forms on practice is acknowledged, employed, and recognized by the group members of the disciplines (Hyland, 2000).

The first Move in the Introductions from the two disciplines also occupies the largest space in the chapter. The length of Move 1 in both the SUT PhD science and

engineering Introductions is at least half of the whole chapter. This result corresponds to what Bhatia (1993) mentioned in his study that the possible reason for the Introductions in the students theses to be generally long is due to the well-established convention of including reviewing previous studies. However, there are 12 (48%) engineering Introductions whose Move 3*: Announcing the present research* have almost the largest space in the chapter, when only 2 (8%) Introductions from the science have this third move as the largest space in the chapter. It is the move that "Statement of purpose, Research questions/Hypotheses, Significance of the study and Overview of thesis chapters" are expected to be elaborated.

After describing important features of the research territory in Move 1, academic writers typically try to claim a "niche" for their research in Move 2: *Establishing a niche* by showing that the previous research (or solutions) are not complete, or that there are aspects of the research field still needing further investigation. Nearly all the SUT PhD science Introductions (84%) have this move, whereas this move is found in all the engineering Introductions (100%). There are also various steps under this move employed by the writers from the two disciplines. The highly frequent used steps for the science Introductions are Step 1A: *Indicating a gap in research* (60%) and Step 1B: *Indicating a problem or need* (60%). The Step 1B and Step 1D: *Continuing a tradition* (72%) are the highly frequently used steps for the engineering Introductions. These mentioned steps from the two disciplines are conventional. The Step 1C: *Question-raising* and Step 1D: *Continuing a tradition* in the science Introductions, and Step 1A: *Indicating a gap in research*, and Step 1C: *Question-raising* in the engineering Introductions are found to have the optional status. The finding on the occurrence of the *Continuing a tradition* as a conventional step in the SUT PhD engineering discipline

(72%) which is quite different if compared with the same step from the science discipline (44%) indicates that the engineering writers prefer to establish a niche for their research by showing that there are aspects of the research field still needing further investigation. Hence, showing readers that their research methods are applied from the previous studies' gaps is typically a nature of the engineering study. Although Step 1B: *Indicating a gap*, the most salient part to identify Move 2: *Establishing a Niche*, has less frequent use than the Step 1D in the engineering field, a possible alternative would be to express the niche move by using Step 1D: *Continuing a tradition* (Swales, 1990).

When the SUT PhD students from the two disciplines write the Introduction chapters to complete their dissertations, nearly all science Introductions (96%) but all engineering Introductions (100%) end the chapter with Move 3: *Announcing present research* (A). This move is to outline purposes of or the work carried out in the research. This crucial conformity to the model in writing PhD Introductions from the two disciplines is also likely to reflect the similarity of science and engineering PhD students in a Thai university and the PhD students from the same fields at the University of Hong Kong reported in Bunton (2002).

The PhD dissertation is a much longer document and its research extends over a considerable period of time (Bunton, 2002). The role of Move 3 is to turn the niche established in Move 2 into the research space that justifies the present study. The ensuing of this move variously offers to substantiate the particular counter-claim that has been made, fill the created gap, answer the specific question or continue the rhetorically established tradition (Swales, 1990). As a result, there are some variations and many more aspects in the steps of this move used in the two disciplines. The *Purposes, aims*, or *objectives* (80%) and the *Work carried out* (84%) are the most highly used steps in the

science corpus and they are the conventional steps in this discipline. However, the *Purpose, aims,* or *objectives* step (100%) is the most highly used as an obligatory step in the engineering discipline.

According to this finding in the engineering corpus, the purpose statement is also the obligatory element in Move 3: *Occupying the niche* in Swales' (1990) study. For the *Work carried out* occurrence in the two disciplines (84%, 92%), it is considered the conventional step and is almost two times higher than Bunton's (2002) finding (50%) of the PhD students in the University of Hong Kong. This difference can point out that the SUT PhD students prefer seeing the importance of providing a brief account of methodology in the introductory chapters to the readers before the same account is fully elaborated again in the Methodology chapter than the PhD students in the University of Hong Kong. The other steps in Move 3 from the two disciplines are considered optional steps as they were found less than 60%, for instance, *Method, Findings or result, Significance/justification, Thesis structure,* and *etc*. However, five Introductions from the science discipline, and seven from their engineering counterparts showed different statements to establish the last move which were indicated neither in Bunton's (2002) model nor in the SUT guidelines. The five from the science field (20%) show *Figure explanation* statements before or under the mentioned figures, three of the engineering Introductions (12%) have section headed *Research motivation*, and the other four of them (16%) have section headed *Research development* in the chapter. These three steps are not identified as the new steps because they were found less than 50%, and this is also considered as an exception in the two corpora. The results can also indicate that the PhD students who are studying under the same discipline but studying in the different university (Thai and Hong Kong) or studying in the same university but under different

disciplines (Science and Engineering) can have variations in composing the PhD Introductions.

The moves are cyclical in nearly half of the science Introductions (48%), whereas more than half of the engineering Introduction moves (68%) are cyclical. It is surprising that six Introductions from each discipline have a single progression of Move 1-Move 2-Move 3 (T-N-A), while the other nineteen texts from each field reveal different cycles, either with only two moves in a single progression or with three moves but in different cycles. There are two, three, or many more cycles of moves in the two corpora. The highest number in the SUT PhD science Introduction move cycles is being 9 with the average of 3.3, and the highest in the SUT PhD engineering is being 6 with the average of 3.05. The practice of move cycles from the two disciplines corresponds to the findings that the moves in the Introduction chapters are cyclical (Bunton, 2002; Crookes, 1986). The most frequently used cycle from the two disciplines is not T-N-A, but T-N. This usually occurs as writers are reviewing previous research and pointing out gaps or problems or raising questions or continuing a tradition as they review the literature, however, the writers announce their very own research until later of the chapter. In addition, this also emphasizes the study in PhD Introduction chapters of Bunton (2002) and Chiu (2012) that the most frequent cycle in their PhD Introduction corpus was also T-N.

4.3.2.3 Conclusion Chapters

Table 4.15 below shows the moves and steps found in the SUT PhD science and engineering Conclusions using Bunton's framework (2005) for the analysis. The column from each discipline shows the total number with percentage of the Conclusion Moves in which particular steps were found. The steps occasionally present in Bunton (2005) are in italics.

Table 4.15: Conclusions Move-Step Structures between the Two Disciplines

Moves & Steps	SUT PhD Science (25)	SUT PhD Engineering (25)
Move 1: Introductory restatement	**22 (88%)**	**19 (76%)**
Work carried out	22 (88%)	19 (76%)
Territory	-	3 (12%)
Centrality	-	1 (4%)
Gap/niche	1 (4%)	2 (8%)
Move 2: Consolidation of research space	**25 (100%)**	**25 (100%)**
Method	19 (76%)	12 (48%)
Finding / Result	24 (96%)	24 (96%)
Claims	5 (20%)	2 (8%)
Reference to previous research	2 (8%)	1 (4%)
Products	-	13 (52%)
Evaluate of method/product	15 (60%)	13 (52%)
Explanation	3(12%)	4 (16%)
Uncertainty	1(4%)	-
Significance	3 (12%)	-
Limitation	5 (20%)	-
Recommendations for future research	11 (44%)	2 (8%)
Practical application or implications		7 (28%)
Move 3: Practical application and recommendation	-	-
Move 4: Future Research	**8 (32%)**	**20 (80%)**
Recommendations	8 (32%)	20 (80%)
Previous research		
Limitations		

** The steps occasionally present in Bunton (2005) are in italics. Move 3: Practical application and recommendation is not found from the two disciplines and it is not the obligatory move in the Conclusions.*

According to the above Table, nearly all SUT science (88%) and nineteen engineering (76%) Conclusions begin the chapter with Move 1: *Introductory Restatement* to offer again an account of the work carried out of the current studies. However, only three (12%) from the science and six (24%) from the engineering start the chapter with Move 2: *Consolidation of research space* by focusing on the results of the study at the very first part of concluding chapter. The beginning with the work carried out in this

chapter corresponds to Bunton's (2005) study that the science and technology (ST) Conclusions in his examined corpus tended to restate the work carried out by emphasizing the overall issue being researched, which includes purpose, research questions or hypothesis of the study.

More than half of the science Conclusions (18 of 25) have only two moves in the chapter and the majority of the texts are composed with a set of Move 1: *Introductory restatement* and Move 2: *Consolidation of research space*. This result also resembles Bunton's (2005) that the ST thesis writers seemed to have two main moves in mind. However, more than half of the engineering conclusions (16 of 25) have all the obligatory three moves as described in Bunton's (2005) model. The three moves are Move 1, Move 2, and Move 4: *Future research.* This result contrasts the study of Bunton's (2005) in that the SUT PhD engineering students prefer to have three main moves rather than two written in their concluding chapter.

In terms of move frequency, Move 2: *Consolidation of research space* is identified as an obligatory move (100%) in the two disciplines. The first (*Introductory restatement*) is conventional (88%) and the fourth (*Future research*) is optional (32%) in the science disciplines. However, these two moves are conventional (76%, 80%) in the engineering fields. Identifying the *Consolidation of Research Space* as an obligatory move from the two disciplines is similar to what Bunton (2005) mentioned in his study that this move occurred in all 36 Conclusions. In addition, this move also occupies the largest space in the present study corpus. This largest size of this move indicates that the move is probably the most crucial for the SUT PhD science and engineering conclusions. Also, this important move is an outstanding part in the academic concluding sections reported in Swales and Feak's (1994) which is called *Consolidate your research space* Move.

In terms of move cycles, the study reveals that all of the SUT PhD science and engineering Conclusions (100%) have a linear structure appearing in a single progression of either *Introductory restatement* > *Consolidation of research space* > *Future research* , or *Introductory restatement* > *Consolidation of research space* (in engineering) , and *Consolidation of research space* > *Future research* (in the two fields). Nonetheless, the result in this present study is slightly different from Bunton's (2005) study which found the straightforward structure of *Introductory restatement* > *Consolidation of research space* > *Practical application* > *Future research*, which was found in 30 of 36 (83%) in his study corpus.

For the steps used in the SUT PhD conclusions, both science and engineering disciplines reveal a variety of the seven often-present steps described in Bunton's (2005) framework. This case can also possibly be a much greater variety of steps than in the RAs and Master dissertation Conclusions. Frequency analysis of steps of the science discipline show that *Finding/Result* (96%) in Move 2, *Work carried out* (88%) in Move 1, *Method* (76%), *Evaluation of method/product* (60%), and *Recommendations for future research* (44%) in Move 2 are the five most frequent steps. Also, *Finding*/*Result* (96%) in Move 2, *Recommendations* (80%) in Move 4, *Work carried out* (76%) in Move 1, *Products* (52%), and *Evaluation of method/products* (52%) in Move 2 are the five most frequent steps used in the engineering discipline. The first four frequent steps and the last one in the science field are conventional and optional steps, respectively. However, all the five most frequent steps from their counterpart are conventional. None of these steps are obligatory for the SUT PhD science and engineering conclusions.

After the *Work carried out* step is mentioned in the first part of the conclusions, the students then usually summarize research findings, describe about the methods in the study, or discuss about the products and evaluate the products of their research. These steps are established in Move 2: *Consolidate of research space*. The finding on *Evaluation of method/product* step from the two corpora is contrary to Bunton's (2005) in that this step was identified as a present one (≤25%), when the step is conventional from the two disciplines. This can possibly indicate that the SUT PhD science and engineering students tend to evaluate the study methods or products in the chapter rather than the University of Hong Kong ST students. The results can also point out that the PhD students who are studying under the same discipline but in different universities (Thai and Hong Kong) can have differences in composing the PhD Conclusions.

The *Recommendations* step in Move 4: Future research is identified as an optional step in the science corpus (32%), when it is conventional in the engineering field (80%). This step appears as a step embedded in the *Consolidation of research space* Move in the science discipline. However, it is almost found in separate section in the engineering discipline apart from the *Summary and Conclusions*, or *Thesis concluding remarks* headings. The results on the embedded *Recommendations* step in the science can possibly suggest that having the *Recommendations* step in Move 4 as a distinctive section is not necessary for the SUT PhD science conclusions and they could have only two moves (Move 1 and Move 2) in mind to write the chapter. Nonetheless, having *Recommendation*s step separated as a new section in a new move is important and necessary for the SUT PhD engineering concluding chapters. The engineering students also have three moves in mind to write their research studies in the chapter (Move 1,

Move 2, and Move 4), and this corresponds to the obligatory moves in Bunton's (2005) framework for the ST PhD students in his corpus.

In this chapter, the details about move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set from the SUT science and engineering PhD dissertations have been revealed. The discourse-based interviews were also employed to offer some useful/insightful expressions to the practice of writing the genre set in the PhD discourse communities of the two disciplines in Suranaree University of Technology. Moreover, the similarities and differences of these three elements in the genre set between the two disciplines have also been reported.

Details about the relationship of the Abstract, Introduction, and Conclusion chapters between science and engineering disciplines and the similarities and differences of the relationship among these three elements in the genre set between these two disciplines will be described thoroughly in Chapter 5.

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CHAPTER 5

RELATIONSHIP AMONG ABSTRACT, INTRODUCTION, AND CONCLUSION CHAPTERS

This chapter presents the findings on relationship among Abstract, Introduction, and Conclusion chapters from the two corpora of SUT PhD science and engineering disciplines, respectively. The chapter aims to provide the answer for the Research Question 2 of this present research to find out the relationship among the three elements or sub-genres of PhD dissertation i.e. Abstract, the Introduction, and the Conclusion. This research attempts to enrich the existing knowledge about the relationship between Abstracts and the Introductions (Samraj, 2005) by extending the investigation to the final element of the dissertation where the author provides the concluding messages for the readers. The presentation of the findings will be organized according to the five main moves identified in the Abstract from the Introduction, Purpose, Method, Product, and Conclusion moves. The analysis results will start from the genre set of science discipline before that of the engineering discipline. Finally, the similarities and differences of the relationship among these three elements between the two disciplines will be presented. Excerpts from the dissertations that show the mapping of the relationship among the three elements in the genre set will be offered alongside the presentation.

5.1 Findings on the Relationship from the Science Genre Set

The structure of the Abstracts from the science discipline was analyzed and it was compared to the structure of the Introductions and Conclusions in the corpus to find out the relationship inside this set of genres. The traditional 5 moves ascribed to the science abstracts (*Introduction*, *Purpose*, *Method*, *Product*, and *Conclusion*) based on Hyland's model (2000) were used and drawn to examine the relationship among Abstracts, Introduction, and Conclusion chapters by mapping the interactions with one another of the three elements, to identify the overlapping communicative purposes of the Introductions and Conclusions that link to the Abstracts, the repeated presence of moves that indicates the relationship among them. Therefore, the structure of the Abstracts will be discussed first in terms of the traditional moves that they contain. Then, the moves and steps found in the Introductions, and the Conclusions that appear in these science abstracts will be considered by mapping the similar communicative functions that the Introduction and Conclusion chapters have with the Abstract of the same PhD dissertations in the discipline. Table 5.1 below presents the results of the analysis of the SUT science PhD abstracts.

Table 5.1: The Abstract Moves from the Science Discipline

Traditional moves	**Number of the science abstracts containing move**
Introduction	4
Purpose	22
Method	19
Product	24
Conclusion	12

The Table indicates that the abstracts from this discipline generally contain *Purpose*, *Method*, and *Product* (P-M-Pr) moves, indicating that the three-move structure is the majority pattern of the abstract corpus. This finding corresponds to Hyland's (2000) study that these three moves were the dominant sequence in his corpus of science and engineering research article abstracts. Therefore, having the *Introduction* and *Conclusion* moves is considered as an optional status in the genre practice of this particular discipline according to the move frequency classification mentioned by Kanoksilapatham (2005).

Figure 5.1 below shows the findings of the number of the SUT PhD science abstracts containing the moves that have been marked again in the Introduction and Conclusion chapters. Number in the parentheses on the left-sided box (Moves from the Abstract) is the number of the science abstracts with the moves from Hyland's (2000) five-move framework in the corpus. Ones on the right-sided boxes are the amount of the science abstracts containing similar moves or steps in the Introduction and Conclusion chapters (Bunton, 2002; Bunton, 2005).

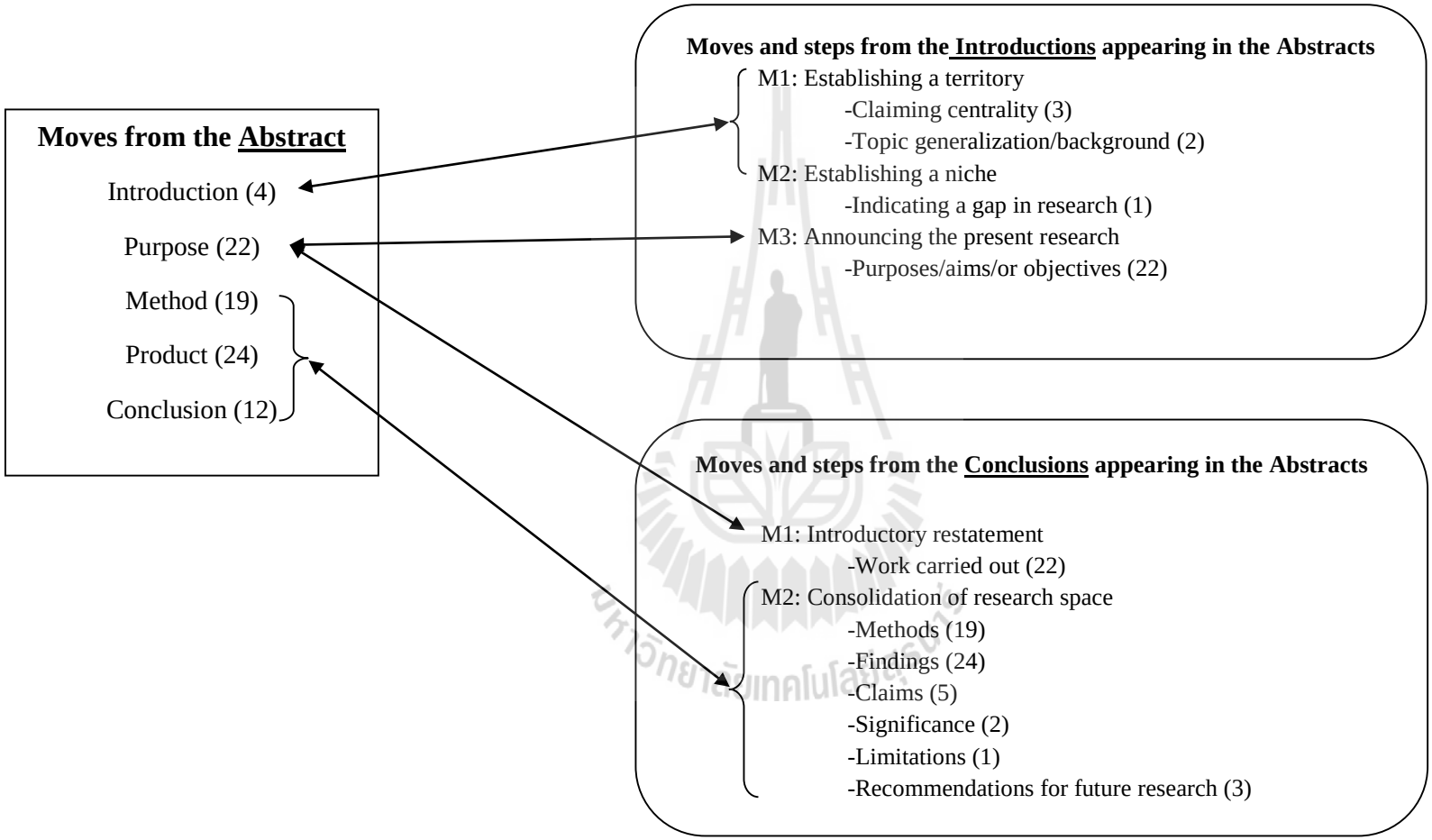

Figure 5.1: Moves in the Abstracts Appearing in the Science Introduction and Conclusion Chapters

5.1.1 The Introduction Move

This move is found in only 4 Abstracts (16%) in the science discipline, pointing out that producing this move is an optional practice of this discipline. The search for this move from these 4 abstracts reveals that the move appears again in the first move, *Establishing a territory*, the *Claiming centrality* (3) step and the *Topic generalization*/*background* (2) step, and in the second move of the Introduction framework (Bunton, 2002), *Establishing a Niche*, the *Indicating a gap in research* (1) step. The result of this study emphasizes the suggestion of the optional status of this move by Hyland's (2000) study. However, the *Introduction* move in these 4 abstracts is not found in the Conclusion of the same dissertation, pointing out that the *Introduction* move does not have to be restated in the SUT science PhD conclusion chapter.

5.1.2 The Purpose Move

This move is found in 22 abstracts (88%) in this corpus, indicating that it is a conventional move for writing the abstract in the science discipline. The move in 22 abstracts is found again as in the third move of the Introduction framework (Bunton, 2002), *Announcing the Present Research*, the *Purposes*/*aims*/or *objectives* (22) step. Interestingly, this move is found to be presented again in the first move of the Conclusion model (Bunton, 2005), *Introductory restatement*, the *Work carried out* (22) step. The 100% maintenance of this move in the science corpus indicates its role as a necessary element in the science PhD dissertation writing as the move connects the three elements in the genre set through the shared communicative purposes in the same dissertation. Table 5.2 below illustrates examples of the *Purpose* move that is employed in all Abstract, Introduction, and Conclusion chapters in the genre set of the

science dissertations. One interesting aspect is the writer's paraphrasing skill of the same message in three different texts.

5.1.3 The Method Move

This move is found in 19 abstracts (76%) in the science corpus, pointing out that it is a conventional move in this discipline. From the mapping, the *Method* move in the Abstract was carried on to 19 Conclusions in the second move of Bunton's (2005) framework, *Consolidation of research space*, the *Method* step but it was not found again in the Introduction. This finding can possibly indicate that although a discussion of research methods is an important aspect of the science PhD research, making it a crucial element in SUT PhD science abstracts and conclusions, it does not have an important status in the introductory chapter of the discipline. The absence of the *Method* statements in the science Introductions is explained by one of the former science PhD students (SCI1) as in the following excerpt. It is learnt from the interview that in general this move does not have to be described in the Introduction chapter of the science discipline.

"*...I think having Method statements in the Introductions is not necessarily needed in the Introductions because it should be placed in the Abstract, the Methodology, and the Conclusion chapters. The Introduction chapter is where the writer writes the ideas of how to conduct the research to readers tentatively. Therefore, the full details of the methods should be written thoroughly in Methodology chapter, and then this has to be described briefty again in the Conclusion chapter, the last part of the dissertation*". (SCI1)

5.1.4 The Product Move

The *Product* move is where the main findings, results, argument, or what was accomplished of the research are stated. This move is found in 24 abstracts (96%) in

the corpus, indicating that it is the most crucial element in abstract writing. From mapping the presence of this move in the three genres, it is found that this is presented again in 24 Conclusions of the same dissertations in the second move of the Conclusion framework (Bunton, 2005), *Consolidation of research space*, the *Findings* step. However, it is not restated in the Introduction chapter. The possible reason for the omission of this move in the Introduction chapter is partly because the key role of the Introductions is to create a research space for the writer, where the writer makes claims for the centrality or significance of the research in question and begins to outline the overall argument of the thesis (Swales & Feak, 1994). Therefore, it is not time to report products, findings, or results of the study in the Introductions but they will be presented again in their own chapter and recounted in the Conclusions in order to make impression to readers by highlighting the results in the last chapter.

5.1.5 The Conclusion Move

As stated in Hyland (2000), the function of the *Conclusion* move in the abstract is to interact or extend results beyond scope of paper, draw inferences, point to applications or wider implications. However, the communicative purpose of the Conclusion chapter stated by Bunton (2005) is to summarize dissertation findings, discuss the analysis results, give implications of findings, make recommendations, and suggest areas of future research. Despite the differences between functions of the *Conclusion* move in the Abstract and the Conclusion chapter mentioned above, the *Method* and *Product* moves in the Abstract can be found to be related with the *Methods* and *Findings* steps in the second move, *Consolidation of the research space* of the Conclusion chapter as well. This *Conclusion* move is found less than half of the science corpus (48%), pointing out that it is the optional status in the science

abstracts. From the mapping, the similar function of the *Conclusion* move in the abstracts is found to be presented again in the second move of the Conclusion framework, the *Consolidation of research space*, the *Methods* (19), the *Findings* (24), the *Claims* (5), the *Significance* (2), the *Limitation*s (1), and the *Recommendations for future research* (3) steps. However, this move is not found in the Introduction chapter, confirming that the function of the Introduction and Conclusion chapters is different despite some overlapping communicative purposes. The Introduction chapter is where the author sets up a research area by showing the important of the research area, provides background information about the topics, and or outlines purposes/aims/, or state the nature of the present research, and etc., whereas the Conclusion chapter is where the author reiterates the main points, and summarizes everything after the Introduction has laid out the research concepts to be investigated. Hence, it is not possible to find the concluding remarks in the Introduction chapter. Table 5.3 below shows the excerpts of the SUT science PhD abstracts containing the moves that have similar communicative purposes in the Conclusion chapters.

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Table 5.2: The Purpose Move from the Abstract Employed in the Science Introduction and Conclusion Chapters

Items	SC Abstracts	SC Introductions	SC Conclusion
SC 4	*"The main objective of this research is to evaluate, compare and verify landslide susceptibility zonation using three different methods namely; analytical hierarchy process (AHP), frequency ratio (FR) model and integrated AHP and FR model in lower Mae Chaem watershed, northern Thailand".* **(Purpose Move)**	*"This research will focus on the three following main objectives:* *1.2.1 To find relative importance of the chosen landslide influencing factors.* *1.2.2 To evaluate landslide susceptibility zonation in the chosen area by using analytical hierarchy process (AHP), frequency ratio (FR) model and integrated AHP and FR model.* *1.2.3 To compare and verify the results of three landslides susceptibility maps by using known landslide locations".* **(Announcing the Present Research Move: Purposes/aims/or objectives Step)**	*"In this study, three different methods :the analytical hierarchy process (AHP), probability-frequency ratio (FR) model, and the integrated AHP and FR model were applied to develop landslide susceptibility maps for the lower Mae Chaem watershed located in northern Thailand.* **(Introductory Restatement Move: Work carried out Step)**
SC 5	*"There are four main works reported in this thesis which are (1) pattern analysis of the observed LULC change and prediction for Kanchanaburi Province during 1992-2006, (2) examination of driving factors that are most related to the temporal changes in amount of agricultural land during the four specified periods, (3)development of land suitability maps for the sugar cane and cassava cultivations, and (4) identification potential suitable locations for new ethanol plant to be situated in the province.* **(Purpose Move)**	*"The main objectives of this work are as follows* *1.2.1 To analyze patterns of the land use/land cover change in the study are between 1992-2006;* *1.2.2 To determine influencing factors of agricultural land use changes found between……, and 1992-2006;* *1.2.3 To evaluate land suitability for sugarcane and cassava cultivations, and;* *1.2.4 To identify suitable locations for the ethanol plant that uses sugarcane and cassava as raw materials.* **(Announcing the Present Research Move: Purposes/aims/or objectives Step)**	*"There are four main works reported in this thesis which are (1) pattern analysis of the observed LULC change and prediction for Karnchanaburi Province during 1992-2006 (Chapter II), (2)Examination of changes in the amount of agricultural land during the specific periods(Chapter III), development of land suitability maps for both sugarcane and cassava cultivations(Chapter IV), and (4)identification potential suitable locations for new ethanol plant (Chapter V). From results obtained from each work, the overall conclusion and some recommendations can be presented as follows.* **(Introductory Restatement Move: Work carried out Step)**

Table 5.3: The Method and Conclusion Moves from the Abstract Employed in the Science Conclusion chapter

Items	SC Abstracts	SC Conclusions
SC 4	*"…Therefore, it can be concluded that the integrated AHP and FR model provides the best result in this study. This knowledge can be used for the landslide hazard prevention and mitigation, and proper planning for land use and construction in the future.* **(Conclusion Move)**	*"…Results of the analysis indicate that maps produced from the AHP, FR model, and integrated AHP and FR model have achieved the accuracies of 64.90%, 84.82%, and 91.22% respectively which are reasonably satisfied. From these results, the integrated AHP and FR model has proved to be most effective in generating landslide susceptibility zonation map in the lower Mae Chaem watershed. These maps are very useful for local authorities and responsible agencies because the data can help them in their decision-making and policy planning efforts in the near future.* **(Consolidation of research space Move: Findings, Claims, and Significance Steps)**
SC 16	*"Ten species of Tertiary leaves belonging to seven genera of Anacadeceae and Leguminosae were described and identifed…..All the species and the genera Adenanthassia, Antheroporum, and Semecarpus are new to the world's Tertiary flora. Mangifera paleoindica and Cassia paleosiamea suggest that Thailand might be (one of) the area(s) of origin of M.indica and C.siamea, respectively".* **(Conclusion Move)**	*"Ten species belonging to seven genera of two families, Anacadeceae and Leguminosae were described…..All the species and the genera Adenanthassia, Antheroporum, and Semecarpus new to the Tertiary flora of the world. Two species, Mangifera paleoindica and Cassia paleosiamea provide evidence for the possibility that Thailand was (one of) the area(s) of the origin of M.indica and C.siamea, respectively".* **(Consolidation of research space Move: Claims Step)**
SC 25	"…*Detections of single- and multiple-target detections are performed by computer simulations and experiments, where two types of images with different spatial-frequency contents are used as the test scenes in the presence of noise in the input plane and the contrast difference*…" **(Method Move)**	*"…In order to achieve these objectives, studies of single- and multiple-target recognitions were performed by using test scenes with different spatial-frequency contents, and by taking into account the presence of noise in the input targets and of contrast difference between the target and the reference images…"* **(Consolidation of research space Move: Methods Step)**

According to the finding of the relationship among Abstract, Introduction, and Conclusion chapters in the genre set of the SUT PhD science discipline, the result resembles the suggestion in Samraj's (2005) study that the similar rhetorical structure and the traditional moves from the genre set are concerned and related to each other. Although the genre set in her corpus was the collection of two genres (RA abstracts, and RA Introductions), extension of her study by adding the Conclusion chapter to the analysis in this present study is considerably worth conducting because it is one of the elements in the genre set that is always found in the PhD dissertation corpora of science and engineering in SUT. Developing the PhD dissertation writing skills for the ever-present chapters in the genre set would provide benefits for the students as a basis of the research composition of the two disciplines. From the excerpts 5.1 and 5.2 above, there is the evidence showing that the communicative purposes from the Introduction and Conclusion chapters relatively link to the Abstract of the same dissertations. These linked communicative purposes are paralleled in the Abstract, therefore, it can undoubtedly indicate that the SUT science PhD Abstract is significantly related to the Introduction and Conclusion chapters in the corpus. Moreover, to confirm this result, all the informants of the science discipline agreed in the interviews that there is the relationship among these three elements in the genre set because the Abstract is the overall summary of either the Introduction or Conclusion chapters. In the next section, the results on the Relationship among the genre set from the SUT engineering PhD dissertations will be reported.

5.2 Findings on the Relationship from the Engineering Genre Set

The method to find out the relationship among Abstract, Introduction, and Conclusion chapters in the genre set of SUT PhD engineering corpus is similar to that mentioned in its science counterpart's genre set. Firstly, the structure of the engineering abstracts was analyzed, it was then compared with the Introductions and Conclusions structures in the corpus to find out the relationship inside these three elements in the set of genres. The Hyland's (2000) five-move framework (*Introduction-Purpose-Method-Product*, and *Conclusion*) was used and drawn to study the relationship among the Abstract, Introduction, and Conclusion chapters. The moves or steps in these three genres will be mapped to uncover their interactions with one another in this set of genres, i.e. the communicative purposes of the Introductions and Conclusions that are linked with the Abstracts, the repeated presence of moves that points out the relationship among them. As a result, the Abstract structure will be discussed first in terms of traditional moves that they contain. Finally, the moves and steps found in the Introductions and Conclusions that emerge in these engineering abstracts will be analyzed by mapping the similar communicative functions that the Introductions and Conclusions have with the Abstract of the same PhD dissertations in the discipline. Table 5.4 below reports the findings of the study of the SUT engineering PhD abstracts.

Table 5.4: The Abstract Moves from the Engineering Discipline

Traditional moves	Number of the engineering abstracts containing move
Introduction	11
Purpose	25
Method	25
Product	24
Conclusion	12

It is indicated in the Table 5.4 that the engineering abstracts mainly contain *Purpose*, *Method*, *Product*, and *Conclusion* (P-M-Pr-C) moves because this four-move structure is the majority sequence of the abstract corpus. This 4-move structure is similar to RA abstract structure of medical and linguistic journals suggested in Salager-Meyer (1992) and Bhatia (1993). Therefore, the *Introduction* move can be considered as an option or can be excluded in this abstract writing practice of the engineering discipline. Figure 5.2 below presents the results of the number of the SUT PhD engineering abstracts carrying the moves that have been repeated in the Introduction and Conclusion chapters. Numbers in the parentheses on the left-sided box (Moves from the Abstract) is the amount of that engineering abstracts having the moves from the frameworks. Ones on the right-sided boxes indicate the number of the abstracts containing similar moves or steps from the Introduction and Conclusion chapters (Bunton, 2002; 2005).

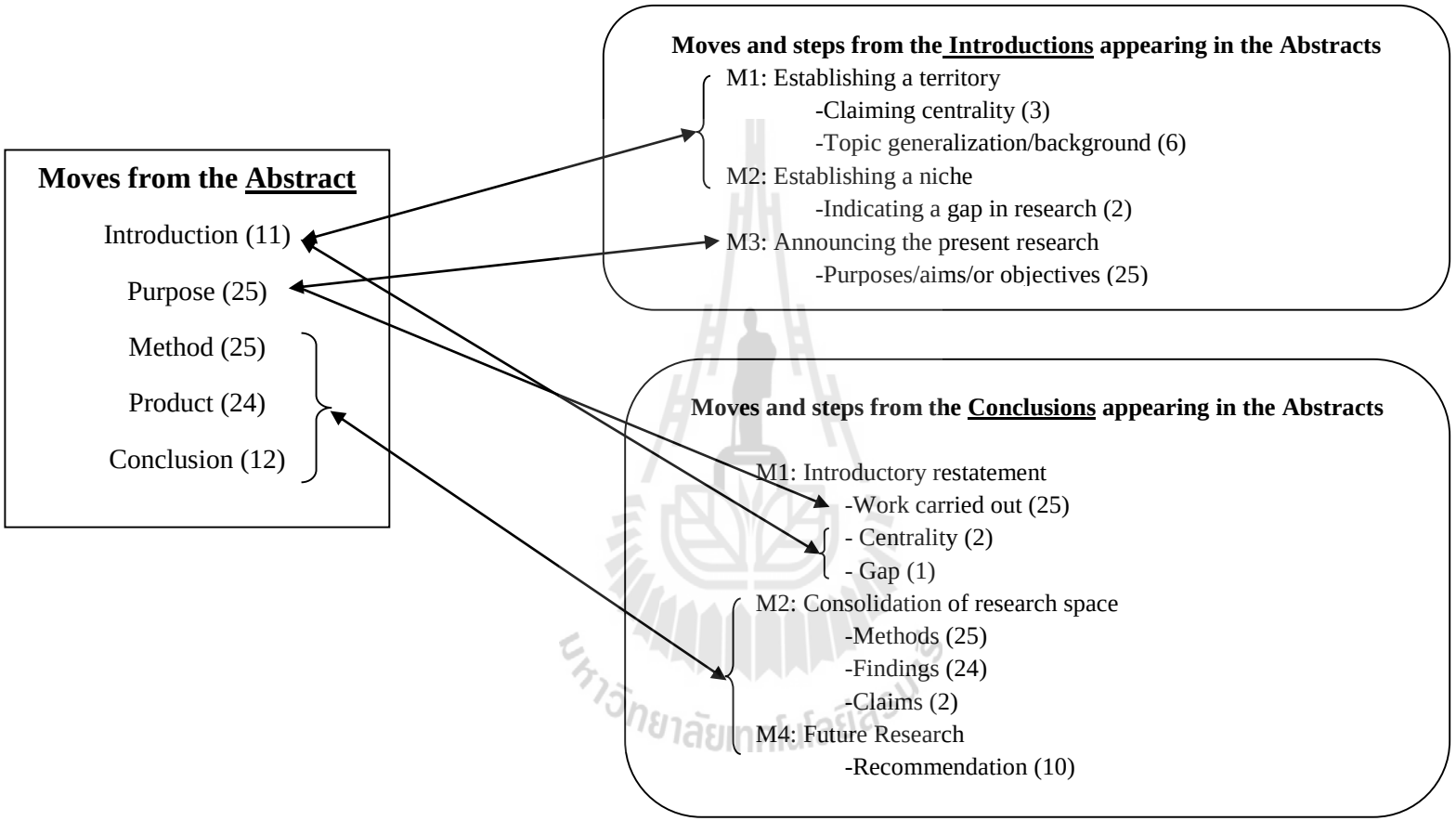

Figure 5.2: Moves in the Abstracts Appearing in the Engineering Introduction and Conclusion Chapters

5.2.1 The Introduction Move

Eleven abstracts (44%) contain this move in the engineering discipline, indicating that the move has an optional status in the genre practice of this field. The examination of this Move from these 11 abstracts shows that the move is marked again in the first move, *Establishing a Territory*, the *Claiming centrality (3)*, the *Topic generalization/background* steps, and in the second move of Bunton's (2002) Introduction framework, *Establishing a Niche*, the *Indicating a gap in research* (2) step. Moreover, the *Introduction* move is also found to be repeated in the first move of Bunton's (2005) Conclusion model, *Introductory restatement*, the *Centrality* (2), and the *Gap* (1) steps. The result on the move mapping among the three elements in the genre set points out that although the *Introduction* move is considered as an option in the engineering Abstract, the move is necessary to be mentioned again in the Introduction and Conclusion chapters of this discipline.

5.2.2 The Purpose Move

This move is found in all 25 abstracts (100%) of the corpus, pointing out the significant role it plays in providing objective(s) of the research to the reader. The search for this move in the Introduction and the Conclusion reveals that all of the 25 Introductions and Conclusions retain this move. For the Introduction chapter, it is found to be employed in the third move, *Announcing the present research*, the *Purposes*/*aims*/*or objectives* (25) step. In the Conclusions, the *Introduction* move of the Abstract is repeated in the first move, *Introductory restatement*, the Work carried out (25) step. The 100% maintenance of this move confirms its role as an indispensable element in engineering PhD dissertations. One possible reason for this repetition is mainly because telling the reader about the purpose(s) of the research and

finding to answer the research question(s) which are translated from the objective(s) of the study are the most crucial part for the writing practice in this particular genre of the engineering discipline. Table 5.5 below shows the excerpts of the *Introduction* move and the *Purpose* move that are employed in all Abstract, Introduction, and Conclusion chapters of this particular field. The writer's paraphrasing skill of the same texts in three different genres is one interesting aspect that can point at an area for pedagogical implications in this PhD dissertation writing context.

According to the findings that the *Introduction* and the *Purpose* moves keep getting repeated in all three different genres of Abstract, Introduction, and Conclusion chapters in the genre set, the reason for this is expressed by one of the former PhD engineering students (ENI3) as in the following excerpt.

"*...In my opinion, these three elements are definitely related to one another. The background information of the research should be written in the Abstract together with the concluding remarks to summarize the research leading the overall conclusion of the whole study in general to the reader. Some elements in the Introduction chapter is also connect with some elements in the Conclusion chapter i.e., how the research is going to be conducted, and what has the research conducted and achieved. In all, the Abstract is where contents inside the Introductions and Conclusions are reported*". (ENI3)

It is learnt from this that this PhD engineering student is aware about what kind of information should be written in the three elements of her PhD dissertation in order to convey the important parts to the reader starting from the first to the last part. This answer corresponds to Devitt's (1991) and Bazerman's (1994) studies that a set of genres interacts to each other in order to accomplish the work, and each genre is required in order for the next one to be produced and used. As a result, this information can inform one of the pedagogical instructions for the practice on writing the particular genres in the genre set.

Table 5.5: The Introduction and Purpose Moves from the Abstract Employed in the Engineering Introduction and Conclusion Chapters

Items	EN Abstracts	EN Introductions	EN Conclusion
EN 14	"*Avoidance of precipitation of surfactants in the detergency industry is especially important for acceptable cleaning results. An important characteristic of anionic surfactants that is deleterious to their use in many detergency applications is their tendency to precipitate from solutions, especially when they are used in hard water, forming soap scum*…." (**Introduction Move**)	"*A significant characteristic of anionic surfactants which can be deleterious to their use is the tendency to precipitate from aqueous solutions by counterions. Avoidance of anionic surfactant precipitation by counterions is crucial in many applications of surfactants especially in the detergency industry*…" (**Establishing a territory Move, Claiming centrality Step**)	"*Avoidance of precipitation of surfactants in detergency industry is especially important for acceptable cleaning results. An important characteristic of anionic surfactants that is deleterious to their use in many detergency applications is their tendency to precipitate from solutions, especially when used in hard water, forming soap scum*…" (**Introductory restatement Move, Centrality Step**)
EN 9	"*Investigations were carried out to evaluate the performance of downflow hanging sponge (DHS) system as a post treatment for industrial wastewater effluents containing high organic and nitrogen concentration*…" **(Purpose Move)**	"*The overall aim of this study was to evaluate the performances of fungal and bacterial downflow hanging sponge system for residual organics removal during post treatment of starch wastewater effluents from an UASB reactor*…" **(Announcing the present research Move, Purposes/aims/or objectives Step)**	"*This study investigated both of fungal and bacterial downflow hanging sponge systems as a post treatment of UASB effluent of tapioca starch wastewater by experimental study and mathematical modeling for evaluated the on biofilm composition and density dynamics*" **(Introductory restatement Move, Work carried out Step)**
EN 20	"*The thesis studies flow in a solar chimney, a device for generating electricity from solar energy by means of turbine extracting the flow energy from the hot air rising through a tall chimney with the ultimate goal of a better design to obtain a higher efficiency. Operating characteristics that are significant to the flow in solar*". **(Purpose Move)**	"The overall objective of the proposed thesis is to study the flow within the solar chimney and its operating characteristics that are significant in optimizing the solar chimney design" **(Announcing the present research Move, Purposes/aims/or objectives Step)**	"This work investigates the behavior of the flow in solar chimney with the ultimate goal of a better design to obtain a higher efficiency" **Introductory restatement Move, Work carried out Step)**

5.2.3 The Method Move

Similar to the phenomenon of the *Purpose* move, this move is also found in all 25 abstracts (100%) of the corpus. It is also found that all of the 25 Conclusions retain this move which is established in the second move, *Consolidation of research space*, the *Methods* (25) step. Although this move is employed in all the Abstracts, and in all the Conclusions, there is no evidence presenting this move in the Introductions. One possible reason for this unpopularity of the move in the engineering Introductions might be due to the different functions of the Introductions and the Methods. The first one establishes context of the research and induces the research or discussion, whereas the latter gives information on methodology, design, study processes, assumptions, approach, and etc. Hence, the functions between these two communicative purposes are dissimilar, making the *Method* move a less important status in the introductory chapter. However, the information on the method will be raised as the main element in the Methodology chapter of the engineering discipline, which is not mentioned as the target text in the present study.

5.2.4 The Product Move

This move is found in 24 abstracts (96%) in the corpus, indicating the significance of reporting findings, results, argument, or what the accomplishment of the research is in the Abstract. The search for this move sees that it is repeated in all 24 Conclusions in the second move, *Consolidation of research space*, the *Findings* step but the move is omitted from all the Introductions. Possible reason that this move is retained in the Conclusions alone might be probably because the key role of the Conclusions is to summarize the research findings, discuss the research results, provide implications of findings, and etc. The function of the Introduction is to give

ideas about research for the writer to conduct the investigation, or make claims for the centrality of importance of the research question in order to outline the overall argument of the research. According to this, reporting findings or results of the PhD study can be found to be conventional writing practice in the Abstract and Conclusion chapter in this engineering discipline.

5.2.5 The Conclusion Move

The Conclusion Move in the Abstract, and the Conclusion chapter tend to be interrelated to each other according to the analysis frameworks of this present study. Extending results beyond scope of paper, drawing inferences, pointing to applications or wider implications are the function of the Conclusion Move in the Abstract (Hyland, 2000). Summarizing dissertation findings, discussing the analysis results, providing implications of findings, making recommendations, and suggesting areas of future research are also the main role of the Conclusion chapter in PhD research (Bunton, 2005). Hence, the *Method*, *Product*, and *Conclusion* moves in the Abstract can possibly be found again in the Conclusion chapter. The Conclusion Move in this corpus is found in less than half of the corpus (48%), indicating its optional status in the engineering abstract. The search for the relationship of this move with Introductions and Conclusions from the same corpus reveals that the *Conclusion* move is not found in the Introductions, but found to be emphasized again in the Conclusion chapter, specially in the second move, *Consolidation of research space*, in the *Methods* (25), *Findings* (24), *Claims* (2) steps, and in the fourth move, *Future research*, in the *Recommendation* (10) step. However, the last two steps (*Claims* and *Recommendation*) seem to be related to the function of *Conclusion* move in the Abstract suggested by Hyland (2000) the most. The finding that this move in the

Abstract is omitted in the Introductions but repeated in the Conclusions can possibly point out that there is variation between the first and the last chapter according to their functions explained by the mentioned frameworks. The concluding remarks about *Methods*, *Results*, and *Conclusions* of the study might not be located in the Introduction chapter, whereas introductory statements of *Background*, and *Purposes* of the research have their certain status not only in the Introduction chapter but also in the Conclusion chapter of this discipline. Table 5.6 presents the SUT engineering PhD abstracts containing the moves that employ similar communicative purposes in their Conclusion chapters but they are not found in the Introductions.

Table 5.6: The Method, Product and Conclusion Moves from the Abstract Employed in Engineering the Conclusion Chapter

Items	EN Abstracts	EN Conclusions
EN 4	*"It was found that the number of effective nuclei of natural fiber PP composites was higher than that of neat PP. This suggest that natural fibers could act as a nucleating agent in the composites".* **(Product Move)**	*"It was found that the number of effective nuclei of natural fiber PP composites was higher than that of neat PP. The highest number of effective nuclei was found in rossells PP composite. This suggested that natural fibers could act as a nucleating agent for crystallization in the PP composites".* **(Consolidation of research space Move, Findings Step)**
EN 12	*"….the power system network is composed in several areas, and then the influence of each outage and its remedial action is taken in the respective zone. A model is trained to forecast the post fault values of limits such as critical line flow and bus voltages to maintain system preventive action. Agents are trained so as to optimize the load and energy to be curtailed during contingency event. The model has been tested based on the simulation; and results are analyzed to show the model performance".* **(Method Move)**	*"…the system state forecast presents the expected situation upon the contingency event. Agents are organized manner that, the load curtailment is maintained to the minimum case of the contingency event, line outage…"* **(Consolidation of research space Move, Methods Step)**
EN 24	*"The user can apply the required temperature increase (ΔT) in the housing on the recommendation charts. The provide size of hot-air tube can be selected, and the housing volume to packed rock volume (Vh/Vb) ratio can be obtained".* **(Conclusion Move)**	*"The efficiency of storage pit and the increasable of housing temperature can be improved by several ways such as installation of ventilator at the hot-air tube increases the mass flow rate from the storage and temperature in the housing model, installed double layers of acrylic sheet on the top of pit, cover the pit walls and floor with impermeable material with also can prevent the heat loss. Some housing with the wall made from bamboo should be covered with the isolator".* **(Future research Move, Recommendation Step)**

The result of the relationship among the sub-genres of Abstract, Introduction, and Conclusion chapters in the genre set of the SUT PhD engineering discipline also extends Samraj's (2005) indication that there is a connection of rhetorical structures and the traditional moves inside the genre set where the three elements are related to one another. The relationship in the genre set is not found just from the Abstract and Introduction chapter, but also in the Conclusion chapter as well.

From the previous excerpts above, the communicative purposes among the Abstract, Introduction, and Conclusion chapters in the engineering PhD corpus show evidence that they are related to one another in the same dissertations. The *Introduction* and *Purpose* moves in the Abstract can be found to be repeated in the other two genres in the set and the *Method*, *Product*, and *Conclusion* moves are omitted in the Introductions but represented in the Conclusions. It can be suggested that their linked communicative purposes are paralleled in the abstracts, indicating that the SUT engineering PhD abstracts are significantly related to their Introductions and Conclusions. In addition, the finding on this relationship among the three elements in the genre set is also explained by all the representatives of this discipline that these three sub-genres are connected to each other. In the next section, the similarities and differences of the relationship among the three elements in the genre set between SUT PhD science and engineering disciplines will be reported in order to answer the Research Question 3. Pedagogical implications from the findings of variations on the relationship among the three elements in the genre set will be offered to benefit dissertation writing practice between the two fields.

5.3 Relationship among the Three Genres in the Genre Set between the Two Disciplines

The structure of the Abstracts from the two disciplines was analyzed and their structure was compared to the structure of the Introductions and Conclusions of the same PhD dissertations in each discipline to find out the relationship inside their PhD set of genres. The traditional 5 moves ascribed to the science and engineering abstracts (*Introduction*, *Purpose*, *Method*, *Product*, and *Conclusion*) based on Hyland's (2000) model were used and drawn to study the relationship among the three elements in the genre set. This is to identify the shared communicative purposes of the Introductions and Conclusions that connect to the Abstracts. Table 5.7 below presents the results of the analysis between the science and engineering PhD abstracts.

Table 5.7: Moves in the Abstract between the Science and Engineering Disciplines

Traditional moves	**Number of the science abstracts containing move**	**Number of the engineering abstracts containing move**
Introduction	4	11
Purpose	22	25
Method	19	25
Product	24	24
Conclusion	12	12

It is described in the Table 5.7 that the science abstracts generally contain *Purpose*, *Method*, and *Product* (P-M-Pr) moves (3-move structure is the main sequence). However, the abstracts from their engineering's counterparts employ *Purpose*, *Method*, *Product*, and *Conclusion* (P-M-Pr-C) moves (4-move structure is the main sequence). Moreover, the *Introduction* and *Conclusion* moves are considered as an option in the

genre practice of the science abstracts, but only the *Introduction* move is optional or even be an excluded status in the engineering abstracts. Figure 5.3 below shows the similarities and differences of the move-step structures of the Introduction, and Conclusion chapters appearing in the Abstract from science and engineering disciplines. Number in the parentheses on the left-sided boxes in each discipline is the number of the abstracts with the moves from Hyland's (2000) five-move framework in the two corpora. Ones on the right-sided boxes of each field are the amount of the science and engineering abstracts containing similar moves or steps in the Introduction and Conclusion chapters (Bunton, 2002; 2005).

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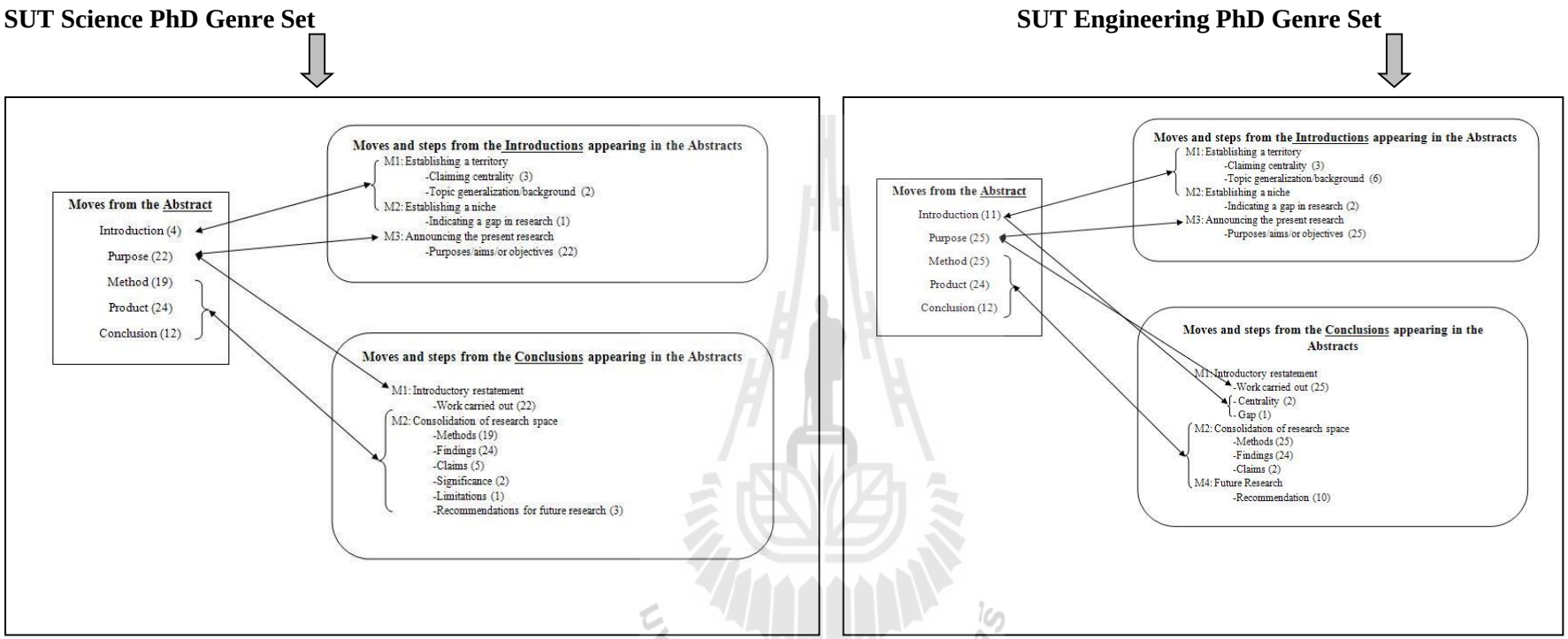

Figure 5.3: Moves in the Abstracts Appearing in the Introduction and Conclusion Chapters between the Two Disciplines

5.3.1 The Introduction Move between the Two Disciplines

This move is found in only 4 science abstracts (16%) and 11 engineering abstracts (44%), pointing out that the move is an optional practice of these two disciplines. The finding of this move from these 4 and 11 abstracts of the two fields indicate that it is repeated in only the first and in the second move of the Introduction framework (Bunton, 2002), *Establishing a territory* and *Establishing a niche* moves in the science discipline, whereas this *Introduction* move in the engineering abstracts appears again in the first and the second move of the Introduction model as mentioned above, and it is also found to be presented again in the first move of Bunton's (2005) Conclusion framework, *Introductory restatement* in the engineering field. The results on the move mapping among the three elements in the genre set between the two disciplines indicate that the science PhD students do not generally claim centrality or inform about background of the study again in the Conclusion chapter, however, the engineering PhD writers prefer to restate the introductory information about their research in three different genres in the genre set.

5.3.2 The Purpose Move between the Two Disciplines

This move is found in 22 science abstracts (88%) and 25 engineering ones (100%), suggesting that the move is a conventional move for writing the abstract in the science discipline but it is an obligatory move for composing the abstract in the engineering's counterpart. The search for this move from the two disciplines also reveals that it is repeated again in the third move of the Introduction framework (Bunton, 2002), *Announcing the present research*, the *Purposes/aims/or objectives* (22, 25), and in the first move of the Conclusion model (Bunton, 2005), *Introductory restatement*, the *Work carried out* (22, 25) step. The findings from the two disciplines point out that this 100%

maintenance of this move indicates the indispensable role of this move in the both science and engineering PhD writing practice because the move links the three elements in the genre set through shared communicative purposes in the same dissertations in each corpus. Table 5.8 below illustrates examples of the 100% maintenance of the *Purpose* move that is used in all Abstract, Introduction, and Conclusion chapters in the genre set of the science and engineering dissertations. The author's paraphrasing skill of the same message in three different genres is one interesting aspect of the present study.

Table 5.8: The Purpose Move from the Abstract Employed in the Introduction and Conclusion Chapters

between the Two Disciplines.

SUT PhD science genre set (SC 4)				SUT PhD engineering ge	
Abstract	**Introduction**	**Conclusion**		**Abstract**	**Introduction**
"The main objective of this research is to evaluate, compare and verify landslide susceptibility zonation using three different methods namely; analytical hierarchy process (AHP), frequency ratio (FR) model and integrated AHP and FR model in lower Mae Chaem watershed, northern Thailand"	*"This research will focus on the three following main objectives:* *1.2.1 To find relative importance of the chosen landslide influencing factors.* *1.2.2 To evaluate landslide susceptibility zonation in the chosen area by using analytical hierarchy process (AHP), frequency ratio (FR) model and integrated AHP and FR model.* *1.2.3 To compare and verify the results of three landslides susceptibility maps by using known landslide locations".*	*"In this study, three different methods :the analytical hierarchy process (AHP), probability-frequency ratio (FR) model, and the integrated AHP and FR model were applied to develop landslide susceptibility maps for the lower Mae Chaem watershed located in northern Thailand.*		*"….Furthermore, the biomass productivity of fish and aquatic plant grown in treatment wet lands were investigated. Finally the simulation model that encompasses the relationship among water quality, aquatic macrophyte, fish and some microorganisms in the free water constructed wetland treating domestic waste water were developed".*	*"The biomas and produc papyrus and fish pro were investigated in fre surface wetland wit without fish. Finall simulation models established to descri relationship among macrophyte, fish, and microorganisms in th water constructed treating domestic wastew*
(Purpose Move)	**(Announcing the Present Research Move: Purposes/aims/or objectives Step)**	**(Introductory Restatement Move: Work carried out Step)**		**(Purpose Move)**	**(Announcing the Present R Move: Purposes/aims/or ob Step)**

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5.3.3 The Method Move between the Two Disciplines

This move is found in 19 science (76%) and in 25 engineering (100%) abstracts, pointing out that it is a conventional move in the science, whereas it is an obligatory move for the abstract writing practice in the engineering field. The finding of the *Method* move that have more than 50% occurrence from the science and engineering disciplines is contrary to Samraj's (2005) study that this move is not frequently found in both sets of abstracts (Conservation Biology and Wildlife Behavior). This move appears in half the abstracts from the two fields, suggesting that the abstract is not a mere synopsis of the research article of her study corpus. However, the *Method* move of the SUT science and engineering PhD abstracts is considered an important aspect of the dissertation, especially in engineering field. Therefore, it can be concluded from this finding that the PhD abstracts from the two disciplines are the mere synopsis of the SUT PhD dissertations. From the mapping, this move in the abstracts from the two disciplines is found to be repeated in 19 science and 25 engineering Conclusions from the same dissertations, making this move has a 100% maintenance status in each discipline. The *Method* move in the abstracts of the two corpora is carried on to appear again as designated in the second move of Bunton's (2005) framework, *Consolidation of research space*, the *Methods* step. Moreover, this move is not found to be restated in the Introductions, indicating its unpopularity element in the introductory chapter from both disciplines. The omission of the *Method* move in the Introductions of the two disciplines might be possibly because the variations in functions between the *Introduction* and *Method* moves, making the *Method* move the less crucial status in the Introduction chapter of the two fields. Moreover, the reason of the omission of the move is explained by one of the former science PhD students that the Method statements are not considered

entirely important to be mentioned in the Introduction chapter, however, it needs to be located in the Abstract, and located again in the Conclusion chapter in order to summarize overall research activities to the reader.

5.3.4 The Product Move between the Two Disciplines

This move is found in 24 science (96%) and the other 24 engineering (96%) abstracts, indicating this move as the most crucial element in the science abstract writing but it is a conventional move in the engineering corpus. From mapping the presence of this move in the three different elements in the genre set from the two disciplines, it is revealed that there is no evidence of this move in the Introductions from the two corpora, however, this move has a 100% retention in the Conclusion chapters of the two fields. The absence of the move in the science and engineering Introductions might be due to the different key role of the *Introduction* and *Product* moves. The first one is where claiming centrality, informing background, or situating the purposes of the present study are stated, whereas the latter is where main findings, argument, or what has been accomplished of the research are written. As a result, this *Product* move can be found in the Abstract, then omitted in the Introductions, and emphasized again in the Conclusions of both of the disciplines, inviting impression from the reader.

5.3.5 The Conclusion Move between the Two Disciplines

As mentioned earlier in the functions of the *Conclusion* move in the Abstract (Hyland, 2000) and the Conclusion chapter (Bunton, 2005), some variations of the *Conclusion* move can be described in the two frameworks. In the Abstract, the move is to interact or extend the results beyond scope of paper, draw inferences, point to applications or wider implications. In the Conclusion chapter, the move is to summarize dissertation findings, discuss analysis results, give implications of findings, make recommendations, and suggest areas of future research. It can be suggested that there is the overlapping of the communicative purposes between these two different genres i.e., *Method*, *Product*, and *Conclusion* moves. This *Conclusion* move is found less than half of the science (48%), and the same occurrence uncovered in the engineering (48%) abstracts, indicating the move as an optional status in both abstracts from the two corpora. The search for this move in the Introduction and Conclusion chapters shows that this move is not found to be related in either science or engineering Introductions, however, the move is repeated in the second move of the Conclusion framework in the science discipline, the *Consolidation of research space*, the *Methods* (19), the *Findings* (24), the *Claims* (5), the *Significant* (2), the *Limitations* (1), and the *Recommendations for future research* (3) steps. In addition, the move is also presented again in the second move, *Consolidation of research space*, in the *Methods* (25), *Findings* (24), *Claims* (2) steps, and in the fourth move, *Future research*, in the *Recommendation* (10) step. A possible reason that there is no evidence of the repeated presence of *Conclusion* move from the Abstract in the Introductions but it is retained in the Conclusions from the two disciplines might be because the differences in functions of these two genres. Setting a research area, showing the importance of a research area, and or announcing the present

research is the role of the Introduction chapter. Nonetheless, summarizing the main results of the research, offering the work carried out of the research, and or suggesting the recommendation for future work is the role of the Conclusion chapter. Therefore, the *Conclusion* remarks have more opportunity to be mentioned in both the Abstract, and Conclusion chapters than in the Introduction chapter of both the science and engineering PhD dissertations. Table 5.9 presents the examples of the *Method*, *Product*, and *Conclusion* moves from the Abstract employed in the Conclusion chapter between the two disciplines.

Table 5.9: The Method, Product, and Conclusion Moves from the Abstract Employed in the Conclusion Chapter between the Two Disciplines

SUT PhD Science Abstracts and Conclusions			SUT PhD Engineering Abstracts and Conclusions		
Items	**Abstracts**	**Conclusions**	**Items**	**Abstracts**	**Conclusions**
SC 25	"…*Detections of single- and multiple-target detections are performed by computer simulations and experiments, where two types of images with different spatial-frequency contents are used as the test scenes in the presence of noise in the input plane and the contrast difference*…" **(Method Move)**	*"…In order to achieve these objectives, studies of single- and multiple-target recognitions were performed by using test scenes with different spatial-frequency contents, and by taking into account the presence of noise in the input targets and of contrast difference between the target and the reference images…"* **(Consolidation of research space Move: Methods Step)**	EN 4	*"It was found that the number of effective nuclei of natural fiber PP composites was higher than that of neat PP. This suggest that natural fibers could act as a nucleating agent in the composites".* **(Product Move)**	*"It was found that the number of effective nuclei of natural fiber PP composites was higher than that of neat PP. The highest number of effective nuclei was found in rossells PP composite. This suggested that natural fibers could act as a nucleating agent for crystallization in the PP composites".* **(Consolidation of research space Move, Findings Step)**
SC 4	*"…Therefore, it can be concluded that the integrated AHP and FR model provides the best result in this study. This knowledge can be used for the landslide hazard prevention and mitigation, and proper planning for land use and construction in the future.* **(Conclusion Move)**	*"…Results of the analysis indicate that maps produced from the AHP, FR model, and integrated AHP and FR model have achieved the accuracies of 64.90%, 84.82%, and 91.22% respectively which are reasonably satisfied. From these results, the integrated AHP and FR model has proved to be most effective in generating landslide susceptibility zonation map in the lower Mae Chaem watershed. These maps are very useful for local authorities and responsible agencies because the data can help them in their decision-making and policy planning efforts in the near future.* **(Consolidation of research space Move: Findings, Claims, and Significance Steps)**	EN 24	*"The user can apply the required temperature increase (ΔT) in the housing on the recommendation charts. The provide size of hot-air tube can be selected, and the housing volume to packed rock volume (Vh/Vb) ratio can be obtained".* **(Conclusion Move)**	*"The efficiency of storage pit and the increasable of housing temperature can be improved by several ways such as installation of ventilator at the hot-air tube increases the mass flow rate from the storage and temperature in the housing model, installed double layers of acrylic sheet on the top of pit, cover the pit walls and floor with impermeable material with also can prevent the heat loss. Some housing with the wall made from bamboo should be covered with the isolator".* **(Future research Move, Recommendation Step)**

The study on the relationship among Abstract, Introduction, and Conclusion chapters in the genre set between the two disciplines which covers a wide range of sub-disciplines from these two fields is to repeat the suggestion on the increased knowledge of genre relations and variations in Connor & Mauranen (1999), and Samraj (2005). As listed in the Figure 5.3, Table 5.8, and 5.9 above, the mapping of the communicative purposes among the three elements in the genre set from the science and engineering disciplines reveals that only one move i.e. *Purpose* move in the science abstracts is relatively repeated in three different genres in the corpus, indicating its role as an important element in the science PhD dissertation writing. However, two moves i.e. *Introduction* and *Purpose* move are found to be retained in Abstract, Introduction, and Conclusion chapter in the genre set of the engineering corpus, pointing out their indispensable parts for the dissertation writing practice in the discipline. The last three moves in the Abstract i.e. *Method*, *Product*, and *Conclusion* moves of the two corpora are not found to be presented in all different texts of the genre set, however, their communicative purposes are employed in the Abstract, omitted in the Introductions, and mentioned again in the Conclusion chapter of the two disciplines. The evidence that three moves in the Abstract are presented again as in the concluding statements in the Conclusion chapter from the two corpora can possibly indicate that the Abstract has more interrelation with Conclusions than the Introductions, making the Abstract closely related to the Conclusions. In this finding, the engineering Abstract corpus has more overlapping communicative purposes than in the science counterparts. Moreover, the two disciplines contain what have been marked as the linked communicative functions that relate to each other. The presence of the selected communicative statements in the genre set from the two

fields indicates that these mentioned moves (*Purpose*, *Method*, and *Product*) are the crucial elements for either the Introduction or Conclusion chapters writing for the students in both of the disciplines. According to the excerpts listed in the Figure and Tables above, there is sufficient evidence to show that the communicative purposes from the Introduction and Conclusion chapters relatively link to the Abstracts of the same dissertations from the SUT PhD science and engineering disciplines. On the whole, abstracts are more similar to the SUT PhD Introductions and Conclusions in engineering than in the science field according the obligatory status of the engineering *Introduction* and *Conclusion* moves and steps appearing in the Abstract. The results also reveal the similar move structure and the traditional moves that are related to each other. Each genre from the two disciplines (Abstracts, Introductions, and Conclusions) connects one another and is required in order to be written, produced, and used for the next one (Devitt, 1991; Bazerman, 1994; Samraj, 2005). Consequently, this present study can undoubtedly indicate that the SUT science and engineering abstracts are significantly related to not only the Introductions but also Conclusions in the PhD corpus. In the next chapter, the overall summary of this present study will be reported.

CHAPTER 6

CONCLUSIONS

This final chapter proposes a brief summary of the main findings attained from this present study. The findings about the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set of science and engineering PhD dissertations produced by graduate students at Suranaree University of Technology (SUT), the relationship among these dissertation elements in the genre set from the two corpora, and the similarities and differences of the move-step structures of these texts in the genre set between the two disciplines aim to answer the three research questions, respectively. Pedagogical implications and the recommendations and limitations for future studies are also offered to conclude this dissertation.

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6.1 Summary of the Findings

6.1.1 Move-step Structures of Abstract, Introduction, and Conclusion Chapters in the Genre Set from the Two Disciplines

Following Kanoksilapatham (2005), this present study summarizes the moves and steps that occurred in three categories; namely, Obligatory (100%), Conventional (60-99%), and Optional (below 60%) of the two corpora in order to answer the Research Question 1 (Table 6.1). The frequency of occurrences identified in each genre of the corpus of 50 PhD dissertations written by science (25) and engineering (25) students at Suranaree University of Technology was recorded in order to verify

the extent to which a particular move or step is used as the number of occurrences divided by the number of chapters being analyzed (in this study 25 in each discipline) and multiplied by 100 to make a percentage. For example, if a particular move or step occurs in all 25 Introductions, the frequency of occurrence will be calculated as (25/25) x 100 = 100%. The moves and steps on the first and second columns are those obligatorily or conventionally employed in composing each genre of the PhD dissertations by science and engineering students (≥60%) while the infrequent moves and steps (≥59%) are presented on the last column on the right hand side.

Table 6.1: Summary of Move-Step Structures of the Abstract, Introduction, and Conclusion Chapters in the Genre Set between the Two Disciplines

Moves and Steps in Abstract, Introductions, and Conclusions	**Obligatory Freq. (%) (100%)**		**Conventional Freq. (%) (60-99%)**		**Optional Freq. (%) (≥59%)**	
	SC	**EN**	**SC**	**EN**	**SC**	**EN**
Abstracts (N=25 in each field)						
Introduction					4	11
Purpose		100	88			
Method		100	76			
Product			96	96		
Conclusion					12	12
Introductions (N = 25 in each field)						
Move 1: Establishing a territory	**100**	**100**				
Step 1: Claiming centrality			76	60		
Step 2: Topic generalizations/Background	100	100				
Step 3: Defining terms **					4	
Step 4: Reviewing previous research			68	72		
Move 2: Establishing a niche		**100**	**84**			
Step 1A: Indicating a gap in research			60			52
Step 1B: Indicating a problem or need			60	60		
Step 1C: Question-raising					16	12
Step 1D: Continuing a tradition					11	18
Counter-claiming					1	12
Move 3: Announcing the present research	**100**	**100**				
Step 1: Purposes, aims, or objectives		100	80			
Step 2: Work carried out			84	92		
Step 3: Method					32	44
Step 4: Materials or subjects					12	24
Step 5: Findings or result					28	40
Step 6: Product or research /Model proposed					20	8
Step 7: Significance / justification					40	28
Step 8: Thesis structure					32	36
Chapter structure						16

Table 6.1: Summary of Move-Step Structures of the Abstract, Introduction, and Conclusion Chapters in the Genre Set between the Two Disciplines (Cont.)

Moves and Steps in Abstract, Introductions, and Conclusions	**Obligatory Freq. (%) (100%)**		**Conventional Freq. (%) (60-99%)**		**Optional Freq. (%) (≥59%)**	
	SC	**EN**	**SC**	**EN**	**SC**	**EN**
Research questions/hypotheses					4	12
Defining terms **					8	4
Figure explanation ***					20	
*Research motivation****						12
Research development ***						16
Conclusions (N=25 in each field)						
Move 1: Introductory restatement			**88**	**76**		
Work carried out			88	76		
Territory						12
Centrality						4
Gap/niche					4	8
Move 2: Consolidate of research space	**100**	**100**				
Method			76			48
Finding / Result			96	96		
Claims					20	8
Reference to previous research					8	4
Products						13
Evaluate of method/product			60			52
Explanation					12	16
Uncertainty					4	
Significance					12	
Limitation					20	
Recommendations for future research					11	8
Practical application or implications						28
Move 3: Practical application and recommendation						
Move 4: Future Research				**80**	**32**	
Recommendations				80	32	
Previous research						
Limitations						

- The steps with double asterisk (**) are found in either Move 1 or Move 3. The (***) indicates the newly identified step in this study. However, it is not considered as a new step because it was not found more than 50% of the corpus (Nwogu, 1997).

6.1.2 Relationship among Abstract, Introduction, and Conclusion Chapters in the Genre Set of the Two Disciplines

Table 6.2 below summarizes the number of the abstracts containing move in the Introduction, and Conclusion chapters from the two disciplines in order to answer the second research question of the present study. In the Table, the first row indicates

number of abstracts from the two disciplines containing general moves following Hyland's (2000) five-move framework. The second and the third rows present moves in the Abstracts appearing in the Introductions and Conclusions moves and steps from the two disciplines, respectively. The two steps; namely, *Recommendation for future research* and *Recommendation* are established as different moves of the Conclusions. The first one appears as a step in Move 2: *Consolidation of research space*, while the latter is a step in Move 4: *Future Research*. This case is mainly found in the engineering disciplines.

Table 6.2: Moves in the Abstracts Appearing in the Introductions and Conclusions between SUT PhD Science and Engineering Disciplines

Move and Step types	**SUT PhD Science abstracts**	**SUT PhD Engineering abstracts**
Traditional moves in Abstracts		
-Introduction	4	11
-Purpose	22	25
-Method	19	25
-Product	24	24
-Conclusion	12	12
Moves/Steps from Introductions		
-Claiming centrality	3	3
-Topic generalization/Background	2 1	6 2
-Indicating a gap	22	25
-Purposes/aims/or objectives		
Move/Steps from Conclusions		
-Work carried out	22	25
-Centrality	-	2
-Gap	-	1
-Methods	19	25
-Findings	24	24
-Claims	5	2
-Significance	2	-
-Limitation	1	-
-Recommendations for future research	3 -	- 10
-Recommendation (in Move 4)		

6.1.3 Similarities and Differences of Move-Step Structures of Abstract, Introduction, and Conclusion Chapters in the Genre Set, and of the Relationship among the Three Elements in the Genre Set between the Two Disciplines

6.1.3.1 Similarities

Tables 6.3 and 6.4 summarize the similarities and differences in the move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set, and of the relationship among the three elements in the genre set written by SUT PhD students from the science and engineering disciplines in order to answer the third Research Question of the present study. In these two tables, the similarities and differences found in each genre of these PhD corpora are presented point by point.

Table 6.3: Similarities between SUT PhD Science and Engineering Disciplines

Abstracts: - Location in the PhD dissertations: first part - The *Introduction* move: the least frequency - The *Conclusion* move: same percentage - The *Purpose* move: mostly begin the section - The *Introduction* and *Conclusion* moves: optional - A sequence structure: linear the framework
Introductions: - Location: next to the Abstracts - Average word counts: nearly the same - Generic and Topic-specific headings: mostly found - Move 3, *Announcing the present research* move: outstanding - Variety of generic headings - Move 1, *Establishing a territory*: mostly begin the chapter - Move 1(*T*) and Move 3(*A*): obligatory - *Topic generalization*/*Background* step: obligatory - *Indicating a problem* or *need* steps: most frequent - Move 3, *Announcing the present research*: mostly end the chapter - *Work carried out* step: conventional - Move cycling: abundance - A single progression of M1(T)-M2(N)-M3(A): 6 PhD dissertations each - T-N cycles: most frequent **Conclusions:** - Location: last chapter - Conclusions heading : most used - Chapter's communicative purposes: same function - Move 1: *Introductory restatement*, and Move 2: *Consolidate of research space*: prevalence

Table 6.3: Similarities between SUT PhD Science and Engineering Disciplines (Cont.)

- Move 1: mostly begin the chapter - Move 2: obligatory - Move 2: largest part of the chapter - Move 3: *Practical implication and recommendation*: no evidence - Varieties of steps used - *Finding* / *Results* step: same percentage (most frequent) - Obligation of steps: none - A linear single progression of moves
Relationships: - Abstract, Introduction, and Conclusions: obligatory chapters - *Purpose* move in the Abstract: repeated in all three elements in the genre set - *Method*, *Product*, and *Conclusion* moves: omitted in the Introductions - *Method*, *Product*, and *Conclusion* moves: mentioned again in the Conclusions - *Purpose*, *Method*, and *Product* moves: crucial elements in the genre set - Abstract is closely related to the Conclusions than the Introductions - Relationship among the three genres in the genre set: significantly related

6.1.3.2 Differences

Table 6.4: Differences between SUT PhD Science and Engineering Disciplines

SUT PhD Science genre set	SUT PhD Engineering genre set
Abstracts	
- 232 words - *Purpose*, and *Method* moves: conventional - P-M-Pr: majority - 3 contain five moves - Less conform to the framework	- Twice longer (447 words) - *Purpose*, and *Methods* moves: obligatory - P-M-Pr-C: majority - Twice more (6) - More conform to the framework
Introductions	
- 5 Introductions have no sections - Statement of problems section: unnoticeable - Evidence of 3 moves: nearly all - Move 2: conventional - Step 1D in Move 2: optional - Move 3: the largest space (8%) - End the chapter with Move 3: nearly all - Step 1 in Move 3: optional - Move cycling: nearly half - Less conform to the framework	- 25 Introductions have sections - Statement of problems section: noticeable - All - Move 2: obligatory - Step 1D in Move 2: conventional - 5 times more (48%) - All - Step 1 in Move 3: obligatory - Move cycling: more than half - More conform to the framework
Conclusions	
- Average length: 4.1 pages - Begin the chapter with Move 2: 12% - More than half of the corpus: contain two moves - Move 4, *Future research*: optional - 5 most frequent steps: 4 are conventional - Less conform to the framework	- Average length: 5.3 pages - Twice more (84%) - Last section as "Future Studies": 76% - Twice more (24%) - More than half of the corpus: three moves - Move 4, *Future research*: conventional - 5 most frequent steps: all are conventional - More conform to the framework
Relationship among A, I, and C in the genre set	
- One move in the Abstract is repeated in three different elements in the genre set: *Purpose* move - The move with 100% maintenance: conventional - Communicative purposes in the Abstract has less conformity to Introductions and Conclusions	- Two moves: *Introduction* and *Purpose* moves - One move is obligatory, one is optional - More conformity to Introductions and Conclusions

Table 6.4: (cont.)

6.2 Pedagogical Implications

From the problems identified in this present study that the graduate students around the world especially the PhD ones are facing the difficulty in their PhD dissertation writing. The case of which can extend to Asian novice writers' writing issues as well (Swales, 1990; Samabhudhi, 1999; Flowerdew, 1995; Thompson, 2001; Bunton, 2002; Paltridge, 2002; Paltridge & Starfield, 2007; Min, et al., 2013). It is important to make PhD students aware of the English language knowledge of a particular genre through formal training in their graduate programs. Moreover, knowledge on genre is crucial in helping English for Academic Purposes (EAP) students to raise their consciousness of the ways genres are organized in order to express certain purposes. Explicit genre instruction on rhetorical moves helps shape non native English writer's knowledge of writing scientific papers. Besides, the discipline, genre, and PhD supervisors are the factors that influence the PhD dissertation writing for the students as they belong to the same discourse community. The writing practice produced by the students is the product of social interactions of the members in the disciplines where they belong. Therefore, the supervisors play a crucial role to construct the students' research writing. Genre analyses and their pedagogical implications based on this approach have been widely acknowledged including works from Swales (1990; 2004); Shaw (1991); Bhatia (1993); Bunton (2002; 2005); Samraj (2002a; 2002b; 2005; 2008); Peacock (2002; 2011); Swales & Feak (2004); Kanoksilapatham (2005; 2007; 2011); Kwan (2006); Cheng (2006); Pramoolsook (2008); Monreal et al. (2011); Ren & Li (2011); Huang (2014); Nguyen (2014). A genre-based approach is, therefore, to teach the future groups of science and engineering PhD students in Suranaree University of Technology discourse community in Thailand.

With regard to the teaching of the move-step structures of science and engineering PhD dissertations, the first three weeks of the graduate writing course will be dedicated for each chapter of a PhD dissertation (Abstracts, Introductions, Conclusions) which is separately taught in every two-hour lesson weekly. In the first lesson, it is important for the PhD students to know the concepts of discourse community, and communicative moves and steps together with the illustrated samples and discussions on why they are necessary and how they function. Then, the week lesson on the target genres (Abstracts, Introductions, and Conclusions) is followed. To do this, the main results of move-step structures of these three elements in the genre set from the two disciplines will be the point to focus. However, other details from the three frameworks (Hyland, 2000; Bunton, 2002; 2005) will also be elaborated to the students in order to help them gain more knowledge of how other PhD students from the same discipline but different discourse community practice their writing in the same genres. The five-step teaching instructions are detailed as following.

Firstly, the structures of the target chapters taken from these three frameworks (Hyland, 2000; Bunton, 2002; 2005) are given. However, the discussion on move-step structures of each chapter is needed to inform the graduate students before the mentioned frameworks are given because this will help them understand how the communicative purposes are linked to the rhetorical structure of each chapter (Swales, 1990). This very first step is crucial for PhD students to know the rationale behind the elements provided in the university's guidelines. Moreover, from the interview data of the present study, it is obvious that the writers simply followed the provided guidelines, their PhD supervisors and / or previous completed theses in their disciplines or Institutions without knowing that a PhD chapter structure is shaped by

its own communicative purposes in their own specialized fields. Although there are variations in dissertation writing guide book between the two fields as the interviewees mentioned, supervisors will be more able than their students to see what variations are conventional in their particular disciplines (Bunton, 2002; 2005).

Secondly, authentic examples of each dissertation chapter from SUTIR of which the moves/steps have been marked are provided to students. In this second stage, the notions of move cycles should also be introduced to students if they are found in the sample texts.

Thirdly, graduate students are asked to read other unmarked chapters and name the moves/steps. Samples of the dissertation chapters employed in this present study can also be used and provided as exercises or assignments for each group of students. This is to mark the moves/steps and the move-step structures of each chapter identified in the study. Such exercises are expected to familiarize these graduate students with a range of options for efficiently organizing the information in each chapter in a PhD dissertation which does not respond to the university's guidelines and handbooks on thesis writing. Also, through comparing the move-step structure identified in this present study, these graduate students will understand complexity and possible variations of the same chapter in a PhD dissertation due to different disciplinary cultures (Peacock, 2002; 2011). For instance, they will know that in the engineering PhD discourse community in SUT, the practice of opening and closing each chapter is absent in the science PhD dissertations from SUTIR.

Fourthly, the concepts of relationship among Abstract, Introduction, and Conclusion chapters in the genre set will be informed to the students as they will be given the ideas that there is relationship inside the PhD texts between the two fields.

This should be done by giving the sample texts to the students and ask them to find whether they see the relationship among the genre set or not. After that, the shared and connected communicative purposes between the three elements will be illustrated and described how they function and relate to each other. Besides, the fact that some moves are employed in all the three different elements means that the same move has to be presented in three different forms of writing. This requires a good paraphrasing skill in the writers. To teach this skill, examples of move that are retained in all Abstract, Introduction, and Conclusion chapters will be given to the students, so that they see how the moves are paraphrased or rewritten in different ways. This is to provide them options of how to write the same communicative purposes in three different formats or patterns in the three different elements in the genre set.

Finally, the PhD students are provided an opportunity to write an example of each genre on their own. This task can be given to the students as class assignments. These five-step instructions in teaching move-step structures of Abstract, Introduction, and Conclusion chapters in the genre set to future science and engineering graduate students are expected to provide a clearer picture of what constitutes an acceptable dissertation and raise their consciousness of composing the focused genre in their own disciplines, PhD dissertations at Suranaree University of Technology.

6.3 Recommendations and Limitations for Future Studies

The suggestions for further research that can benefit from this current study are based on the result of the fact that there are insufficient studies into academic and professional English writing in Thai science and engineering PhD contexts, as

previously mentioned in the Introduction and Literature Review chapters. Given this lack, Thailand can be a source of conducting a wide range of research that should be of interest to the international community of academic writing and genre practitioners and researchers. According to the present study that analyzed the move-step structures and the relationship among only the three genres (Abstract, Introduction, and Conclusion chapters) in the genre set of the PhD dissertations, the significant area that can be further explored is the textual analysis of complete PhD dissertations written by Thai students in English from various disciplines. Moreover, to have a clearer picture of how these groups of science and engineering PhD students compose their dissertations, conducting the particular research from universities across Thailand would yield better results.

In addition, there are some universities in Thailand that have currently provided PhD programs in English in other disciplines for supporting the Thai students who do not have an opportunity to study in domestic or international universities that offer English program. A similar study project to the present one can then be conducted to find out the unexplored move-step structures and the relationship among the genres inside the students' PhD dissertations from other universities across Thailand, following the frameworks of this present study (Hyland, 2000; Bunton, 2002; 2005) or the more compatible models in the future.

Another unaddressed area of Thai PhD dissertation that should be worth investigations in the future is the studies on linguistic features in Abstract, Introduction, and Conclusion chapters. This would be very helpful to the PhD writers because the appropriate linguistic features e.g., tense/verbs should be parts of structural moves explanation, and they should be seen as resources instead of rules in

academic writing (Hyland, 2004; Swales, 1990; 2004; Huang, 2014). As revealed in Huang's (2014) study on PhD students writing for their publication in English that the linguistic features help the students gain formal knowledge, process knowledge, and rhetorical knowledge. Further studies, therefore, are needed to extend the similar study to find out the typical linguistic features used in each PhD dissertation chapter.

Finally, future research comparing the move-step structures inside the PhD dissertations should be conducted to find out the disciplinary variations between two or more related disciplines (Samraj, 2002a; 2002b; 2005). This will be helpful for the PhD students to have more knowledge about the writing practice complexity and possible move-step structure variations of the same chapter in the dissertation of other related PhD fields due to different disciplinary norms, nomenclature, bodies of knowledge, sets of convention, and mode of inquiry (Swales, 1990; Becher & Trowler, 2001; Pramoolsook, 2008). However, the uneven number of text available in each field under the engineering discipline may affect the study results. Therefore, future studies should also be aware of the selection of the texts for a more reliable corpus management. Moreover, gaining more qualitative data from the discourse-based interviews to enrich the move-step structure findings for further analyses, interviews with the real authors of the texts would give better insights on their writing process in the genres. Last but not the least, every single detail of the move-step structures or the surface structures inside the texts has meanings. It is suggested that future research of this particular area should not ignore the communicative purposes, details, or messages that the writers are conveying to the readers.

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APPENDIX A

EXAMPLES OF SCIENCE MOVE-STEP STRUCTURE ANALYSIS PILOT CORPUS

1. Abstract (SC_Diss 24)

Chitinase A from *Vibrio carchariae* is an endochitinase that degrades chitin, yielding GlcNAc2 as the end product. To understand the mode of enzyme action, four crystal structures of wild-type chitinase A, mutant E315M without substrate and mutant E315M in complex with NAG5 and NAG6 were refined at 2.00 Å, 1.70 Å, 1.72 Å and 1.80 Å resolution. The overall structure of chitinase A comprises three separate domains; an *N*-terminal chitin-binding domain, a catalytic (β/α)8-TIM-barrel domain, and a small (α+β) insertion domain. The substrate binding cleft of the enzyme has a long, deep groove structure of 33 Å × 14 Å and comprises multiple binding sites extended from subsite -4 (at the non-reducing end) to subsite +2 (at the reducing end). The crystal structures of E315M-NAG5 and E315M-NAG6 revealed that the enzyme bound to the straight conformation of NAG5, but to the bent conformation of NAG6. The transient conformation of -1 NAG observed in the electron density map of E315M-NAG6 complex strongly suggested that the interacting sugars adopted a conformational change to facilitate hydrolysis. Several conserved aromatic residues that lie along the substrate binding cleft are found to act as the binding residues, by forming hydrophobic stack against the pyranose rings of the bound sugars.

Point mutations of Trp168, Tyr171, Trp275 and Trp570 to glycine and Trp397 to phenylalanine significantly changed the cleavage patterns against chitooligosaccharides, indicating that these residues are important for the hydrolysis of soluble chitin.

M1: Introduction

M2 & M3 Purpose & Method

M4: Product

M5: Conclusion

2. Introduction Chapter (SC_Diss 16)

1.1 Rationale of study

Crystal growth has prominent role to play in the era of immense technological excellence attributing to the usefulness of many crystals in important areas of service to the humanity namely science, medicine, engineering, technology and also strategic areas of defence and space science. In addition, many crystals be as useful as elements in piezoelectric, accousto-optic, photo-refractive, photo-elastic, elasto-optic applications and also as radiation detectors, laser hosts, parametric amplifiers, transducers, harmonic generators, bragg cells etc., (Junaidah Osman et al., 1998; Wenhua Jiang, 2003; Mackay Salley, 2002)…….

M1S1 Claiming Centrality

Further- more, the great and wide potential of oxide superconductors with high transition temperatures could not be explored so far because proper crystal growth and ma- terials technology development was neglected (Santhanaraghavan and Ramasamy,2001)…….

M2 S1B Indicating a problem or need

Crystal growth is more often an art than a science and many trials are often necessary before good crys- tals of a given material may be produced. Buckley (1951) has elegantly put the matter, “It should be remembered that, in the preparation of large crystals, the touch of the artist is about as important as the application of established scientific principles”…..

M1S4 Reviewing Previous research

From this point of view, we have attempted to grow unidirectional, bulk, good quality single crystals of organic and semiorganic NLO from its aqueous solution by SR method.

1.2 Research objective

The objectives of this thesis are as follow:…..

M3S1 Purposes/aims /objectives

1.3 Scope and limitation of the study

1.3.1 Synthesis and growth of SA, LAM, LAMD and LPZ seed crystals were carried out using the conventional slow evaporation method……

M3S2 Work carried out

3. Conclusion Chapter (SC_Diss 8)

6.1Conclusion

The structure correlation method was used to explore the character of five fused six-membered ring friedelane skeletons. The favored conformation of friedelane skeletons is chair-chair-chair-boat-boat or S form which has an average bond distance 1.548(19) Å. The average endocyclic bond angles at secondary and tertiary carbon atoms are larger than 109.4°, as 114.1(20)° and 113(3)°, respectively, while quaternary carbon atoms are less than 109.4° as 108.3(10)°. The average torsion angles for rings A-E are 54(6)°, 54(6)°, 54.3(21)°, 39(7)° and 41(6)°, respectively, which can confirm the ring conformation of friedelane skeletons.

M1 Work carried out

M2 Results / Claims

The structure correlation method can also indicate anomalous structures in the structure database for which the values of structure parameters deviate from normal values. The method was used to identify a disordered structure in the database by structure correlation of the 34 compounds that contain saturated five fused six-membered rings with the oxygen atom attached to C3 of ring A.

M1 Work carried out

6.2 Suggestions for Further Study

The previously undescribed >C(δ+)···O(δ-) supramolecular carbonyl-ether intermolecular interaction synthon can be added to the library of synthons available to enable the design and manipulation of molecular systems such as those found in the field of rational drug design, crystal engineering, supramolecular chemistry and physical organic chemistry. Additional studies of spectroscopy such as infrared spectroscopy, and *ab initio* molecular orbital calculations should be used to provide a better understanding of this interaction.

M4 Future research

APPENDIX B

EXAMPLES OF ENGINEERING MOVE-STEP STRUCTURE ANALYSIS PILOT CORPUS

1. Abstract (EN_Diss 24)

Braille characters have been devised to assist blind people in reading and writing. The system has been adopted in almost all languages. Conventional Braille characters have been recorded by hand using a slate and stylus, or by a Braille type writer. Moreover, Refreshable Braille Display System (RBDS) has also been recently developed. RBDS is a human-computer interface utilized to create refreshable raised dots in order to present information. Demand for this device has been dramatically increasing in consumer markets and other tangible applications, while the requirements in terms of reliabilities have been driving forces adapting its various mechanisms. However, commercial products are currently expensive due to their complex mechanisms and special fabrication techniques. Among numerous Braille displays, Micro-Electro-Mechanical Systems have been utilized to revolutionize these product categories. Nevertheless, its applications in tactile display have been limited due to several factors. Based on repeated fabrication by micro-molding of polymer and electroforming used in Lithographic Galvonoformung Abformung (LIGA) technologies, RBDS with lower cost and better performance can be achieved. This thesis concentrates on realization of tactile dots for RBDS utilizing X-ray LIGA process which is performed at the beamline BL-6 of the Synchrotron Light Research Institute (Public Organization), Ministry of Science and Technology, Thailand. Two specific tactile display mechanisms were formulated regarding the design of X-ray LIGA based on the pneumaticRBDS. The first mechanism that the tactile display can actively raise the tangible dot up with a thin PDMS membrane has been evaluated through the strength of suspended PDMS membrane on the X-ray LIGA structure. The

M1 Introduction

M2 Purpose

second mechanism that the single tactile dot can perform similar to the conventional tangible dot has been considered through a complicated X-ray LIGA structure. The tactile dot as a piston inside a cylinder has been successfully fabricated, resulting in the robust and obvious perception under the applied pressure. Consequently, the refreshable tactile displays improved from these mechanisms were realized by combining them together for the first X-ray LIGA tactile display. The tactile dot was placed on the suspended PDMS membrane to create the spring element. It can operate as the rigid tactile display with the maximum applied pressure of 16.87 kPa resulting in the actuated force of 76.71 gf. Furthermore, the second X-ray LIGA tactile display was improved by adding two curved segments of metal under the tactile dot. It is operated as the refreshable tactile display with the maximum load of 10 g required the applied pressure of 109.48 kPa. To increase the performance of the refreshable tactile display systems, the curled-up closure plate microvalve was combined instead of the conventional valve. The microvalve was positioned under the tactile display with PDMS spring element and controlled by high dc voltage. In the repeat operation as the RBDS, the tactile dot can be move upward and downward at the actuated voltage of 150 V with maximum distance of 120 μm and 42.98 kPa applied pressure. This innovation is demonstrated the possibility to bring out a new system that invents tactile display device as a new interface for visually impaired people.

M3 Method

M4 Product

M5 Conclusion

2. Introduction Chapter (EN_Diss 08)

1.1 Background

Growth rate dispersion (GRD) is a phenomenon, known as a problem in the crystalline product industries, where individual crystals of the same initial sizes do not grow at the same rate even when they are subjected to identical temperatures, supersaturation levels and hydrodynamic conditions (Mitrovic et al., 1997). The phenomenon has a significant effect on the crystal size distribution from industrial crystallizers, with significant decrease in product quality. It was first shown experimentally for sucrose, an industrially significant product grown primarily in batch crystallizers (White and Wright, 1971). In the thirty years since this initial study a large amount of research has been conducted to determine the causes and mechanisms of GRD and to model its effects. A better understanding of GRD is important for various reasons. Since it provides information about the growth process taking place at the crystal surface, the nature and magnitude of the GRD may give information about the growth mechanism.This will substantially benefit users of industrial crystallizers and improve the capability of crystallizer modeling as well as the design of higher performance crystallizers.

While a number of significant advances have been made, the mechanisms of GRD are still not fully elucidated. … As discussed above, the crystal growth rate results obtained from the different types of the crystallizer should be compared to conclude which growth rate measurement technique can provide the most reliable results. The causes of GRD based on the growth mechanism (diffusion and surface integration mechanism) should also be considered.

1.2 Objective….

1.3 Scope of Work…

1.4 Output

M1S2 Topic generalization

M1S1 Claiming centrality

M3S7 Significance

M21A Indicating a gap in the research

M3S7 Significance

M3S1 Purpose

M3S2 Work carried out

3. Conclusion Chapter (EN_Diss 16)

6.1 Summary and conclusions

This thesis is made to meet three main objectives. The first is to develop the generalised critical state model for structured clays based on the Structured Cam Clay model (Liu and Carter, 2002) for explanation of clay behaviour in different structured states. The second is to improve a generalised model for structured clay for better simulation of the stress-strain behaviour in overconsolidated state. The third is to implement the developed model into the finite element code to study the inhomogeneous stress-strain behaviour influenced by the strength of soil cementation structure. In the following sections, the conclusions obtained from the study are summarised.

M1
Work carried out

6.1.1 Modified effective stress concept

The modified or explicit mean effective stress presented in Chapter III has been successfully adopted to generate the state boundary surface for structured clay in the q / p¢ - p¢ / p¢ plane……. The implemented MSCC model in finite element analysis was used to simulate the inhomogeneous stress-strain behaviour of triaxial compression test influenced by soil cementation structure. It was seen that the increase in the strength of soil-cementation structure increased the inhomogeneity in the specimen. The inhomogeneity of stress-strain behaviour is dependent on the initial stress state before shearing and structural properties of soil mass. For chemical stabilised soil, the increase in cement or lime content leads to the significant difference in the stress- strain behaviour at local element level under drained and undrained conditions.

M2
Method, results, Caims

6.2 Recommendations for future work

The single element and finite element analyses of MSCC model presented in this research study have demonstrated the very good predictive capabilities for structured clays. However, the model limits only for monotonic loading and clayey soil, some extension of the model and numerical analysis for actual structures field problems are still required before the general validity of the series of MSCC models can be fully established….

M4 Future research: Recommendations

APPENDIX C

DETAILS OF THE QUESTIONAIRE SURVEY

The questionnaire survey was conducted at SUT in March, 2011. It was randomly distributed to the main academic areas around campus, for example, the students' laboratories, the library, the classrooms, and the dormitories.

The questionnaire was created in both Thai and English versions which consists of two main parts, namely; demographic information of the students, and the open-ended questions to ask their opinions on the issues concerning; 1) their background knowledge about the structures of other types of academic documents that the students have to deal with not only dissertation writing, 2) their existing knowledge about other academic documents written by students from various disciplines in SUT, 3) their English writing difficulties, and 4) the students' needs to improve their academic writing skills. The questions were approved by the research supervisor.

At the end of the survey, the information was gathered from 107 SUT graduate students. There were 100 PhD students and 7 Master's students from various disciplines. However, the minority of the students were social science disciplines. The survey results indicated that 99 (97 PhD, and 2 Master's students) of them had to write their dissertations in English and only 8 of them, including 2 PhD students, had to write in Thai. One hundred and one of them were Thai, 4 of them were Chinese, and the other 2 were Vietnamese. Ninety-eight of them were in the middle of their research process, and 9 of them already completed their research. As for the students'

opinions toward the dissertation structure, 26 of them agreed that dissertation structure was similar in all disciplines, 12 thought that it was totally different**,** varying across disciplines, 60 of them thought it contains both similar and different elements in the structure**,** 13 of which gave some examples to support their knowledge on what should be in the dissertation structure. Only 9 students had no idea about this question. Information gathered from Part 2 (open-ended questions), knowledge, needs and problems in dissertation writing, indicated that apart from the dissertation, most of the students have to write research articles, presentation, progress reports, and lab reports in English as well. In addition, some of the students have to write proposals, essays, examination papers as well as seminar class papers. In terms of the difficulties that the students had to face while writing their dissertations in English, the majority of them mentioned that 1) the lack of grammatical knowledge, 2) the selection and use of appropriate vocabulary, as well as 3) the sentences composition are their main problems. To probe further on the students' knowledge of dissertation structures from the first part of the questions, answers were expressed in a wide range of idea. Most of them reported that there are differences in dissertation structures across disciplines, especially from the different content in science and social science inside the dissertations. However, only 19 of them mentioned that the main chapters in each discipline should be named according to the SUT's dissertation writing regulations. So, the dissertations can be both similar and different, depending on the content and the structures in each discipline. However, a big number of students (22 students) mentioned that they had no idea about this issue as they had never read dissertations from other fields. Finally, help to support the improvement of academic English writing for the students was necessary. When the students were asked about the needs

to improve their academic writing, they reported that knowledge on how to 1) use grammatical structures, 2) select appropriate words or sentences to write in their academic documents, and 3) write effectively English was needed the most, respectively. Moreover, support from relevant organizations, writing courses as well as reading as much as research articles were also mentioned by the students to be helpful for them to overcome those difficulties. As a result, the specialized comprehensive courses and services are very much needed for the students, which further emphasizes what reported in the study of PhD students' research articles writing by Pramoolsook et al. (2011).

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APPENDIX D

DISCOURSE-BASED INTERVIEW QUESTIONS

The following questions were designed to ask the informants including the supervisors from both of the science and engineering disciplines in Suranaree University of Technology in order to enrich the move-step findings of this study. The answers from these questions are described as the listed excerpts in Chapter 4, and Chapter 5 of the present study.

1.Questions for the science representatives

Question 1: I have found that one abstract in your discipline employs only one move to write (the *Product* move), what do you think about this? Can you please explain this to me?

Question 2: According to the survey on the surface structure of the science Introductions, I have noticed that the science writers usually have Topic-Specific headings instead of generic ones, can you please explain this?

Question 3: Almost all of the science Introductions end the chapter with Move 3, *Announcing the present research*, however, the only one in the corpus employs Move 1, *Establishing a territory* to close the chapter. Can you please give me the possible explanation to this variation?

Question 4: Many of you do not usually provide details inside chapter structure in the Introductions, can you please explain to me about this?

Question 5: More than half of you do not have sections in the Conclusion chapter, what makes you think that having section in the chapter is not important for in order to write this chapter in the PhD dissertation?

Question 6: What is the most important content to be summarized in your Conclusion chapter?

Question 7: Why do you usually evaluate methods or products in the Conclusion chapter?

Question 8: Do you think that the three elements of Abstract, Introduction, and Conclusion chapters are related to each other? If you think they do, please explain how are these three genres related?

2. Questions for the engineering representatives

Question 1: In the search for the move in the engineering abstracts, why you do not usually put some introductory statements in this particular genre?

Question 2: Nearly all of the engineering Introductions open the chapter by informing the reader about background or claiming centrality of your research, however, only one in the corpus begins this chapter by talking about the problems from previous studies. Can you possibly please explain about this?

Question 3: What makes you think that writing about general background of your study is the most crucial element in the Introduction chapter in your discipline?

Question 4: According to my study, I have found that all the Conclusions in the engineering corpus use a direct structure of either *Introductory restatement > Consolidation of research space > Future research*, or *Introductory restatement > Consolidation of research space*, and *Consolidation of research space > Future research*. Do you think that this is a good way to provide the summary of your research in this chapter? Please give reasons?

Question 5: I can see from the concluding chapter in your engineering discipline that more than half of you usually evaluate about the methods and products in the chapter. Why these elements are quite important for you to write in this chapter?

Question 6: Do you think that the three elements of Abstract, Introduction, and Conclusion chapters are related to each other? If you think they do, please explain how are these three genres related?

APPENDIX E

LIST OF PHD DISSERTATIONS USED FOR THE ANALYSES

1.The SUT Science Corpus

SC1 Phothikanith, A. (2003). *Single Crystal X-ray Characterization and Structure Correlation of Pentacyclic Friedelane Ring System* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC2 Charoen-In, U. (2010). *Growth of Some Inorganic, Organic, and Semi-Organic Nonlinear Optical Crystals by Sankaranayanan-Ramasamy Method and Their Characterization* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC3 Songsiriritthigul, C. (2007). *Structural and Functional Characterization of Chitinase A from Vibrio carchariae* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC4 Intarawichian, N. (2008). *A Comparative Study of Analytical Hierachy Process and Probability Analysis for Landslide Susceptibility Zonation in Lower Mae Chaem Watershade, Northern Thailand* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC5 Tienwong, K. (2008). *Applications of Geoinfomatics Technology to Land Evaluation for Energy Economic Crops in Western Thailand* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC6 Saravisutra, A. (2010). *Urban Growth Pattern Modeling and Quality of Life Prediction in Mueang Nakhon Ratchasima District* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC7 Klongdee, W. (2010). *Minimal Initial Capital and Value Function Problems in Insurance* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC8 Sompong, J. (2008). *Numerical Computation of the Flow and Heat Transfer over Two Rotating Circular Cylinders* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC9 Srihirun, B. (2005). *Application of Group Analysis to Stochastic Differential Equations* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC10 Boontawan, P. (2010). *Development of Lactic Acid Production Process from Cassava by Using Lactic Acid Bacteria* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC11 Chumkhunthod, P. (2004). *Lectins from Tropical Mushrooms* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC12 Rugmai, W. (2006). *The Paleoenvironment and Vegetation Change during the Late Quaternary Period of Southern Thailand from the Palynological Record* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC13 Chookietwattana, K. (2003). *Diversity of Halophilic Bacteria in Saline Soil at Nong Bo Reservor, Mahasarakham Province, Thailand* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC14 Suriyapong, Y. (2003). *Study of Ground Dwelling Ant Populations and Their Relationship to some Ecological Factors in Sakaerat Environmental Research Station, Nakhon Ratchasima* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC15 Khanema, P. (2009). *Carbon Sequestration and Turnover by Vetiver (Chrysopogon SPP.)* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC16 Sawangchote, P. (2003). *Systematic Study of Tertiary Leaves of Anacardiaceae and Leguminosae from LI and Mae Moh Basins, Northern Thailand, Using Leaf Architectural Analysis* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC17 Siritapetawee, J. (2004). *Comparison of Functional and Structural Properties of an Outer Membrane Porin between Burkhloderia pseudomallei and Burkhloderia thalandensis* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC18 Chantarangsee, M. (2006). *Characterization of β-Galactosidase from Rice (Oryza sativa L.)* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC19 Jungthawan, S. (2007). *Effects of Ordering in III-V Semiconductor Alloy Systems: A Theoretical and Computational Study* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC20 Chunjarean, S. (2009). *High Field Insertion Devices for Low Energy Electron Storage Rings* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC21 Payaka, A. (2009). *AB Initio Qm/Mm Md Simulations of Formate (HCOO) and Acetate (CH_3COO) Ions in Aqueous Solution* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC22 Intharathep, P. (2006). *Applications of Combined Qm/Mm-Md Simulations in the Study of Ammonium and Hydronium Ions in Aqueous Solution* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC23 Kruapech, S. (2009). *Development of Eye-Safe Laser Range Finder* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC24 Kaewkasi, P. (2008). *Effects of Threshold on Detection Performance of Modified Amplitude-Modulated Joint Transform Correlations* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

SC25 Suripon, U. (2005). *Automatic Target Recognition by Using Joint Transform Correlator with Compressed Reference Images* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

1.The SUT Engineering Corpus

EN1 Pantaraks, P. (2004). *A Study into the Mechanism of Crystal Growth Rate Dispersion* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN2 Suebsuk, J. (2010). *Development of the Modified Structured Cam Clay Model and Finite Element Implementation* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN3 Phatthanakun, R. (2009). *Development of Pneumatic Braille Display System Using High-Aspect-Ratio Microstructure* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN4 Somnuk, U. (2007). *Studies of Crystallization of Natural Fibers-Polypropylene Composites* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN5 Kaewdoungdee, N. (2006). *Effects of Trans-Reserveratrol and Red Grape Products on Absorption and Liver Ultrastructures of Mice, Cytotoxicity, Cell Cycle Arrest, and Induction of Adoptosis in Human Cancer Cell Lines* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN6 Pimpan, P. (2006). *Investigations and Mathematical Modeling of Cadmuim Removal from Industrial Wastewater in Constructred Wetlands* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN7 Tantrakarnapa, K. (2003). *Performance Evaluation and Modeling of Upflow Anaerobic Sludge Blanket Process Treating Dairy Wastewater* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN8 Perbangkhem, T. (2008). *Waste Recovery in Constructed Wetlands Using a Combination of Aquatic Plant and Fish* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN9 Racho, P. (2009). *Investigation of Downflow Hanging Sponge (DHS) System Using Bacterial and Fungal Cultures as a Post Treatment for the UASB Effluent of a Tapioca Starch Wastewater* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN10 Kruaysawat, S. (2006). *Increasing Adsorption Efficiency of Activated Carbon for H_2S Removal by Surface Oxidation and Metal Addition* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN11 Krachodnog, P. (2007). *Microstrip Reflectarray Antenna Using Backcattering Technique* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN12 Greyson, K.A. (2011). *Contigency Analysis Model for Power Systems Based on Agents* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN13 Kumsawat, P. (2005). *Digital Image Watermarking Using Multiwavelet Transform* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN14 Maneedang, A. (2010). *An Investigation into Inhibition of Precipitation in Mixed Anionic Surfactant Systems* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN15 Weerachanchai, P. (2009). *Studies of Biomass Pyrolysis and Gasification for Fuel Production* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN16 Promraksa, A. (2008). Reduction of Dextran Contamination in Raw Sugar Production (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN17 Ngernyen, Y. (2007). *Wood-Based Activated Carbon: Preparation, Surface Modification, and Adsorption Study* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN18 Junpirom, S. (2006). *Activated Carbon from Longan Seed: Its Activation Model and Adsorption of Water Vapor and Benzene* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN19 Mueansichai, T. (2012). *A Study of Nucleation by Attribution in Agitated Draft-Tube Baffle Crystallizers* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN20 Srisa-nga, S. (2005). *The Effect of the Mutarotation Reaction on the Crystallization of Glucose Monohydrate* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN21 Luangkiattikhun, P. (2007). *Activated Carbon from Oil-Based Palm Solid Wastes: Preparation and CFD Simulation of Spouted Bed Activator* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

EN22 Koonsrisuk, A. (2009). *Analysis of Flow in Solar Chimney for an Optimal Design Purpose* (PhD thesis). Suranaree University of Technology, Nakhon Ratchasima.

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Yanumart Saengsai was born on September, 25, 1978 in Nakhon Phanom Province, Thailand. She received a B.Sc. in Biology from Khon Kaen University in 2000 and obtained an M.A. in English from Khon Kaen University in 2003. Six years later, Yanumart Saengsai were granted a scholarship from Rajamangala University of Technology Isan, Khon Kaen Campus to pursue her doctoral degree in English Language Studies at Suranaree University of Technology, which she completed in 2015. Her academic areas of interest mainly lie in Genre Analysis, Second Language Acquisition, and Applied Linguistics. Yanumart Saengsai currently works as an English lecturer at English for International Communication Department, Technical Education Faculty, Rajamangala University of Technology Isan, Khon Kaen Campus.

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