

**RHETORICAL STAGES AND LINGUISTIC
RESOURCES IN THE 'RESULTS AND
DISCUSSION' SECTIONS OF
RESEARCH ARTICLES ON
MATERIAL SCIENCE AND
AGRICULTURAL
SCIENCE**

GUO BING WU



**PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH**

**THESIS SUBMITTED IN FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY**

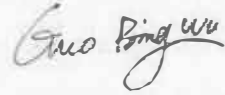
**CENTRE FOR THE PROMOTION OF KNOWLEDGE
AND LANGUAGE LEARNING**

**UNIVERSITI MALAYSIA SABAH
2020**

DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, excerpts, summaries and references, which have been duly acknowledged.

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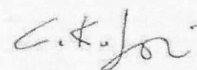
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ABSTRACT

Competence in writing and publishing research articles (RAs) has become increasingly important for academicians and postgraduate students who intend to achieve greater heights in institutions of higher learning. Despite the voluminous literature on research writing, the 'Results and Discussion' sections (RDSs) of research papers in certain hard sciences have not been studied in detail in previous genre-based investigations. Such research gaps are especially noticeable in (i) cross-disciplinary studies, and (ii) linguistic research involving academic disciplines such as Material Science and Agricultural Science. To assist novice researchers in these applied sciences, this study focuses on identifying the useful information elements and linguistic resources that expert writers use in the RDSs of research articles in the two disciplines, namely Material Science and Agricultural Science. It aimed to ascertain the extent to which the frequencies of rhetorical categories (moves and steps) and the percentages of texts containing each category in Material Science RDSs differ from those in Agricultural Science RDSs. This study was also intended to explore the linguistic resources which are employed to perform each of the rhetorical moves and steps in the two disciplines concerned. With respect to research methods, a total of 60 research articles were collected from six established journals in the two disciplines, each of which was represented by 30 articles obtained from three international refereed journals indexed in Web of Science. The investigation was conducted using (i) Swales' (1990, 2004) framework for analysing rhetorical moves, (ii) Lim's (2005, 2008, 2009, 2010, 2014, 2017, 2018, 2019) techniques for describing salient linguistic resources for rhetorical steps, and (iii) Bhatia's (1993) principles for eliciting information via face-to-face interviews with specialist informants in the disciplines concerned. In regard to research results, the researcher has found seven rhetorical moves containing a total of 16 constituent steps in the RDSs in both disciplines. So far as frequencies are concerned, the first three moves, comprising 'setting a stage for research results', 'presenting results' and 'explaining results', constitute the obligatory moves in both disciplines, but differences in the mean frequencies of specific rhetorical steps in these three moves have also been identified across the two disciplines. 'Comparing results' has been ascertained as a quasi-obligatory move in both fields, while the mean frequencies of most rhetorical moves have been found to be lower in Material Science RDSs compared to Agricultural Science RDSs. While the last three moves ('making a generalisation', 'evaluating the study', and 'making deductions from the study') constitute only optional moves in Material Science RDSs, they are quasi-obligatory in Agricultural Science RDSs. My specialist informants' inputs are largely consistent with the findings obtained on the degrees of prevalence of each constituent step in both disciplines. In terms of linguistic realisations, this study has ascertained a broad spectrum of recurrent linguistic resources which are used in the RDSs. While some commonalities in linguistic realisations have been identified across the two disciplines, important divergences have been found in the use of major linguistic categories, particularly noun phrases, verb forms and adverbials which are written to perform the specific communicative functions in only one of the disciplines. Such cross-disciplinary differences are evident in certain constituent steps, especially 'providing background information', 'reiterating research procedures', and 'describing a category or group'. Based on the findings, it is recommended that the recurrent linguistic resources identified in this investigation be flexibly used by instructors and material developers to prepare appropriate teaching materials aimed at helping novice writers and second language writers to comprehend and write the 'Results and Discussion' sections in the two applied sciences.

ABSTRAK

TAHAP RETORIKAL DAN SUMBER LINGUISTIK DALAM BAHAGIAN 'DAPATAN KAJIAN DAN PERBINCANGAN' MAKALAH JURNAL SAINS BAHAN DAN SAINS PERTANIAN

Kebolehan menulis dan menerbitkan makalah jurnal menjadi semakin penting untuk ahli-ahli akademik dan pelajar pascasiswazah yang ingin meningkatkan tahap pencapaian dalam institusi pengajian tinggi. Meskipun terdapat banyak karya yang telah diterbitkan dalam bidang penulisan untuk tujuan penyelidikan, bahagian 'Dapatan Kajian dan Perbincangan' (DKP) dalam laporan penyelidikan dalam bidang sains gunaan belum lagi dikaji secara terperinci dalam kajian lepas mengenai genre. Kekurangan kajian ini adalah jelas, khususnya dalam (i) kajian silang disiplin, dan (ii) penyelidikan linguistik yang melibatkan Sains Bahan dan Sains Pertanian. Untuk membantu penyelidik muda dalam disiplin sains gunaan, kajian ini bertujuan mengenal pasti unsur-unsur maklumat dan sumber-sumber linguistik yang lazim digunakan oleh penulis-penulis pakar dalam bahagian DKP makalah jurnal dalam dua disiplin, iaitu Sains Bahan dan Sains Pertanian. Secara khusus, kajian ini bertujuan meninjau sejauh mana DKP Sains Bahan berbeza dari DKP Sains Pertanian dari segi kekerapan kategori retorikal (gerak dan langkah) dan peratusan teks yang mengandungi setiap kategori tersebut. Penyelidikan ini juga bertujuan meninjau sumber-sumber linguistik yang digunakan dalam setiap gerak dan langkah retorikal dalam dua disiplin berkenaan. Mengenai kaedah kajian, sejumlah 60 makalah penyelidikan telah dikutip dari enam jurnal terkemuka dalam dua disiplin tersebut, dan setiap disiplin diwakili oleh 30 makalah yang diperoleh dari tiga jurnal antarabangsa berwasit yang terindeks dalam Web of Science. Kajian ini dijalankan dengan berdasarkan (i) rangka analisis yang dipelopori oleh Swales (1990, 2004) untuk menganalisis gerak retorikal, (ii) teknik penghuraian sumber-sumber linguistik yang dicadangkan oleh Lim (2005, 2008, 2009, 2010, 2014, 2017, 2018, 2019) untuk mengkaji langkah-langkah retorikal, dan (iii) prinsip yang ditentukan oleh Bhatia (1993) untuk memperoleh maklumat melalui temubual bersemuka dengan pakar-pakar dalam bidang berkenaan. Berkenaan dengan hasil kajian ini, penyelidik telah mendapati bahawa penulis yang berpengalaman menggunakan tujuh gerak retorikal yang merangkumi sejumlah 16 langkah dalam DKP dua bidang tersebut. Dari segi kekerapan, tiga gerak retorikal yang pertama, iaitu 'bersedia untuk melaporkan hasil kajian', 'membentang hasil kajian' dan 'menjelaskan hasil kajian', merupakan gerak retorikal yang wajib (obligatori) dalam dua disiplin berkenaan, tetapi perbezaan juga boleh dikesan dari segi kekerapan purata (kekerapan min) untuk langkah-langkah tertentu dalam tiga gerak retorikal utama dalam dua disiplin berkenaan. 'Membanding hasil kajian' juga telah dikenal pasti sebagai satu gerak retorikal yang bersifat separa wajib (obligatori-kuasi) dalam kedua-dua bidang, sedangkan kekerapan purata untuk kebanyakan gerak retorikal adalah lebih rendah dalam DKP Sains Bahan berbanding dengan DKP Sains Pertanian. Tiga gerak retorikal yang terakhir ('membuat generalisasi', 'menilai kajian' dan 'membuat deduksi dari kajian') merupakan gerak opsyenal dalam DKP Sains Bahan, tetapi merupakan gerak retorikal yang bersifat obligatori-kuasi (separa wajib) dalam DKP Sains Pertanian. Input yang diperoleh daripada pakar-pakar bidang tersebut adalah sejajar dengan hasil kajian penyelidik berkenaan dengan tahap kelaziman setiap langkah retorikal dalam dua disiplin berkenaan. Dari segi realisasi linguistik, kajian ini telah mengenal pasti pelbagai sumber linguistik yang berulang kali digunakan dalam DKP tersebut. Persamaan dalam realisasi linguistik telah dikenal pasti dalam dua disiplin tersebut, sedangkan perbezaan yang ketara juga didapati wujud dalam penggunaan kategori linguistik, khususnya dalam penggunaan frasa nama, bentuk kata kerja dan adverbial yang bertujuan melakukan fungsi komunikatif dalam sesuatu disiplin. Perbezaan antara dua disiplin tersebut adalah lebih nyata dalam langkah-langkah retorikal tertentu yang berkaitan dengan tujuan 'membekalkan maklumat latarbelakang', 'mengulangi prosedur penyelidikan', dan 'memberi huraian mengenai sesuatu kategori/kumpulan'. Berdasarkan hasil kajian ini, adalah dicadangkan bahawa sumber linguistik yang lazim digunakan itu diperkenalkan kepada pengajar dan pereka bahan agar mereka dapat menyediakan bahan pengajaran yang sesuai untuk membantu penulis muda dan pelajar (bahasa Inggeris sebagai bahasa kedua) memahami dan menulis bahagian DKP dalam dua bidang sains gunaan berkenaan.

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LIST OF ABBREVIATIONS

AS	:	Agricultural Science
CaRS	:	Create a Research Space
DS	:	Discussion Section
DSs	:	Discussion Sections
EAP	:	English for Academic Purposes
EGAP	:	English for General Academic Purposes
EGP	:	English for General Purposes
ELT	:	English Language Teaching
EOP	:	English for Occupational Purposes
ESAP	:	English for Specific Academic Purposes
ESL	:	English as a Second Language
ESP	:	English for Specific Purposes
IMRD	:	Introduction, Methods, Results and Discussion
ISI	:	Institute for Scientific Information
JCR	:	Journal Citation Reports
L2	:	Second Language
MS	:	Material Science
NR	:	New Rhetoric
Ob.	:	Obligatory
Op.	:	Optional
Q.	:	Quasi-obligatory
RA	:	Research Article
RA_s	:	Research Articles
RD	:	Results and Discussion
RDS	:	Results and Discussion Section
RDS_s	:	Results and Discussion sections
RS_s	:	Results Sections
SFL	:	Systemic Functional Linguistics
SIA	:	Specialist Informant A
SIB	:	Specialist Informant B
SIC	:	Specialist Informant C
SID	:	Specialist Informant D

SIE : Specialist Informant E
SIF : Specialist Informant F



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CHAPTER 1

BACKGROUND AND PURPOSE OF THE GENRE-BASED STUDY

1.1 Introduction

English has been widely recognised as a major international language used for conveying information and acquiring knowledge in various developed and developing countries across the globe. As a matter of fact, knowledge and command of the English language is particularly essential when students and academicians need to acquire and share the latest research-related information in different fields of study. In particular, English has become the language of research communication *par excellence* in a preponderance of disciplines and fields over the last two decades" (Swales, 2004: 58). More specifically, in academic, science and technological domains, it is widely known that English has attained the dominant status of a scholarly and an international medium for communication (Kanoksilapatham, 2005). The importance of English can be ascribed to the rise of "English as the lingua franca of academic publishing" (Sheridan, 2015: 70-71). Given that it has been the lingua franca in international academic communication (Fairclough, 2006), and its influence is continually growing (Mauranen, Hynninen and Ranta, 2010), an increasing number of scholars have been writing papers to be considered for publication in international journals in English (Flowerdew, 2007). These research articles in English may become one of the major ways for distributing and advancing knowledge, especially in the era of globalization and internationalisation, and under the pressure of the marketization of the academy (Aronowitz, 2000; Giroux and Myrsiades, 2001).

Academicians around the world unanimously consider the academic research article (RA) as the main channel for scientific or scholarly communication (Holmes, 1997) as well as "the central genre of knowledge production" (Yang and Allison, 2003: 365). Thus, the research article, as an academic genre, has been a major method by which new scientific knowledge, information and arguments are shared and

exchanged in various fields (Johns and Swales, 2002). It generally acts as a key channel or a prestigious genre (Swales, 2004) for disseminating advanced knowledge and principles which are continuously updated or challenged in such a way that new knowledge is acquired and developed. Therefore, researchers nowadays, regardless of their native origin, usually make their research findings spread around the world or known to others by means of having their research papers published in high-ranking and reputational international journals, which is regarded as a symbol of academic achievement in their academia and also a kind of “recognition for their position in the discourse community” (Liu and Lim, 2014: 14).

Given the aforementioned importance of the RA and its prestigious status in the area of the academic discourse community, writers’ competence in reading and writing research articles (RAs) often becomes critical in their attempt to hold the quality and standard of the genre (Swales, 1990, 2004) to achieve greater heights in academic and professional arenas. When researchers report the results of their work via the research article, they are likely to receive international recognition for their positions in the discourse community. As such, more and more scholars are now interested in getting their works published, especially published in international English journals in a bid to achieve a higher level in the research community hierarchy, which may then lead to opportunities for career advancement or research grants (Swales, 1990, 2004). Through satisfactory performance in producing texts in the research genre, novice members learn to familiarise themselves with the practices in the expert realm of the research community. Hence, it is no surprise that, on the one hand, RAs in English play an important role in spreading academic knowledge (Kanoksilapatham, 2005; Hamel, 2007), and on the other hand, the competence to write professionally is considered as a significant advantage if writers aim to be successful in the discipline concerned (Salager-Meyer, 2008). Therefore, to improve the competences required in reading and/or writing research articles, both native and non-native speakers of English are all expected to familiarise themselves with the conventional rhetorical organisation which is commonly used in the fields which they are interested in, and thus, they may produce a discourse that is appropriate to the situation or context concerned (Bazerman, 1994).

In terms of studying RAs, genre analysis is a set of effective and workable analytic methods that provide a thick description of language beyond the level of a sentence, covering the communicative intentions of speakers, writers or the language resources that they use (Hyland, 2007b; Molle and Prior, 2008). Genre analysis aims to provide “socio-cultural, institutional and organisational explanation” (Bhatia, 1993: 11) in thicker descriptions of language, which may provide information to help learners comprehend the relationships between language and context as well as simultaneously valuable insights for the teaching and learning of language (Tardy, 2011).

The practical application of the genre method to ESP classroom has been attracting more and more attention from genre theorists and language teachers. For instance, according to Swales (1990: 1), “a genre-centred approach offers a workable way of making sense of the myriad communicative events that occur in the contemporary English-speaking academy”. Hyland (2007a) opined that genre theories have evolved under different circumstances as a result of different problems, thus leading to increasing interest in genre as an approach. In a discussion on the relevance of genre analysis to the language classroom, Cheng (2006) generalized that many teachers and researchers in the sphere of English for Specific Purposes (ESP) and/or English for Academic Purposes (EAP) attempted to link the analyses of discipline-based genre exemplars with different pedagogical recommendations and tasks for preparing genre-based teaching materials. Genre pedagogies have been a part of L2 writing classes “as a response to process pedagogies, as an outcome of communicative methods” (Hyland, 2007a:7). On the whole, the leading driving force of a genre analysis approach appears to be associated with its pedagogical applications (Flowerdew, 2015).

Given the increasing attention and academic interest given to ESP genre-based approach, many past studies on academic genres, such as textbooks, academic reports and research articles, drew on the analytical framework developed by Swales (1990, 2004) to identify the rhetorical organisations and the various linguistic resources. Research articles constitute a genre which has been extensively studied using the move-step analysis. The different sections of research articles,

consisting of the Introduction, Methods, Results and Discussion (IMRD) sections, have been analysed by different researchers (e.g., Lim, 2005; Samraj, 2013). Some studies focus on the complete rhetorical structure of RAs in a range of disciplines, such as on Medicine (e.g. Nwogu, 1997; Li and Ge, 2009), Computer science (e.g. Posteguillo, 1999), Geology (Dressen, 2003), Management (Lim, 2005), Biochemistry (e.g. Kanoksilapathan, 2005), Agriculture (e.g. Shi and Wannaruk, 2014) and Engineering (e.g. Maswana, et. al., 2015). Moreover, investigations into move-based analyses have been conducted to compare the rhetorical structures of RAs written in English and other languages, such as Thai (Jogthong, 2001), Arabic (Fakhri, 2004), Brazilian and Portuguese (Hirano, 2009), Chinese (Loi, 2010; Lei, 2012) and Malay (Loi, Lim and Wharton, 2016).

Although there were past genre studies focusing on the Results section (e.g. Kwan and Chan, 2014) and Discussion section (e.g. Basturkmen, 2012; Samraj, 2013), they mainly investigated the rhetorical structure of the sections in single discipline. Furthermore, to my knowledge, there have been no study which focused on genre-based analysis of the rhetorical structures of the 'Results and Discussion' section and their linguistic strategies across different disciplines, including Material Science and Agricultural Science. The present study therefore uses a genre approach to analyse the 'Results and Discussion' section in two important disciplines, namely Material Science and Agricultural Science, aiming to identify some major similarities and differences across these disciplines with special reference to the 'Results and Discussion' sections (RDSs) of empirical RAs. It adopted the move-step analytical framework developed by Swales (1990, 2004) which also formed theoretical basis for understanding research genres. Furthermore, it should be noted that Material Science and Agricultural Science constitute two disciplines which continue to evolve, and as such, it is important to investigate such commonalities and distinctions using recently published reports in the two disciplines. The need to study the rhetorical stages in the two disciplines is also evident because previous studies have rarely elicited viewpoints from academicians and/or editors in the two fields of study, and as such, it would be interesting to conduct interviews with the specialist informants concerned in order to find out what their discipline-related views and perspectives on the rhetorical practices relating to the writing of the combined 'Results and