

Investigating First Year Science Students' Academic Writing Development

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Abstract

This study investigates academic writing tutors' perceptions of their students' performance and compares it with an analysis of first-year science students' academic writing. Specifically, it examines the challenges tutors perceive students to face when writing in academic contexts and then explores the linguistics resources students choose when writing in a scientific academic context. To achieve this aim, two sets of data were collected: tutor interviews and students' texts. The data from the tutor interviews was analysed to reveal academic writing tutors' perceptions of their students' academic writing abilities and challenges. The students' texts were then analysed to examine how effectively students make meanings valued in scientific contexts. To examine students' texts, Systemic Functional Linguistic analysis is employed; specifically, the study examines the ideational meanings (i.e., experiential and textual meanings) and textual meanings within the texts. The findings reveal that the students of science face some linguistics challenges across both the Lexico-Grammar (e.g., under-using more valued specialised and technical entities; overusing less valued logical relations) and the Discourse Semantics (e.g., thematic progression). The data also show that there is some alignment between tutors' perceptions of students' writing development and their actual writing performance (e.g., lack of lexical variation and cohesion across the text). The study concludes with a discussion proposing the most critical areas for instructional intervention to focus to assist students in overcoming these linguistic challenges.

Statement of Candidate

I certify that the work in this thesis entitled “Investigating first year science students’ academic writing development” has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree to any other university or institution other than Macquarie University.

I also certify that the thesis is an original piece of research and it has been written by me. Any help and assistance that I have received in my research work and the preparation of the thesis itself have been appropriately acknowledged.

In addition, I certify that all information sources and literature used are indicated in the thesis.

The research presented in this thesis was approved by Macquarie University Ethics Review Committee, reference number: Reference No: Ref. No 5201700362 on the 3rd May 2017.

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Chapter 1: Introduction

1.1 Introduction

Academic writing in the university is an area of significant interest for researchers and practitioners alike. When entering the university, students are required to adapt to the unique linguistic demands of their disciplines, refining skills of communication while building their disciplinary knowledge. Although incoming students are expected to have a good grasp of English, academic writing is still a challenge requiring further development (Bailey, 2009; Coffin & Donohue, 2012; Chen & Foley, 2004; Hood, 2010; Motta-Roth, 2009). The need for effective teaching methodologies to facilitate learning academic discourse has led to the emergence of English for Academic Purposes (EAP; Hyland, 2009), a subfield of applied linguistics investigating the linguistic features of academic discourse.

1.2 Academic Writing in the University

Research into EAP has developed significantly over the past two decades, to become a major force in English language teaching. Teaching academic writing, in this sense, becomes crucial in academic contexts to enable students to understand the conventions and linguistic features used in specific disciplines. Thus, increasingly, researchers have considered academic writing as their main concern in relation to academic contexts (i.e. Jones, 2000; Oshima & Hogue, 2006; Zhu, 2004). Researchers emphasise the importance of teaching academic writing in higher education as it determines undergraduate students' academic and career success and provides them with access to the target community of a

particular discipline. In addition, many undergraduate students express the need for more writing skills to help them express their ideas clearly and academically, to achieve success in their courses and participate in academic publications in the future (Austin, 2002; Hunter, Laursen & Seymour, 2007; Jones, 2011).

Research into academic writing also highlights the important role that teachers play in helping students to develop their writing and overcome their writing challenges (Beaufort, 2007; Jordan, 1997). Thus, writing teachers' perceptions and beliefs about writing development are valuable areas for exploration, as these beliefs reflect and determine their actual teaching practice in the classroom (Kagan, 1992; Wilkins, 2008).

1.3 Motivations for the Study

As a university English Language Teacher in an EFL setting, my work is concerned with equipping undergraduate students with the communication skills necessary to succeed in their disciplinary courses. In particular, my background, in teaching medical students and preparing them to comprehend and write advanced scientific texts, motivates my research. The present study is motivated by my curiosity to better understand how accurately tutors' perceptions of student writing are reflected in students' actual performance. In short, if teachers' beliefs about student writing shape their classroom practices, it is worth investigating whether teachers' perceptions of their students' performance are accurate.

The theoretical motivations for this project derive from English for Academic Purposes (EAP) and Systemic Functional Linguistics (SFL). First, EAP was developed as a field of research investigating learners' development of academic

discourse, and has found wider practical application in English language teaching (Benesch, 2001). Second, Systemic Functional Linguistics (SFL) provides a detailed linguistic framework for mapping learner development and identifying the nuanced semiotic choices that users make when creating texts in various contexts (Matthiessen & Halliday, 2009; Thompson, 2004). SFL research examining learner development of academic writing is extensively focused on the linguistic resources and text construction deployed in students' writing in a particular discipline (i.e. grammatical patterns and structure of texts; e.g., Celce-Murcia, 2005; Coffin, 2006; Maxwell-Reid, 2015; Grammatical Metaphor; e.g., Byrnes, 2009; Liardét, 2015; Ravelli & Ellis, 2005; Ryshina-Pankova, 2010; linguistic challenges in learning language in a specific discipline; e.g., Gebhard, Chen, & Britton, 2014; Schleppegrell, 2002, 2007; Schleppegrell & Colombi, 2005).

Building on these investigations, the present pilot study serves as a first step toward investigating the specific linguistic and instructional needs of undergraduate science students, prior to their admission into a 'pre-med' program. It is my intention to build on this investigation in my subsequent PhD study to specifically examine the disciplinary requirements for undergraduate 'pre-med' students and to identify the specific challenges that these students face in the medical school context.

1.4 Study Overview

The present study seeks to examine the linguistic challenges undergraduate science students face in their academic writing. Specifically, it explores tutors' perceptions of their students' academic writing and examines how the tutors' perceptions align with students' actual performance. The aim here is to identify the

most prevalent and frequent challenges that emerge from both tutor interviews and student text analyses.

The thesis is organised into five chapters. Following this introduction chapter, Chapter 2 reviews the most relevant literature defining and investigating academic discourse and, specifically, the development of academic writing. It reviews the broader work on English for Academic Purposes, before outlining the linguistic theory of Systemic Functional Linguistics and the detailed framework it provides for analysing texts. Chapter 3 describes the research design and methodology used for this study, describing the participants and data collection procedures, and providing an overview of the framework for analysis. Chapter 4 is divided into two sections (Sections 4.1 and 4.2). The first section presents the main themes that emerged from the tutors' interviews. This is followed in the second section by a detailed analysis of students' texts. These results are then discussed to investigate how accurately the tutors' perceptions of student writing are aligned with that of the students' texts. Finally, Chapter 5 concludes the investigation of the study with a summary of the major results obtained from the interviews and text analysis, and a discussion of the limitations of the present study and directions for future research into students' academic writing skills.

Chapter 2: Literature Review

This chapter begins by defining academic discourse and, specifically, the role of academic writing for success in tertiary study. It also identifies academic writing, its importance in higher education, and the challenges students encounter when writing for academic purposes. The chapter further sheds light on the Systematic Functional Linguistic (SFL) theory of language, and concludes with its application in academic contexts.

2.1 Academic Discourse

Academic discourse refers to “the ways of thinking and using language that prevail in the academy” (Bizzell, 1992; p. 3). More specifically, academic discourse is the way in which the members of academic communities communicate with each other, disseminating their knowledge and research (Rynes, Bartunek & Daft, 2001; Graham & Sunderland, 1998). Thus, linguistic and educational research has extensively examined the language necessary to succeed in academic contexts (e.g. Biber & Conrad, 2009; Nunan, 2008); and in the past few decades, a growing number of English Language Teaching (ELT) researchers have focussed their investigations on English for Academic Purposes (EAP).

English for Academic Purposes (EAP) is a subfield of English for Specific Purposes that focuses on the language skills required for students’ success in academic and workplace settings (Gillett, 1996; Hyland, 2000, Jordan, 1989). It refers to “the language of research and instruction that focuses on the specific communicative needs and practices of particular groups in academic contexts” (Hyland & Hamp-Lyons 2002, p. 2). According to Dudley-Evans and St. John (1998),

EAP is divided into two strands: English for General Academic Purposes (EGAP) and English for Specific Academic Purposes (ESAP). The former is related to the teaching of language skills (e.g. reading, writing) that are common across different disciplines, whereas the latter is concerned with teaching language features specific to particular disciplines. The notion of discourse *community* has become significant in EAP research, implying that each discourse within a specific discipline has its own patterns shared by the members of that disciplinary community' (Swales, 1990). Therefore, in order for a student to be part of a particular academic community, they need to understand and be able to communicate using the linguistic patterns that are privileged within that community (Biber, 2006; Hyland, 2006).

As such, much research has emphasised the importance of teaching EAP to help undergraduate students succeed in their fields of study at university level and prepare them for the future professions (e.g. Zhu, 2004). In particular, several researchers (e.g. Bhatia, 2002; Chen, 2008; Storch & Tapper, 2009) stress the crucial role EAP plays in higher education as it provides students with exposure to different types of texts and enhances their understanding of the generic structures and linguistic features used in various genres. EAP research also explores students' academic lexical knowledge to help them understand the common and specific vocabulary used in disciplinary contexts (Hyland & Tse, 2007; Nagy & Townsend, 2012). However, in a study of undergraduate medical students, León Pérez and Martín-Martín (2016) argue that teaching disciplinary genres should not occur in the first year of university study, as the students are less familiar with the disciplinary language, and they firstly need more knowledge in the target field.

One particular discipline in which English for Academic Purposes has been extensively explored is in the sciences. English has not always been the dominant

language for international communication in the sciences. Chinese, Sanskrit and Latin have all at some time served as lingua franca; and Latin was once the powerful language medium for all scholarly discourse in Europe, including science (Maher, 1986). However, due to modern scientific information storage systems and publications, English has become the language for international scientific communication, leading to the specific study of English for scientific purposes (Ammon, 2001; Hutchinson & Waters, 1987; Robinson, 1991).

In scientific disciplines, students are required to write texts such as description, comparison and definition, requiring specific language to achieve each of these social purposes (e.g. describing a phenomenon; Halliday & Martin, 1993; Martin & Veel, 1998; Lemke, 1990). In this regard, language plays a crucial role in the formation and development of scientific concepts with distinctive features and patterns that differ from everyday language. In fact, many of the descriptions of EAP resonate with those of scientific discourse. For example, scientific language is presented in a condensed manner in which the information is presented in a compacted, shorter amount of text achieved mostly through nominalisation and logical organisation (Halliday, 2004). Schleppegrell (2004) elaborates:

“Students organise scientific information in texts that set up taxonomies and classifications, presenting and sharing knowledge in more generalised way. Reports use timeless verbs in simple present tense and relational clauses with technical terms as participants. Science explanations describe how something occurs, explore cause-effect relationships...with the grammar enabling a logical organisation and sequencing as it draws on grammatical metaphor to structure clauses in ways that enable the accumulation of information.” (p. 116).

In summary, understanding the discourse of an academic community is important for anyone wishing to engage with the members of that community. Thus, English for Academic Purposes is an important field in ELT, providing insight into the skills required for academic success and an understanding of the language used by community members within a specific discipline.

2.1.1 Academic Writing

While both spoken and written modes of EAP are explored extensively in the research, of primary concern to the present study is the construction of written texts. The written mode is an important form of communication and the hallmark of students' success at tertiary levels (Jones, 2000; Sparks, Song, Brantley & Liu, 2014). Understanding and producing cohesive written texts in higher education is considered an important skill for anyone wishing to interact in academic communities (Flowerdew, 2014; Flowerdew & Wang, 2015; Motta-Roth, 2009). To achieve these aims, undergraduate students need to be aware of different types of writing, organise their ideas logically, and express their meanings appropriately according to the discourse norms of the particular academic community of which they are a member (Flowerdew, 2000; John, 2009; Ravelli & Ellis, 2005).

Academic writing involves choosing language carefully to communicate complex ideas to academic audiences (Strongman, 2013, p. xiii). The process of academic writing is not only a process of writing but is a process of meaning-making and social interaction (Byrnes, 2013; Gebhard, Chen, Graham, & Gunawan, 2013; Hyland, 2004; Ryshina-Pankova & Byrnes, 2013; Smagorinsky & Lee, 2000). Academic writing plays an essential role in undergraduate students' academic life.

Johnson (2016) argues that it is important to master academic writing “because it shapes thinking, represents us to others ... and enables us to effectively and efficiently communicate important ideas” (p. 72). In short, students’ success in the university depends on their ability to access, evaluate and synthesise the ideas and opinions of other writers in order to develop their own academic voice (Al Fadda, 2012; Hewings, 2004).

2.1.2 Teaching Academic Writing

The teaching of academic writing in higher education has been researched extensively (e.g. Bailey, 2014; Hyland, 2015; Wingate, 2012). In general, research suggests that it is necessary to teach academic writing explicitly to university students so as to prepare them for the specific requirements of writing the different genres of assignments (i.e., case analyses, summary, report, research reports, essays and literature review; Cooper & Bikowski, 2007; Hyland, 2007). For students to write effectively in academic settings, they are required to understand how different genres are written and the linguistic features and discourse structures used within a specific context (Hyland, 2002a; Jones, 2000).

In this sense, Raimes and Jerskey (2012) argue that creating academic genre awareness among the university students is central to teaching writing for academic purposes, as it helps students identify the purpose and putative audience, synthesise ideas and sources, and present their stance. Furthermore, undergraduate students are required to have knowledge of acknowledgement writing systems such as quotations, citation and references, to appropriately integrate evidence and support within their texts (Jordan, 2002). As such, teaching academic writing contributes positively to undergraduate students’ knowledge of research

production (e.g., scientific report: Cilliers, 2012; Shih, 1986).

Research into academic writing has further explored the important role that teachers play in helping students develop their writing and overcome their writing infelicities. Although Spack (1988) argues that “English teachers cannot and should not be held responsible for teaching writing in the disciplines” (p. 40), many researchers argue that language teachers play an important role in assisting students to master academic writing and introducing them to academic discourse communities to be able to participate and engage in written communication (Beaufort, 2007; Hyland & Hyland, 2006; Jordan, 1997).

Writing teachers’ perceptions and beliefs about writing development form an important area for exploration, as these beliefs influence instructional practices in the classroom (Burns, 1992; Butler, Trosclair, Zhou & Wei, 2014; Pajares, 1992). Research suggests that English teachers emphasise the importance of academic writing in higher education (Ganobcsik-Williams, 2006; Ryan, 2011; Veel, 2005). In general, instructors consider academic writing to be an important communication tool at the university level for helping learners to communicate effectively with academic staff, achieve success in their academic courses (Hyland, 2004a), and prepare them for future research (e.g., publishing research in peer-reviewed journals: Hunter, Laursen & Seymour, 2007).

2.1.3 Academic Writing Challenges

Despite the strong focus on researching and facilitating the teaching and learning of academic writing, students continue to face challenges adapting to the requirements of written academic communication (Bailey, 2009; Ravelli & Ellis, 2005). Researchers suggests that, in addition to developing appropriate lexico-

grammatical structures, students often have problems in using punctuation marks (e.g., comma misuse), in spelling accuracy (e.g., letter omission or addition), and in adapting to the writing style of academic contexts (e.g., citation and referencing conventions; Al Badi, 2015; Al-Khasawneh, 2010; Evans & Morrison, 2011; Mwangi, 2017). Although students have basic reading skills and are able to understand academic materials, some still find it difficult to summarise academic articles, and to paraphrase or synthesise different ideas (Ankawi, 2015; Luzón, 2015).

Many studies conducted on teachers' perceptions of the challenges their students encounter in learning academic writing indicate that writing is perceived to be one the most challenging skills among undergraduate students (e.g., Chen & Foley, 2004; Hood, 2010; Weigle, 2002). While there are many studies investigating the challenges students face, few of these studies explore the teachers' perceptions of student writing and the interaction between teachers' beliefs and student performance. Studies exploring students' development typically analyse student performance independently, for example, examining their vocabulary and grammatical constructions or referencing skills (e.g., Liardet & Black, 2016; Ryshina-Pankova, 2015), use of nominalisation (e.g. Gebhard, Chen & Britton, 2014; Gong, 2008), condensation (Maxwell-Reid, 2015), and coherence in their writing (Spycher, 2007).

Students generally struggle with grammatical and lexical knowledge, the mechanics of writing, and text cohesion. In particular, limited lexical knowledge appears to be one of the most common challenges students encounter when writing for academic purposes (Nyikos & Fan, 2007; Saengpakdeejit, 2014; Schleppegrell, 2009;). Research indicates that undergraduate students' vocabulary

knowledge is often insufficient for them to communicate their ideas clearly (e.g., Evans & Green, 2007; Güler, 2013; Hinkel, 2003). Students with less knowledge about the specific discourse of a particular context (e.g., science) are likely to experience significant difficulties when writing specialised texts (Fang, 2005). They are unable to use appropriate expression or lexical resources that enable them to express higher level complex thoughts, opinions or concepts. Schleppegrell (2001) elaborates on these difficulties, noting that students' inability to express meanings effectively is a result of their lack of academic vocabulary and unfamiliarity with technical terms. As such, Hyland and Tse (2007) stress the need for developing students' discipline-specific lexical repertoires.

Similarly, students often find it difficult to overcome fundamental challenges of producing sentences with appropriate grammar (e.g., Burns & Knox, 2005; Giridharan, 2012; Gonye, Mareva, Dudu, 2012; Macken-Horarik, Love & Unsworth, 2011). This grammatical obstacle prevents many students from expressing complex ideas in a clear manner. Such structural difficulties are also seen at a macro level in students' difficulty in organising ideas and producing comprehensible texts. Anderson, Hartshorn, Keogh, Webster (2014) for example, argue that undergraduate students struggle to write clear, organised and condensed texts. *Discourse Analysis* research also reveals that undergraduate students face challenges in terms of thematisation (Theme-Rheme Structure), thematic Progression (information flow), and cohesion and coherence (Herriman, 2011; Jalilifar, 2010; Wei, 2013).

Another area of challenge that arises in the academic writing research involves students' critical thinking skills. Because academic writing is linked to the critical thinking and analytical process, researchers (e.g. Bean, 2011; Cottrell, 2011; Welch,

Hieb & Graham, 2015) emphasise its role in academic writing. However, critical thinking appears to be one of the major challenges university students encounter (Whitehead, 2002). For example, Golpour's (2014) study revealed that students with limited critical thinking skills scored lower in writing for academic purposes (e.g., argumentative essay) compared to those with higher critical thinking proficiency. Moreover, the importance of critical thinking in education is highly emphasised to help students be engaged in critical analysis of a given task (e.g., evaluation of a research article). Thus, teaching critical thinking in disciplinary contexts is an important for teaching academic writing (Edwards, 1998; Çavdar & Doe, 2012).

Taking these challenges into account, researchers have highlighted the need for educators and curriculum decision makers to teach undergraduate students academic writing explicitly, familiarising students with generic linguistic features and conventions so as to help them distinguish between the different genres related to their fields (e.g. report, research project: Curry & Lillis, 2003; Maxwell-Reid, 2014; Wang & Shen, 2015). Familiarising students with these patterns facilitates the process of academic writing, as “engaging in written communication within a discourse community requires shared knowledge of the genres and discourses” (Tusting & Barton, 2016, p. 19). One approach to integrating the explicit teaching of genres within content courses involves collaboration between language lecturers and core course specialists. In these collaborations, teachers can exchange experience, negotiate meaning of technical terms and concepts, and solve teaching problems associated with specific disciplines, to create more effective learning environments (Montes, 2002; Pineteh, 2013).

Within the classroom, many researchers point to the efficacy of group work in writing tasks to enhance students' academic writing skills. Gimenez and

Thondhlana (2012) and Fernández Dobao (2012) highlight the importance of collaborative writing for improving students' complexity and accuracy. Group collaboration integrates verbal interaction into the writing process, requiring students to discuss language choices and draw on their linguistic knowledge (Storch, 2013).

Similarly, written feedback is another intervention highly regarded in the academic writing research. Many researchers (e.g., Bailey, 2008; Harris, 2016; Parr & Timperley, 2010) stress the importance of feedback in academic writing to help students identify and understand their mistakes and learn how to overcome them. The importance of corrective feedback is seen as a scaffolding process wherein written interaction occurring between teachers and students, helping students develop their writing (Bitchener & Storch, 2016; Hyland & Hyland, 2006). Ferris (2006), for example, examined the effectiveness of corrective feedback on students writing performance, and concluded that students who received error feedback and addressed their errors showed the most progress in their academic writing over time.

2.1.4 Academic Discourse and Writing Summary

In short, this section has reviewed recent research investigating academic discourse and academic writing. It has defined academic discourse and its importance in higher education for ensuring students' success in university study. Specifically, the teaching of academic writing was reviewed and the importance of exploring teachers' beliefs and perceptions in relation to academic writing instruction was highlighted. Finally, this section outlined common obstacles university students face when developing their academic writing, and reviewed some strategies and

approaches EAP research has proposed for overcoming these challenges. One specific gap in this literature, however, is the limited attention paid to tutors' perceptions of students' writing challenges and to what extent these perceptions align with students' actual outcomes.

2.2. Systematic Functional Linguistics

Investigations into the development and description of academic discourse and, specifically, of academic writing, have been conducted from a diverse range of approaches, engaging various linguistic frameworks and methodologies (e.g. Second Language Acquisition; e.g., Ellis, 1994; Ellis & Barkhuizen, 2005; Corpus Linguistics; e.g., Biber, Conrad & Reppen, 1998; Charles, Pecorari & Hunston, 2009). One theory that is particularly useful for exploring learner development is Systemic Functional Linguistics (SFL), a theory of language that examines the choices users make to express meanings in different contexts (Halliday & Matthiessen, 2004). SFL provides a systematic framework for examining language, with rich descriptions of the language necessary to achieve appropriate writing standards within academic registers. As a social semiotic theory concerned with the study of meaning (Halliday & Hasan, 1985; Martin, 1991; Martin & Rose, 2007), language in SFL is perceived to be fundamentally about making meaning, and grammar is viewed as semiotic (i.e. concerning with *meaning*) and functional (concerning with *how* the language is used (Bloor & Bloor, 2013; Eggins, 2004, p. 11).

In viewing language as a practice of construing meaning, SFL perceives language as a network of relationships to represent the meaning potential of a language, organised along two axes: syntagmatic relations are patterns, or regularities, “in what goes together with what” (Halliday & Matthiessen, 2004. p. 22); and

paradigmatic relations are patterns “in what could go instead of what” (Halliday & Matthiessen, 2004, p. 22). An unfolding series of these structure and system choices by speakers and writers construct *texts* (Halliday & Hasan, 1985), which are understood as “any stretch of language which is held together cohesively through meaning” (Feez, 1998, p. 4).

Furthermore, SFL maps language across a series of levels or *strata*, called *stratification* (Halliday & Matthiessen, 2004, p. 592). Following Hjelmslev (1961), SFL views language as an abstract semiotic construct organised across distinct strata of content (lexicogrammar, and discourse semantics) and expression (phonology and orthography), which interfaces with the material world (Halliday & Matthiessen, 2013; Martin, 2008). In other words, each stratum realises the stratum at the higher level and is at the same time realised by the one at the lower level (Martin, 2009). Therefore, as learners produce meaningful text in various contexts, their linguistic choices expand across the different strata (Butt, Fahey, Feez, Spinks & Yallop, 2000; Halliday & Matthiessen, 2013). These levels are modelled metaphorically as metaredundant strata to map levels of abstraction in language (Martin, 2010, p. 5) as illustrated in Figure 2.1.

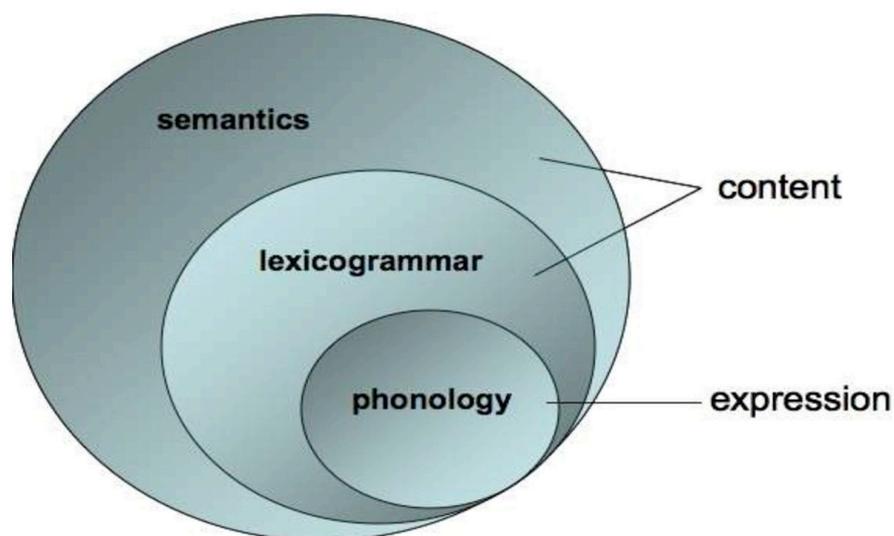


Figure 2.1 SFL's stratified model of language (Martin, 2014, p. 7)

Across these strata, SFL views language as a tri-metafunctional semiotic system fulfilling three social-functional needs: language for construing experience, interacting with the social world, and organising messages (Butt, Fahey, Spinks & Yallop, 2007). In Halliday's (1978) terms, these are called, respectively, the ideational, interpersonal, and textual *metafunctions* of language. The ideational metafunction is concerned with clauses as representations of the writer's or speaker's experience of the world. The interpersonal metafunction is concerned with clauses as exchanges or interactions between speaker and hearer or reader and writer. The textual metafunction is concerned with clauses as messages, connecting clauses to create a text (Halliday & Matthiessen, 2013, p. 30-31). For purpose of scope, the present study will focus on the meanings construed in the ideational and textual metafunctions.

2.2.1. Ideational Metafunction

The ideational function enables people to construe reality by constructing their experiences into clauses, and uses language to represent these experiences through two types of meaning: experiential and logical (Thompson, 2004).

2.2.1.1. Experiential Meanings

Experiential meanings are concerned with language content and “construing a model of experience” (Halliday & Matthiessen, 2004, p. 61). Within experiential meanings, *Transitivity* deals with the transmission of worldviews and construing human experience through the clause (Eggins, 2004), specifying “the different types of Processes that are recognized in the language and the structures by which they are expressed” (Halliday, 1985, p. 101). Expression in transitivity is realised by Participants, Processes and Circumstances. These build a picture of reality that tells “Who does what to whom under what circumstance” (Butt et al. 2000, p. 46).

At the center of every clause is a Process, realised through a verbal group, which can be further categorised according to the types of meanings it realises. Each process type provides its own schema for construing a particular domain of experience as a figure of a particular kind (Halliday and Matthiessen, 2004, p.170). For instance, Material processes describe processes of doing and happening, whereas Relational processes represent states of being (i.e., Identifying and describing a subject). As such, the choice of a specific type of Process determines the role that Participants will play in the clause. For example, a Material process is performed by Actors impacting on the Goal; while Relational attributive processes describe a Carrier with a certain Attribute (These will be discussed in detail in Chapter 3, Section 3.3.1.1).

While Processes and Participants play a central role in the construction of experiential meanings, these meanings are often situated within varying contexts or Circumstances. Circumstances are realised by adverbial groups or prepositional phrases, and function to add specificity to the information provided (Droga & Humphrey, 2002; Eggins, 2004). In combination, experiential meanings can be fully explored through a transitivity analysis of the meanings expressed through the types of Processes, Participants and Circumstances engaged.

2.2.1.2. Logical Meanings

Logical meanings comprise the second part of the ideational metafunction, and are concerned with the relationship between experiences, as expressed through joining the experiential meanings of clauses together forming clause complexes (Bloor & Bloor, 2013; Halliday & Matthiessen, 2013; Martin, 2002). Thus, logical meanings “build connectedness between the meanings of clauses” (Christie, 2002, p. 12). This connectedness is realised through the resources of the grammar in terms of two types of relationship: the degree of interdependency (Taxis) between clauses, and the logico-semantic relationship between clauses (Halliday & Matthiessen, 2004). Taxis describes whether the clauses in a clause complex are linked via dependent or independent relations whereas the logico-semantic relations describe the type of meaning relationships between linked clauses in terms of types of projection (locution or idea) and expansion (elaborating, extending, or enhancing; Eggins, 2004, p. 255; Halliday and Matthiessen 2004, p. 373).

These types of relations between clauses are identified in terms of conjunctions (Martin & Rose, 2007), and these conjunctions are further categorised according to their function: additive (e.g., and), comparative (e.g., as), temporal (e.g.,

after), or consequential (e.g., thus). Each type of relation has a different function. For example, additive conjunctions (e.g., and) function to add clauses together in a paratactic sequence, whereas comparative conjunctions (e.g., but) are used to contrast two different clauses (Martin & Rose, 2007, pp. 123-124). The analysis of these relations, in conjunction with those of experiential meanings, provides a mapping or framework for understanding the reality that is construed through a text's ideational metafunction.

2.2.2. Textual Metafunction

The textual metafunction involves the meanings that connect the text together, and organises writers' experiential, logical and interpersonal meanings into a coherent text (Halliday & Matthiessen, 2013, p. 30). This organisation of information is referred to as the *hierarchy of periodicity*. The Hierarchy of Periodicity is understood as the layers of text organisation (i.e., layers of higher level Theme and Rheme: Martin & Rose, p. 20), which reorientates the reader's experiences in terms of the direction of the unfolding text (Egins, 2004, p. 326). Within a single clause, Theme and Rheme make up the thematic structure, where Theme is understood as the point of departure the speaker has chosen for the text and Rheme is the remainder of the message (Halliday & Matthiessen, 2004, p. 64).

In relation to the organisation of Theme and Rheme in English text, SFL identifies the concept of *thematic progression* to refer to the way in which the Theme of a clause may pick up, or repeat a meaning from a preceding Theme or Rheme (Paltridge, 2012, p. 131). Thematic progression is based on the three basic patterns postulated by Danes (1974): *Constant* theme (Theme is picked up and repeated at the

beginning of each clause), *Linear* or *Zig-zag* theme¹ (the subject matter in the Rheme of the previous clause is taken up in the Theme of a following clause), and *Derived* or *Multiple* theme (a Rheme may include some different information which may be taken up as theme in some subsequent clauses; Eggins, 2004, p. 324-325).

According to SFL research, there are certain correlations between the pattern of thematic progressions and text type. For example, linear progressions occur frequently in expository and medical texts, constant progressions occur in narratives and news stories, and derived progression is used in specialised articles (Carter-Thomas, 1999; Francis, 1990; Fries, 1995; Wang, 2007). In short, the analysis of thematic progression and Theme and Rheme patterns allows researchers to investigate how the meanings expressed across the other metafunctions are held together. Textual analysis is therefore an important tool for examining text structure and cohesion which are fundamental concepts for the development of academic writing.

2.2.3 Academic Register

SFL conceptualises the relationship between language and social context as natural, in which language realises context, and context is realised through language (Halliday & Hasan, 1985). Thus, the way people communicate with others, whether spoken or written, is affected by the situation of context. For example, in written communication, a business letter will appear different in style from a letter written to a friend. This leads over time to the development of specific socially recognised forms, known as *genre* and *register* (Bloor & Bloor 2013, p. 3; Thompson, 2004).

¹ This pattern is also referred to as *Given and New* prosody. SFL does not conflate Given and New, as was the case in the Prague School work; with Given, normally conflated with Theme, referring to what is already known or predictable, whereas the New, normally conflated with Rheme, refers to what is unknown or unpredictable (Halliday & Matthiessen, 2004, p. 89).

Genre is defined as a goal-oriented social process, referring to a particular text type, and are understood as social processes enabling and facilitating sociocultural purposes (Martin & Rose, 2007, p. 8; Painter, 2001; Schleppegrell, 2004).

Register is a term used to describe “the functional variety of language” associated with a particular context (Halliday, 1989, p. 44; Halliday & Matthiessen, 2004, p. 27). It focuses on the language choices deployed in academic contexts (Coffin & Donohue, 2012). Language use is socially and structurally situated, in which what we learn and how we learn depends on the context (Schleppegrell, 2004, p. 4). In other words, the choice of linguistic resources is related to the functional purposes that are foregrounded by language users in a particular discipline (Schleppegrell, 2001).

Functional linguists define the context in terms of register variables: Field, Tenor, and Mode (Martin & Rose, 2007). Field refers to what is to be talked or written about; Tenor involves the relationship enacted between the speaker and listener (or, reader and writer), and Mode describes the kind of text being constructed (e.g. spoken, written, or both; Butt et al., 2000, p. 5). These three areas correspond directly to the language metafunctions: ideational, interpersonal and textual, respectively (Humphrey, Droga & Feez, 2012; Thumpson, 2004). The relationships between register variables and the three language metafunctions are visually illustrated in Figure 2.2.

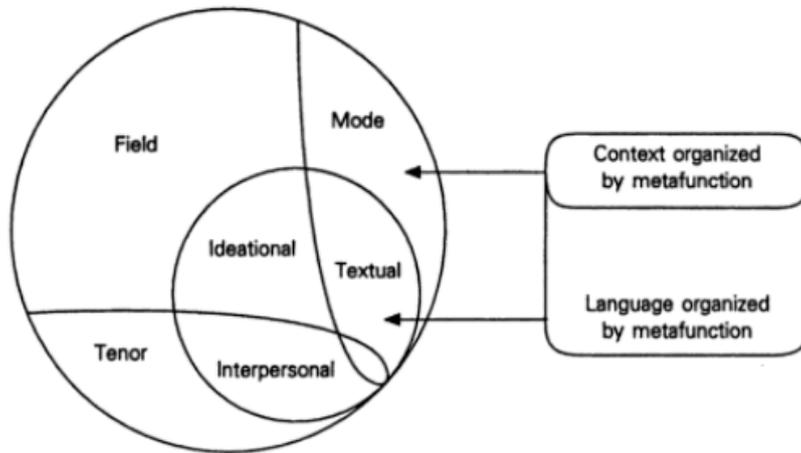


Figure 2.2 Language and Context (Martin & Rose, 2007, p. 297)

In academic contexts, academic registers are defined by certain lexical and grammatical features. As such, the choice of register for a particular text varies depending on the genre type and audiences. Furthermore, the language features used within the three metafunctions construe different fields, tenors and modes. Therefore, an important aspect of academic writing analysis involves an investigation of the register features deployed in learner texts. For example, the fields valued in academic contexts are typically construed through technical and specialised disciplinary entities and organised in condensed cause and effect networks (Halliday & Martin, 2003; Martin & Rose, 2007). From this perspective, the choices of Processes and the corresponding Participants construe different experiences which, in turn, realise the field of the texts. Furthermore, the tenors valued in academic texts typically construct relationships in distanced and objective ways to position writers within their field of knowledge (e.g., an impersonal style; Coffin & Hewings, 2004). Finally, academic modes are realised by textual meanings, which are used to package information into comprehensible texts through cohesive structures (e.g., thematic progression; Eggins, 2004).

To achieve appropriate use of language within an academic register, it is necessary to distinguish between the domains of language use: broadly, everyday and academic (Humphrey, 2008; see also Biber, Conrad, Reppen, Byrd & Helt's, 2002 distinction of spoken and written discourse in the university). The everyday language domain is characterised by low lexical density, high grammatical intricacy, subjective mood, and action-oriented processes (Biber, 1991, p. 229). In contrast, formal, academic and specialised language is characterised by high lexical density, low grammatical intricacy, more objective mood, relationally oriented processes and abstract, technical entities (Humphrey, 2008, p. 45). Thus, a text may employ certain experiential meanings to achieve the register valued in that particular context. For instance, everyday language may deploy Material processes to account for events; whereas, in academic texts, Relational processes are commonly used to represent cause and effect relationships and contributions (i.e. *lead to*, *result in*; Halliday & Martin, 2003; Fang, 2005). The analysis of academic registers helps in understanding the specialised register of a particular discipline and the linguistic level of difficulty in learning those registers (Schleppegrell, 2009). It also guides teachers in the selection and preparation of course materials, and helps ensure appropriateness of content (Biber & Conrad, 2009; Christie, Gray, Gray, Macken, Martin & Rothery, 1990).

2.2.4. SFL Research on Academic Discourse

SFL research has extensively studied the language and structures valued in academic contexts. For example, researchers have investigated the features distinct to various disciplines, such as History (Coffin, 2009; Schleppegrell, Achugar & Oteíza, 2004), Science (Brown, 2006; Drury, Langrish & O'Carroll, 2006; Lemke, 1990), English (Christie, 2002), Medicine (Matthiessen, 2013), and

Business Management (Orta, 2010).

SFL research has also examined students' texts at the level of lexicogrammar to understand the linguistic resources used when writing in academic contexts such as grammatical metaphor (Byrnes, 2009; Gebhard, Chen & Britton, 2014; Liardét, 2013; Kazemian, Behnam & Ghafoori, 2013; Maxwell-Reid, 2015; Ryshina-Pankova, 2010), Appraisal (Hood, 2010) and academic register (Gardner, 2012; Schleppegrell, 2002). Furthermore, SFL is used as a framework for analysing students' writing in terms of cohesion, thematisation, and thematic progression (e.g., Alyousef, 2016; Hawes, 2015; McCabe, 1999; Yan, 2015).

A significant amount of research has investigated the development of students' language in terms of genre, in particular in primary and secondary schools (e.g., Christie & Derewianka, 2008; Christie & Martin, 2005; Coffin, 2006; Maxwell-Reid, 2014; Unsworth, 2005). Many of these studies focus on the need for school children to develop their linguistic repertoires in, for example, cohesion and register (Matthiessen & Kashyap, 2014; Maxwell-Reid & Coniam, 2015), nominal group development in young foreign language English (Fang, Schleppegrell & Cox 2006; Whittaker, Llinares, & McCabe, 2011), and in the development of grammar (Liamkina & Ryshina-Pankova, 2012). Other researchers (e.g., Gebhard, Chen, Graham, & Gunawan, 2013; Schleppegrell & Go, 2007) have investigated challenges students face in learning language at school. These studies discuss the generic conventions and linguistics features required in different disciplines, and suggest teaching these features to students, as they facilitate the learning of academic language and increase students' language repertoires (e.g., Christie & Martin, 2005; Macken-Horarik, 2002, 2008; Schleppegrell, 2004).

Moreover, many SFL researchers investigate the development of students' academic language at the university level (e.g., Bailey, 2009; Baratta, 2010; Donohue, 2012); however, most of these studies investigate ESL or EFL learners but not necessarily English L1 learners, focusing on the development of their linguistic resources required for academic contexts (e.g., Byrnes, 2009; Liardét, 2013; Martinez Lirola & Irwin, 2016; Payaprom, 2012; Ryshina-Pankova, 2015). Therefore, there is a need to further investigate both the 'native' (i.e., English as a first language) and English as Additional Language (EAL) learners' experiences developing academic writing in the university.

Furthermore, many studies emphasise the role of SFL in informing writing instruction and learning in higher education (e.g., Christie, 2002; Nesi & Gardner, 2012; Ravelli & Ellis, 2005; Fang & Schleppegrell, 2008). In higher education, for instance, genre-pedagogy was introduced as a teaching approach in academic contexts to support students in learning how to write and understand the generic conventions and features of a particular discipline (Flowerdew, 2014; Schleppegrell, 2004). In this regard, researchers investigated the challenges learners face at tertiary level in learning disciplinary genres to provide students with the linguistic resources to produce advanced academic discourse (Hewings, 2004; Schleppegrell, 2002; 2006). However, Schleppegrell (2004) argues that it is not enough to investigate and correct students' linguistic errors: students need to develop a range of linguistic choices for helping them in structuring their academic writing in different subject areas (p. 17).

In short, SFL studies are concerned with describing the conventions and linguistic features of academic discourse in various disciplines. SFL advocates teaching genre to facilitate the learning and teaching of language (e.g., through the

Sydney School's Teaching & Learning Cycle; Rothery & Stenglin, 1995). However, it is shown in the literature review in this chapter that, while much of the research into academic registers focuses on primary and secondary learners, there is a need for greater focus on university-level writing analysis, and specifically, analysis to include users of English as a first language.

2.3 Summary

As illustrated in the research investigating academic discourse, academic writing is an important skill for tertiary education, yet it remains an obstacle to many students' success in university. This indicates a need for further research examining learners' academic writing development and identifying the specific challenges students face when writing for academic and disciplinary purposes. A further consideration in this investigation is the need to investigate teachers' role in developing students' academic writing, and their perceptions and beliefs of academic writing instruction. Therefore, the present study explores teachers' perceptions of their students' writing and analyses the linguistic challenges demonstrated in students' texts to identify how students' writing reflects or contrasts with their teachers' beliefs.

Chapter 3: Methodology

This chapter outlines the analytical framework and research design for this study. Specifically, it describes the research procedures and outlines the framework of analysis employed to explore the linguistics challenges students face when they write in an academic context and their tutors' perceptions of these challenges. The research design and methodology for the investigation are described in three main sections. The first section (Section 3.1) defines the purpose of the study and the research questions; the second section (Section 3.2) describes the research design of the study including the data collection and analysis; and the third section of the chapter (Section 3.3) outlines the theoretical framework used for analysing students' texts.

3.1. Study Focus

The goal of this study is to explore how accurately tutors' perceptions of their students' academic writing align with their students' actual performance. It focuses on the tutors' perceptions about the linguistics challenges students of science face. These perceptions will then be compared to an analysis of the students' actual writing through the lens of Systemic Functional Linguistics (SFL). To examine the alignment between perceptions and actual performance, firstly, tutors are interviewed to identify their perspectives on students' academic writing and the challenges the students face when they write for academic purposes. Secondly, students' assignments are analysed to identify the linguistic resources used and how effectively the students' texts achieve the features of academic writing. The study will address the following questions:

- 1- What do tutors perceive to be the most significant challenges that first-year

university students face when developing their academic writing?

- 2- What are the linguistic obstacles that first-year university students face when developing their academic writing?
- 3- Is there alignment between tutors' perceptions and the students' actual writing performance?

To explore these questions, the study relies on both a qualitative research method (interview) and quantitative analysis (text analysis based on the SFL framework), as outlined in the following sections.

3.2 Research Design

This study employs an integrated qualitative and quantitative approach to investigate how accurate tutors' perceptions of learners' academic writing are, in comparison to the actual challenges identified through text analysis.

3.2.1 Research Participants

The first stage of the analysis examines tutors' perceptions of their students' academic writing performance. The tutors participating in the study teach academic writing to science students in the Faculty of Science at a large university in Australia. They were invited to join the study to obtain in-depth information about students' writing development and the challenges they encounter in writing for academic contexts. Three of the participating tutors are Australian and one is Brazilian. They have been teaching academic writing for 1-6 years.

Student participants are first-year undergraduate university students enrolled in science degrees, with different First Language (L1) backgrounds (16 speakers of

English, one speaker of Arabic, one speaker of Mandarin, and one speaker of Spanish). The texts we collected were submitted as part of their enrolment in an academic communication unit that is designed to facilitate the development of academic practices and enable them to understand generic conventions used in the academic contexts. Within this unit, students are explicitly taught specific skills of academic expression (e.g. formal expression, language density, cohesion, and lexical density).

3.2.2 Tutor Interviews

To examine tutors' perceptions of students' academic writing, the first stage of analysis involves tutor interviews. Four tutors were interviewed individually, and the interviews are audio-recorded and transcribed for further analysis. The rationale behind choosing this small sample, as many researchers suggest (e.g., Cleary, Horsfall & Hayter, 2014; Patton, 1990; Punch, 2013), is to gain in-depth understanding and exploration of tutors' experiences in relation to students' academic writing development (i.e. academic expression and linguistic choices) and challenges.

The interview consists of 8 open-ended questions to obtain more detailed information about their teaching experiences in relation to teaching writing to undergraduate science students (see Appendix B). Specifically, tutors were asked about their experiences teaching academic writing, the academic writing challenges the students face in developing their academic discourse, and about any strategies they use to overcome the students writing challenges. These open-ended questions allow the tutors to contribute as much detailed information as they desire, and enable the researcher to ask further questions as a means of follow-up (Turner, 2010).

The obtained data from the tutors' interviews were transcribed and analysed qualitatively to demonstrate in depth the tutors' perceptions and experiences, identify the key themes, and reflect the key issues to emerge in the data (Hatch, 2002). As a means of identifying the key themes, three procedures of analysis of the interview data were applied. Following Huberman and Miles (1985) and Gibbs (2008), the analysis of the interview data was achieved through these three stages: data reduction (i.e. coding, summarising, and paraphrasing, selecting some required information and excluding other information); data display (e.g., quotations); and drawing of conclusions (i.e., noticing regularities and patterns, deriving conclusions). In the first stage, the collected data were reduced by coding common features that were shared by the interviewees, identifying the key points in the data (e.g., importance of academic writing, linguistics challenges, strategies students use to overcome their writing problems). In the second stage, short extracts from the tutors' interview data were used to display relevant information on their perceptions regarding the importance of academic writing for science students, their writing development, and any distinctive linguistic challenges they noted in students' writing. The final stage involved drawing conclusions and comparing these findings with the data collected from the written texts.

3.2.3 Text Analysis

The second stage of analysis examines students' texts through the framework of Systemic Functional Linguistics (SFL) to identify the linguistic patterns students employ when constructing academic texts and any problems inhibiting their academic writing development. The study employs the SFL framework to examine students' written assignments, as it focuses on language in use and deals with texts within

social contexts (Halliday & Matthiessen, 2004; Schleppegrell, 2016). Specifically, the study analyses the ideational and textual meanings students construe when writing for academic purposes (Martin & Rose, 2007; Halliday & Matthiessen, 2004). Within the ideational analysis, the study examines how students express their experiential and logical meanings by looking at lexical choices of Participants, Processes and logical relations used in their writing. In the textual analysis, the study examines students' organisation of their ideas and construction of their texts by focusing on sentence structure and Thematic Progression.

The primary data of the text collection in this study are the participants' second assignment while enrolled in a first-year academic communication unit. The participants are required to write a scientific information report as part of their assessment. The data of this study comprises just short of 400 to 1400 words of essays on the topic of social issues (e.g. Obesity in Australia, Water, sanitation and hygiene, Climate change). In total, 19 texts were collected. As an academic genre, the scientific report presents objectively, with appropriate grammar and more generalised expression (Schleppegrell, 2004, p. 116). It is written with simple, clear and concise writing style and correct citations to avoid misunderstanding and reduce the chances of misinterpretation (Goldbort, 2006; Matthews & Matthews, 2008).

For the protection of participants' anonymity, texts are identified with numbers (e.g. Text 1), and for labelling, each text is assigned a number from one to nineteen given in square brackets (e.g. [Text 2]). This labelling is applied whenever excerpts are presented. The length of the texts varies from 400 to 1338 words. The data comprises 18647 words and 871 clauses in total, with an average of 981 words per text and 44 clauses per text (i.e. 23 words per clause; see Table 1).

Table 3.1 Text Length

Text	No of Words	No of Clauses	No of Words /Clause
1	1338	62	22
2	1033	46	22
3	891	39	23
4	1013	41	25
5	1051	45	23
6	802	36	22
7	1038	59	18
8	1038	32	32
9	1126	49	23
10	1080	51	21
11	990	45	22
12	1043	43	24
13	1013	61	17
14	949	35	27
15	958	44	22
16	1038	41	25
17	916	38	24
18	403	16	25
19	927	47	20
Total	18647	871	
Average	981	44	23

3.3 Framework of Analysis

This study employs the theoretical framework of SFL to examine students' written texts, with a focus on the ideational and textual metafunctions. As discussed in Chapter 2, SFL provides a coherent framework for analysing learner language development and identifying the linguistic challenges they encounter when developing their writing (Christie, 2002; Schleppegrell, 2016). Specifically, within the ideational metafunction, transitivity analysis will be conducted, and within the textual metafunction, the analysis will focus on how participants structure their sentences and organise their ideas. Such analysis provides a clearer understanding of the students' linguistic infelicities and reveals the specific obstacles they face when developing their academic writing.

3.3.1 Ideational Metafunction

The ideational metafunction involves a construal of reality through the organisation of experiences into clauses and can be further understood as the interaction of experiential and logical meanings. Experiential meanings refer to the grammatical resources involved in construing human experience through the clause; whereas the logical meanings refer to the linguistic resources used to organise these experiences in terms of their logical relations (Butt et al., 2000; Thompson, 2004).

3.3.1.1 Experiential Meanings

Within experiential meanings, *Transitivity* generally refers to how meaning is represented in the clause and views the Process as the center of every clause (Eggins, 2004). These processes can be further categorised according to the experiential

meanings they achieve (e.g., processes of doing or happening, as *Material*; behaving as *Behavioral*; feeling or sensing, as *Mental*; saying as *Verbal*; existing as *Existential*; and relating as *Relational*; Halliday & Matthiessen, 2004).

The distinction between processes is determined by the way each is functioning in a particular clause. For instance, the English verb ‘feel’ can function as a Material process, a projecting Mental process, or a Relational process, depending on its relation to other elements in the clause, as illustrated in Sentences 1-3, respectively:

1. I **felt** the wood and decided it needed more sanding (material)
2. I **felt** that I was at a crossroad in my life (projecting)
3. I **felt** tired (relational) (Butt et al., 2007, p. 45)

Transitivity analysis within SFL generally commences with the identification and classification of the process into one of the six types: Material (construes doing and behaving), Verbal (construes saying), Relational (describes attributes of a Thing or identifies a Thing), Mental (construes the human inner experience), Existential (sets up the existence of a Participant) and Behavioural (construes physiological processes).

In academic contexts, the choice of Processes, and thus the corresponding Participants, expresses different experiences which, in turn, construe the Field of the texts. Thus, a text may employ certain experiential meanings, for instance: the language of everyday texts tends to use Material processes to recount events; whereas in academic contexts (i.e. sciences), Relational processes are commonly used to represent cause and effect relationships (Fang, 2006). Similarly, Material, Behavioral and Mental processes are related to human participants (e.g., Actors, Behavers and

Sensors), whereas Relational processes link Tokens and Values or Carriers and Attributes which can contribute to the construal of non-human, abstract entities valued in academic discourse. This phenomenon is illustrated in the examples below:

1. Residual silver ion particles would not only prevent bio-fouling in periods of non-use, but prevent microbial contamination in the water itself upon storage. [Text 12]
2. Countries with higher solar potential are the ones located in the red sea area. [Text 13]

In the first example, the Process ‘prevent’ expresses the kind of action enacted by an Actor, ‘particles’, impacting on the goal, ‘microbial contamination’. In the second example, the identifying relational process, ‘are’, identifies the first participant, ‘countries with higher solar potential’, as being ‘the ones located in the red sea area’ (i.e., Token and Value). In this way, the transitivity analysis reveals what type of verbs the students rely upon most frequently when constructing texts for academic purposes.

The analysis of the process types within this framework of SFL provides greater insight into the choices students make when construing a Field appropriate and valued in academic contexts. To complement this analysis, the present study also examines the types of entities deployed alongside these processes. While Participants can be classified according to the processes with which they occur (e.g. Material processes are realised by Actors), Participants can be further classified into three types of entities: concrete, abstract, and metaphoric (Halliday & Webster, 2009, p. 78). Concrete entities are typically used for everyday activities (e.g., *people, child*); whereas the abstract and metaphoric entities are used more for technical contexts (e.g., *application*). Concrete entities can be further categorised as either everyday

(e.g., *man*) or specialised entities (e.g., *gearbox*). Abstract entities are divided into four types of entity: technical (e.g., *gene*), institutional (e.g., *offence*), semiotic (e.g., *question*), and generic (e.g., *kind*). Metaphoric entities are classified as process (e.g., *relationship*) or quality (e.g., *security*; Martin & Rose, 2007, pp.113-114).

It follows, therefore, that in the field of science or, simply, within academic contexts, some concrete everyday entities may be deployed but mostly concrete specialised, abstract and metaphoric entities will be used to construe a more specialised, technical Field, as illustrated in Excerpts 3-4.

3. Additionally, children and adolescents are more likely to on packaged foods that are unhealthy while watching television. [Text 9]
4. They deal with physical impacts such as loud noise and visual changes (Hall 2014 p. 223). These usually lead to symptoms like sleep disturbance, headaches and high blood pressure (Russell 2010 p. 11). [Text 2]

As illustrated in Example 3, when several non-specialised everyday (*children, adolescents, foods, television*) entities appear together, they tend to construe less specialised fields. In contrast, the metaphoric entities (i.e. *impacts, changes, and disturbances*) and specialised abstract entities (i.e. *symptoms and high blood pressure*), in Excerpt 4, construe a more technical, specialised discourse which is more valued in scientific discourse.

3.3.1.2 Logical Meanings

To build connection between the meanings within the clauses, SFL analyses logical meanings, arguing that “systems set up logical-semantic relationships between

one clausal unit and another which, in turn, create clause complexes” (Halliday, 2003, p. 17). In academic contexts, conjunctions are used to create cohesion among clauses and signal the logical connections between ideas, as well as to assist the reader’s comprehension by providing explicit cues about the logical relationships between more than one clause (Schleppegrell, 2009; Spycher, 2013).

Martin and Rose (2007) identify four types of conjunction: additive (e.g., *and*), comparative (e.g., *as*), temporal (e.g., *after*) and consequential (e.g., *thus*). Each type of conjunction has a different function. For example, additive conjunctions function to add clauses together in a paratactic sequence; whereas comparative conjunctions are used to contrast two different clauses (Martin & Rose, 2007, pp.123-124). However, excessive use of these logical relators or the use of a particular relator over a text (e.g., *and*) may detract readers from comprehending the text or present an informal academic tone (Lee, 2013; Millis, Graesser, & Haberlandt, 1993). For example, in Excerpt 5 below, the frequent use of determiners accumulates across the excerpt.

5. The role of biotechnology for agricultural sustainability in Africa’ points out ... pesticides on their farming crops (Thomson 2008 p. 905). Furthermore, one negative result ...African farms will be rich in pest content (highly toxic) and at the same time, would lack in nutritional value as no fertilisers have been used on these crops. So, for people in Africa who consume these toxic crops are at great risk of encountering a number of health effects. Short term health effects... and so on (Damalas & Eleftherohorinos 2011). On the other hand, long term health effects include: emergence of non-genetic related cancers, ... health effects can arise (Damalas & Eleftherohorinos 2011). [Text 2]

In this example, the student uses various kinds of conjunction in a short excerpt, performing different functions: addition (i.e., *furthermore, and*), consequence (i.e., *so*) and comparison (i.e., *on the other hand*) within only four clauses. Such analysis of logical relations used in students' texts provides greater insight into how the students connect their clauses to produce the concise and clear texts valued in academic discourse.

3.3.2 Textual Metafunction

The study also analyses the textual metafunction, examining structural infelicities at the clause and sentence level as well as Thematic Progression. Specifically, It focuses on the types of infelicity found in students texts related to the structure of the sentence within clause level (i.e., SVA) and beyond the clause (i.e., run-on sentences and incomplete sentences). The textual metafunction involves the meaning that connects the text together and organises speakers' experiential, logical and interpersonal meanings into a coherent text (Halliday & Matthiessen, 2013). Within a single clause, Theme and Rheme make up the thematic structure wherein Theme involves the first clause element and is understood as the departure point the speaker has chosen for the text (i.e., 'given' information), and Rheme is the remainder of the message (New information) (Halliday & Matthiessen, 2004, p. 64-66); as can be seen in the example below:

Genetic modification of crops	has been the issue of debate regarding multiple areas.
Theme	Rheme

By investigating the thematic structure, it is possible to examine thematic progression through a text; thus providing greater insight into how cohesively students structure their texts. As discussed in Chapter 2 (Section 2.2.2.), SFL thematic progression refers to the way in which the Theme of a clause may pick up or repeat a meaning from a preceding Theme or Rheme (Paltridge, 2012, p. 131). According to Daneš (1974), there are three basic thematic progression patterns: Constant theme, Linear or Zig-zag theme, and Derived or Multiple theme. In constant theme pattern, a Theme is picked up and repeated at the beginning of each clause, as illustrated with the Participant ‘the article’ in the following example:

6. The Article sufficiently explains the procedures and methods in response and how new policy is inducted. This article is crucial in ensuring that emergency personnel understand the need for cooperation in terms of logistics, response and evacuation procedures. [Text 15]

In a zig-zag theme pattern, the subject matter in the Rheme of the previous clause is taken up in the Theme of a following clause. In Halliday and Matthiessen (2004), this pattern is known as a ‘Given-New’ pattern. Given refers to what is already known or predictable (related to Theme), whereas New refers to what is unknown or unpredictable (related to Rheme; Halliday & Matthiessen, 2004, p. 89). This pattern is illustrated with the Participant ‘cotton’ in the following Excerpt:

7. The most widely grown BT crop is cotton, mostly grown in Chinese and Indian areas. Cotton can be genetically modified to resist different parasites such as the American bollworm. [Text 19]

The last pattern of thematic progression is multiple theme, whereby a Rheme may include some different information that may be taken up as Theme in some

subsequent clauses (See Paltridge, 2012, p. 130-133). This pattern is illustrated in the repeated Thing 'issue' as in Excerpt 8 below:

8. Here, this report will outline the global issues that arise with genetically modified crops. A recent issue is that agricultural industries across the globe are becoming underfunded within the area of agricultural research and development and this in turn slowing down the production rate of genetically modified crops. Another issue is that *Bacillus thuringiensis* (Bt) crop destroy pesticides. [Text 3]

These patterns of organisation are not fixed; rather, their use varies according to the purpose of the writing (Humphrey, Droga & Feez, 2012). For example, constant theme pattern is common in factual writing (e.g. narrative), whereas zig-zag theme pattern is more valued in the context of academic writing. Therefore, it is expected that the present analysis of academic texts will reveal the frequent use of zig-zag (i.e., Given-New) thematic patterns.

Based on the discussion above, SFL analysis examines the internal and external organisation of academic texts. Thus, the present study employs these layers of analysis to texts written by a group of first-year science students. The aim here is two-fold. Firstly, the analysis aims to interpret the students' construal of meaning in relation to the context of academic writing as science students; and secondly, it aims to identify the challenges these students encounter when developing their academic writing. Specifically, within the ideational metafunction, these texts are analysed at the level of lexico-grammar for transitivity and logical relations; and within the textual metafunction, they are analysed at the level of Discourse Semantics for Thematic Progression.

3.4 Summary

This chapter has presented the research design, methodology and framework of analysis for the investigation into academic writing tutors' perceptions of their students' writing and how accurately these perceptions align with their students' performance. The three procedures of analysis of the interview will be applied to the interviews, and the framework of SFL will be employed to analyse the students' texts. The results of these analyses are discussed in the next chapter, Chapter 4.

Chapter 4: Findings

This chapter outlines and discusses the findings of the study examining undergraduate students' academic writing, and identifies the challenges they face when writing in scientific contexts. Section 4.1 will review the results from the tutor interviews, identifying four major themes that emerged. Section 4.2 will outline the results from the analysis of the students' texts, detailing the linguistic challenges emerging across three main areas: experiential meanings, logical meanings and textual metafunction.

4.1 Tutors' Perceptions

The first research question addressed in this study explores tutors' perceptions of first-year university students' academic writing, and specifically, the challenges these students face when writing in scientific contexts. Four tutors were interviewed about their experiences of teaching undergraduate students in a scientific communication unit, and four key themes emerged: 1) the importance of academic writing in scientific contexts; 2) students' academic writing awareness; 3) common challenges the students face in developing their writing; and 4) strategies used for overcoming writing obstacles. Each of these themes is explored in the following sections.

4.1.1 Theme 1: Importance of Academic Writing in science Discipline

The first key theme to emerge from the tutor interviews involves the importance of academic writing (AW, hereafter) in scientific disciplines. All tutors

emphasised the importance of academic writing to science students, identifying three main reasons why AW is a crucial skill that students need to develop. The first reason points to the centrality of AW for success in academic study. AW is perceived to be an essential skill for science students to achieve higher marks in their academic courses, as academic contexts require an understanding of the conventions of different genres (e.g., report, article summary, reflection essay). For example, Tutors 2 and 4 emphasised the need for teaching AW to help students understand the writing style and communicate their message clearly in academic contexts (Excerpts 1 and 2):

1. “Teaching AW is important for training students to write academically, learn to use academic sources and the information that they use for their studies at the university”. [Tutor 2]
2. “I think it is really important for university students to learn how to write and present in academic way”. [Tutor 4]

The second reason tutors argued for the importance of AW looks to the future needs of students who will eventually be involved in conducting research and publishing journal articles² (Excerpts 3 and 4):

3. “It is important for science students to communicate research findings, publish in pre-reviewed journals and learn how to use academic resources for their studies and future career”. [Tutor 2]
4. “They need AW if they involve (sic) in research and presenting research findings”. [Tutor 1]

² Although students at this level are not conducting primary research, professional communication courses focus on preparing students to eventually research and publish findings.

Finally, the tutors argue for the importance of AW for students' future careers, presumably in a field of science. Writing effectively is commonly regarded as essential for students' professional success. When recent graduates apply for a job, they will be required to write professional papers to demonstrate their eligibility for professional positions (Excerpts 5 and 6):

5. "Students need to know how to write clear, high-level English and logical professional documents for their future career". [Tutor 2]
6. "AW is important, particularly if the students are looking to have an academic career as they need to write in academic way". [Tutor 4]

This first theme focuses on the importance of academic writing, both for students' current academic success and for their future work in research and throughout their professional careers. These findings are in line with previous findings (e.g. Bruce, 2010; Hyland, 2006; Zhu, 2004) revealing teachers' perceptions of the importance of writing for students' success in both their academic courses and professions.

4.1.2 Theme 2: Students' Awareness of Academic Writing

The second main theme that emerged from the tutor interviews focusses on students' awareness of AW, or more specifically, their lack of awareness. Three out of four tutors indicated that science students are not aware of the importance of AW in their field. Tutors consistently lamented students' lack of awareness, and noted how important it was for students to develop their understanding of AW, as evidenced in Theme 1. One possible reason behind this lack of awareness may be the students' youth and how recently they have transitioned into university. Tutor 4 suggested a reason why the students are not familiar with AW conventions (Excerpt 7):

7. “They have just come from high schools where there is a big change in the methodology of teaching writing”. [Tutor 4]

This tutor clarified that, in high school, there is no focus on scientific writing. Thus, when the students begin university, they find it difficult to write not only in an academic style but specifically for a scientific context. Tutor 3, however, explained that the issue is not specifically a ‘lack’ of awareness, but rather it is the low ‘level’ of students’ awareness that is problematic (Excerpt 8):

8. “I think the students are aware of the importance of AW but it is their level of awareness. I am sure they understand how it is important to clearly communicate but you only understand when they use it”. [Tutor 3]

Despite this lack of or low level of awareness when entering the program, Tutor 1 noted that students quickly develop their AW (Excerpt 9):

9. “Students at the beginning of the year are struggling with writing and they are not aware of its importance but they develop their awareness and catch on very quickly through the semester”. [Tutor 1]

This common problem of students’ lack of awareness was found in the literature review as well. Research suggest that students’ inability to write academically at university levels is associated with their lack of awareness of the importance of academic writing (e.g., Johns, 2008; Yasuda, 2011).

Another aspect of this lack of awareness relates to students’ interpretation and understanding of assignments. Understanding the guidelines and the teaching expectations of a given task plays a critical role in successful academic performance, as it is essential for selecting appropriate resources and providing a foundation for effective task engagement (i.e., understanding what needs to be done and in what

way). In this regard, all four tutors argued that students struggle to understand the requirements of the assigned tasks. For example, Tutor 1 explained (Excerpt 10):

10. “Some of them do not understand the requirements of the tasks and they think they write them well enough, but the main problem is that they do not follow the rubric”. [Tutor 1]

Despite this general inability to interpret assignment expectations, Tutors 2 and 3 point out that more successful students are able to apply the requirements of the assigned tasks (Excerpt 11 and 12):

11. “Only good students apply what they find in the rubric”. [Tutor 2]
12. “I think they do understand the requirements; the high achievers try the best to follow the requirements”. [Tutor 3]

Accordingly, students’ understanding and interpretation of the task requirements, and how effectively they address these requirements, are essential skills the tutors identified for their students’ academic success at the university level.

In short, the second theme that emerged from the tutor interviews focusses on students’ lack of awareness and familiarity with the conventions of academic writing. This knowledge gap may be due to the students’ inexperience with the university-level science curriculum; however, they tend to develop this awareness quickly through their first semester of university enrolment.

4.1.3 Theme 3: Linguistic Challenges

The third theme to emerge from the tutor interviews concerns the linguistic challenges students face when writing for academic purposes. Across the feedback from the four tutors, their perceptions of their students’ linguistic challenges varied greatly. For example, some focussed on lexico-grammatical infelicities such as word

choice or grammatical errors (e.g., sentence fragments), whereas others focussed on communicating content and organising language at the level of the discourse semantics.

The first linguistic challenge that emerged from the data was sentence structure. All four tutors agreed that students struggle to construct their sentences appropriately. For example, Tutor 4 explained (Excerpt 13):

13. “Although students come with high English language proficiency, some of them still struggle with writing well-structured sentences in academic contexts”. [Tutor 4]

The second challenge the tutors identified relates to lexical choices. Three out of four tutors indicated that first-year university students use inappropriate words and expressions when they write for academic purposes. For example, Tutor 1 stated (Excerpt 14):

14. “Some of the students are really struggling. I had a couple of students last year who are not from English-speaking backgrounds had quite an unusual choice of words”.

Tutor 2 further elaborated (Excerpt 15):

15. “Some of the students use Microsoft resources to search for advanced vocabulary; however, those resources in some cases do not represent or give the intended meaning or the academic meaning”. [Tutor 2]

Not all tutors, however, were aligned with this belief. For example, Tutor 3 lamented the use of ‘fancy’ words, and indicated a preference for clarity and conciseness (Excerpt 16):

16. “Terminology, I find it, it is good. Of course, some students do not use kind of more fancy words, but it is not something I paid much attention

to because what I care much [sic] about is if the message is clear, well-structured and concise”. [Tutor 3]

The third linguistic challenge the tutors identified involves the organisation of ideas and the flow of information. Three out of the four tutors indicated that science students struggle with organising their ideas and constructing sentences appropriately when writing for academic purposes. For example, Tutor 4 comments (Excerpt 17):

17. “The majority of the students have good structure but others struggle to put ideas into writing. They either write very long sentences, fragments or unclear sentences”. [Tutor 4]

Tutors 2 and 4 further clarified that these challenges are a result of students’ lack of familiarity and knowledge in relation to academic genres (e.g., how to write a report or a summary), as they have just matriculated to university where there is a big change in teaching and writing in an academic style (Excerpts 18 and 19):

18. “I think it is coming from high school. Maybe, they were not necessarily taught academic writing and they get to the university where we expected that straightway, and I think it is a big jump and many students struggle with this jump because what would have been perfectly acceptable in high school is now not going to get a Pass”. [Tutor 2]

19. “The challenge is in the differences between high school and the university focus”. [Tutor 4]

The fourth linguistic challenge to emerge from the interviews involves the mechanics of writing. Specifically, the tutors identified students’ inability to use punctuation accurately. Three out of the four tutors mentioned that students’ problems

with organising sentence structures were often linked to their use of appropriate punctuation. Tutor 3 noted (Excerpt 20):

20. “What I see more often is like with structuring and punctuations, some students write very, very long sentences”. [Tutor 3]

Spelling is also identified as a writing challenge for the students. The tutors highlighted how some students’ spelling is very poor while others just rely on digital tools to proofread their papers. For example, Tutor 1, explains (Excerpt 21)

21. “Some students are often very poor in spelling”.

However, Tutor 3 noticed that (Excerpt 22):

22. “Students just misspell the words because they let the computer pick it for them without doing proofreading for their papers before submission”. [Tutor 3]

The fifth linguistic challenge the tutors identified involves the use of an informal style. According to the tutors, first-year students tend to use informal language when expressing their ideas (Excerpts 23 and 24):

23. “Students use informal language or colloquial language in writing an academic paper and at the beginning of the semester, they write based on their opinion rather than using academic writing”. [Tutor 1]

24. “It is a lot to do with casual and formal writing. Sometimes, students use contractions in their writing. One thing they quite often do is use ‘uni’ instead of ‘university’ which I would not expect in an academic setting”. [Tutor 3]

The final challenge the tutors identified involves the appropriate acknowledgement of outside resources. Students are required to reference and integrate in-text citations appropriately to demonstrate an understanding of their

reading. Evidence integration enables readers to locate the sources and supports the arguments with research findings. However, the tutors suggested that students frequently use other people's works (i.e., words and ideas) without proper acknowledgement (Excerpts 25 and 26):

25. “The biggest challenge is acknowledging others’ work, for example, using the correct format of references and in-text citation”. [Tutor 1]

26. “They often get feedback about referencing being incorrect”. [Tutor 2]

In short, the tutors identified six linguistic challenges students typically face when developing their AW: sentence structure, lexical choices, organisation and flow of ideas, writing mechanics, informal style, and referencing. These areas of challenge have also been indicated in previous studies. A number of researchers point out that students often have problems in using appropriate lexis (e.g., Nagy & Townsend, 2012), constructing their clauses correctly (e.g., Singh, Singh, Razak & Ravinthar, 2017), using appropriate punctuation marks (e.g., misuse of comma; e.g., Almkhaizeem, 2013), and adapting to the writing style of academic contexts (e.g., citation and referencing conventions; e.g., Schembri, 2009). Thus, this is an area that needs to be taken into account to help students overcome these writing challenges.

4.1.4 Theme 4: Guidelines for Developing Students’ Academic Writing

The fourth and final theme that emerged from the tutor interviews involves tutors’ perceptions of how students’ writing difficulties should be addressed. The tutors proposed several ways to help students overcome their AW challenges, both within and outside the classroom. In the classroom, tutors argue for the explicit teaching of genre and register conventions, and the provision of corrective written

feedback. Outside the classroom, the tutors highlighted the need for AW workshops and related resources to support students' AW development.

The first suggestion the tutors proposed inside the classroom is teaching AW explicitly. Teaching AW is critical for raising students' awareness of the register and genre features of disciplinary texts, and for developing their understanding of the discourse of the academic scientific community, as mentioned by Tutors 3 and 1 (Excerpts 27 and 28):

27. "I am sure students understand how important is to clearly communicate, but because you only actually understand when you use it, that is where I think it is important to teach AW because they may not truly understand the need for that kind of written communication. They cannot see that now but will definitely see it when they start working". [Tutor 3]

28. "In terms of structuring their assignments, teaching AW helps students learn to use sub-headings and link paragraphs". [Tutor 1]

Moreover, three out of the four tutors pointed to written feedback as a significant contribution to developing students' writing and helping them understand their writing weaknesses, as Tutors 3 and 2 explain (Excerpts 29 and 30):

29. "I always give them written feedback into their writing. So I always look if it is clear and concise, and make comments around, for example, it is mostly clear, or you need to work on it because it is not that clear, pay attention to grammar or to punctuation". [Tutor 3]

30. "Some of the students think that they are doing well, but when they receive the feedback, they find they are not". [Tutor 2]

This approach is widely discussed in the literature, with many researchers (e.g., Hyland & Hyland, 2006; Parr & Timperley, 2010) arguing for the benefits of specific feedback in helping students to understand their mistakes. Such feedback is seen as scaffolding the written interaction occurring between tutors and students (Bitchener & Storch, 2016).

However, as Tutor 4 argued, this feedback is “only beneficial if students know how to interpret it and apply it”. In their study investigating effective feedback, Burke and Pieterick (2010) support this view, arguing that students often struggle to interpret their teachers’ written feedback. Furthermore, it can be argued that tutor feedback varies greatly, and that some points are less beneficial to the students’ development. Therefore, while such feedback may support students’ development of AW, it needs to be supported by a more holistic approach to AW.

In terms of strategies the tutors proposed for addressing students’ difficulties outside the classroom, tutors often referred students to a university academic skills workshop and encouraged them to use library resources. For example, the tutors suggested that workshops on how to write academic papers (i.e., focussing on writing style, reference, genre types), provided at a time suitable to students’ schedules, would be valuable for developing students’ understanding of AW conventions and the registers of different disciplines (Excerpt 31):

31 “It is perfect to conduct academic writing workshops at the end of the semester, at times that suit students’ schedules (e.g. in Week 13) to help students understand the context of academic writing”. [Tutor 4]

In short, the tutors proposed various strategies for improving students’ AW both inside and outside the classroom. Strategies used inside the classroom include teaching AW explicitly and providing students with written corrective feedback.

Strategies proposed for outside the classroom involve referring students to university resources such as AW workshops.

4.1.5 Summary of Tutors' Perceptions

The findings of this section reveal that AW is perceived as being essential for students' success in their academic studies, preparing them for their future research and careers. However, the tutors generally perceived these students as being unaware of the importance of AW in their field. In terms of AW challenges, some students struggle to write grammatically accurate sentences, vary their lexical choices, organise their ideas with appropriate structure and punctuation, and to write in a formal, academic style. The tutors suggested a number of strategies for addressing these challenges. These recommendations include teaching writing explicitly, using library resources, and providing written feedback. While tutors' perceptions are important for understanding the challenges that students face when developing their AW at university level, further analysis of students' texts is necessary to assess whether the tutor's perceptions accurately characterise students' writing proficiency.

4.2 Students' Texts

The second stage of the analysis involves an in-depth linguistic examination of nineteen students' written texts. This analysis with its findings is organised into two main areas: ideational meanings and textual meanings. The analysis of ideational meanings first explores students' construction of experiential meanings, analysing the types of processes and entities deployed and the types of logical meanings used to organise them. The analysis of the textual meanings examines clause and sentence structure and thematic progression through a detailed examination of the Theme-

Rheme structure. These findings are presented in order according to their prevalence and frequency in the data.

4.2.1. Ideational Meanings

The analysis of ideational meanings reveals the choices students make when construing the Field of their texts. Within the experiential meanings, these choices involve the types of processes and entities deployed, and within the logical meanings, the types of logical relations deployed. As discussed in Chapter 2, formal, academic discourse values language that is organised statically and linked together in cause-and-effect networks (Halliday & Martin, 2003). Therefore, academic discourse privileges certain processes (i.e., Relational, Verbal, and some Material and Mental) over others (e.g. Behavioural). Section 4.2.1.1 below analyses the types of processes the students in this study deployed and the kinds of meanings achieved through these choices.

Furthermore, the types of entities deployed construe different meanings in the texts. As discussed in Chapter 3, the use of abstract and metaphoric entities allows for more specialised meanings to be expressed. In contrast, everyday, informal language may deploy more concrete, non-specialised entities (Martin & Rose, 2007). Section 4.2.1.2 analyses the types of entities deployed in the students' texts, and discusses the meanings construed through these choices.

Finally, an analysis of the logical relations reveals how effectively the students are organising their texts to achieve the valued structures of academic discourse. As detailed in Chapter 3, logical relations can be analysed for their organisational function (i.e., addition, consequence, time and comparison; Martin & Rose, 2007, p.

121). Section 4.2.1.3 analyses the logical relations used in the student texts, and identifies how these choices contribute to the aims of academic discourse.

4.2.1.1 Process Types

The analysis of the nineteen student texts reveals that a total of 780 Material, Relational, Verbal, Mental, Behavioural, and Existential processes were deployed with various degrees of frequency across the nineteen texts. Among these processes, Materials are the most frequently occurring, used 391 times, comprising 50% of all processes, as illustrated in Figure 4.3.

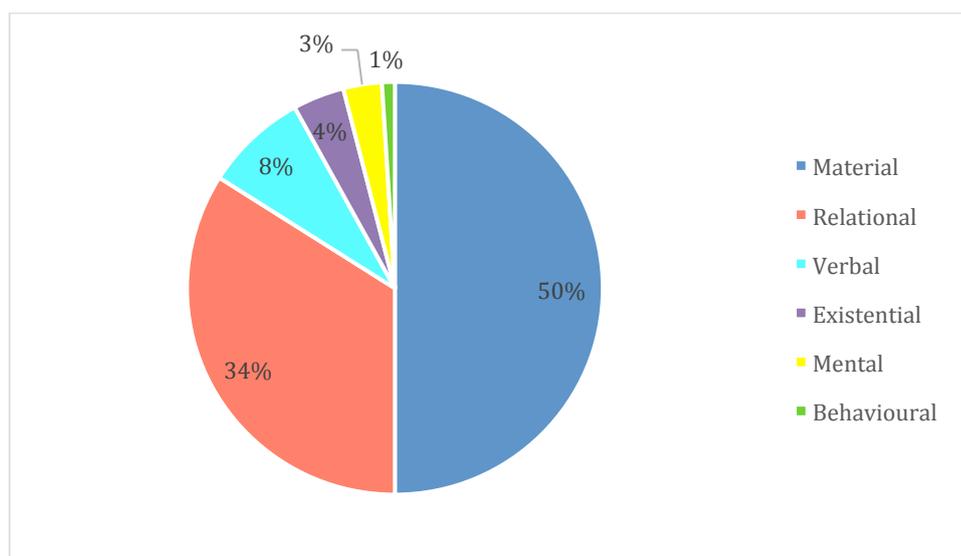


Figure 4.3 Proportion of process type reliance

For example, in Excerpts 32 and 33, the processes *deal* and *destroy* construe active, material meanings:

32. They **deal** with physical impacts such as loud noise. [Text 6]

33. Another issue is that *Bacillus Thuringiensis* crop **destroy** pesticides. [Text

2]

Relational processes are the second most frequently used type of process (e.g., *is, have*) (Excerpts 34 and 35), comprising 34% of all processes used across the nineteen student texts (occurring 264 times). As discussed in Chapter 2 (Section 2.2.1.1), Relational processes can be further understood as being either Identifying or Attributive. Of the 264 Relational processes deployed in these texts, most are Attributive processes (54%). For example in Excerpt 34, ‘water’ is Carrier and ‘inadequate’ is Attribute and in Excerpt 35, ‘strategies...’ is the Carrier being described by the attribute ‘the greatest potential’:

34. Yet international policies presented by influential organisations such as WaterAid on drinking **water** is **inadequate**. [Text 12]

35. Strategies that aim to improve the population’s attitudes and behaviour towards nutrition and exercise **have** the greatest potential to address the epidemic. [Text 1]

The third most common type of process used in the analysed texts is the Verbal process (e.g., *state*, Excerpt 36) comprising 8% of the processes (i.e., occurring 66 times). Verbal processes are accepted in academic texts to quote and report from various scholars. However, some verbal processes are more valued than others in this sense (e.g., *suggest* and *argue* convey more meaning than *states* or *says*):

36. Chandrasekhara and Mahendra **state** that “the public has to increase its efforts in fundamental and applied biotech research”. [Text 17]

Existential (e.g., *there are*, Excerpt 37), Mental (e.g., *understand*, Excerpt 38), and

Behavioural (e.g., *watch*, Excerpt 39) processes are comparably less frequent in the students' texts, deployed only 4% (28 times), 3% (23 times), and 1% (8 times), respectively.

37. There are some issues that impede the development and the implementation of renewable resources. [Text 13]

38. The importance of hygiene is not understood or applied. [Text 7]

39. Yet, interestingly (Brown) discovered that children of part-time working mothers were less likely to watch television. [Text 1]

There is some variation in the usage of these processes in each text. For example, Text 15 deploys Material processes most frequently (i.e. 70%), whereas Text 5 uses Relational processes most frequently (i.e. 53%), as can be seen in Figure 4.4.

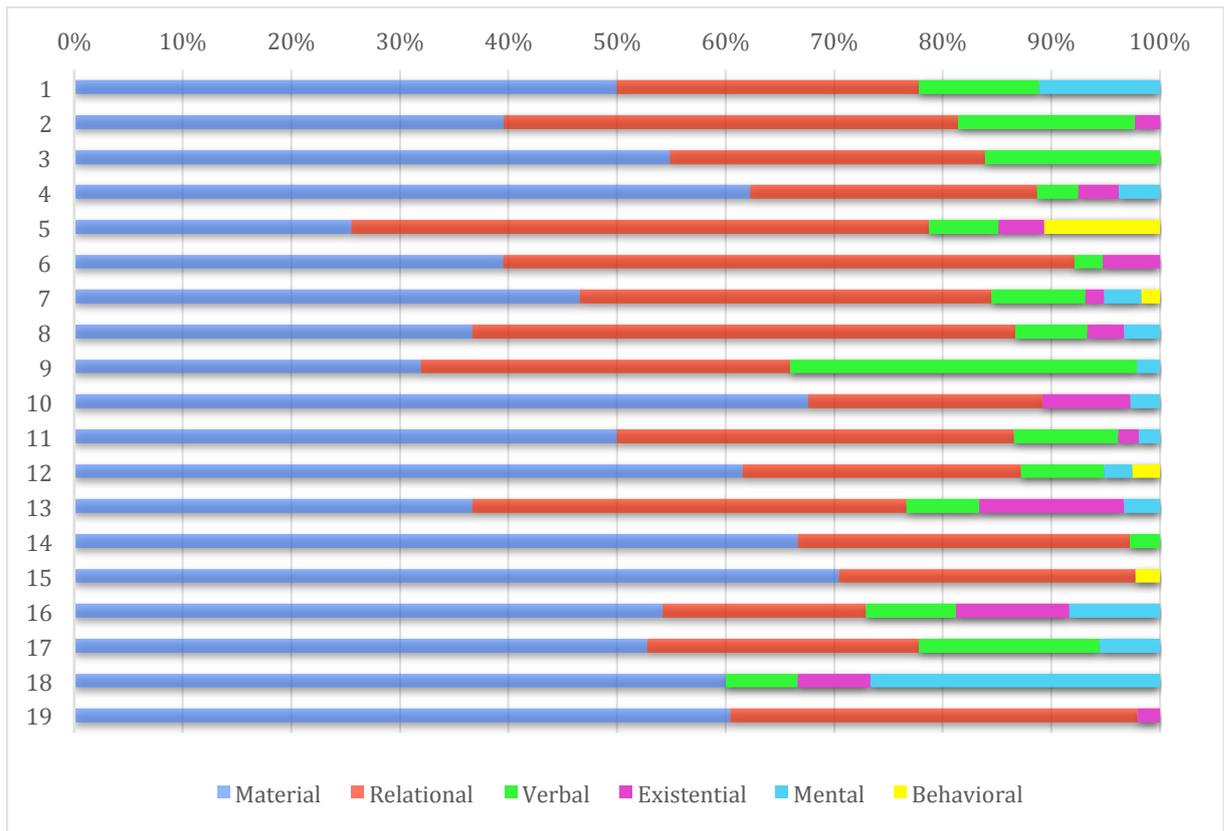


Figure 4.4 Proportions of process types per text

The choice of process type contributes to the experiential meanings construed in the texts. As discussed in Chapter 2, AW most values relational processes, organising events into cause-and-effect, relational networks (Halliday & Martin, 2003; Schleppegrell, 2004). While some Material, Mental and Verbal processes are to be expected in AW, Behavioural processes construe a personal, ‘human-linked’ expression that is less valued in academic discourse. Therefore, while the deployment of more valued forms, such as Relational processes, occur second most frequently in the text, there appears to be room for further improvement to organise the texts more statically.

4.2.1.2 Entity Types

The entity analysis examines which types of entities the students most frequently deployed. Overall, there were 3314 entities found across the nineteen texts. Of those, 60% are abstract (i.e. 2003 instances), 29% are concrete (955 instances), and 11% can be classified as metaphoric (356 instances).

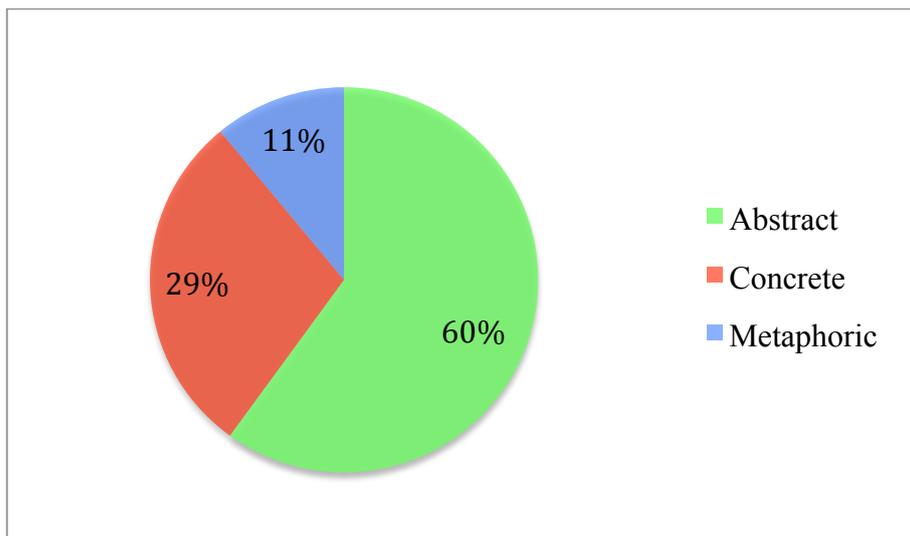


Figure 4.5 Proportions of entity type reliance across the nineteen texts

As illustrated in Figure 4.5, the students in this study generally relied upon abstract entities (i.e., 60%) and within this category, the students most frequently deployed institutional entities (i.e. 46% of all abstract entities, 885 occurrences) such as *application* (Excerpt 40), followed by technical (36% of all abstract entities, 696 occurrences) such *diabetes*, *cardiovascular* (Excerpt 41):

40. The **application** of pesticides to crops increases their yield as less is eaten or rendered unusable due to invasive species such as insects. [Text 17]

41. While other health problems include **diabetes** and other **cardiovascular** related conditions. [Text 2]

The second most frequently deployed type of entity is concrete (29%), occurring 955 times across the nineteen texts. While some concrete entities are to be expected, even in academic texts, the majority of those deployed in these students' texts are everyday entities (i.e. 796 occurrences or 83% of all concrete entities) as opposed to the more valued, *specialised* concrete entities. Everyday concrete entities in these texts are used mostly to refer to people (e.g., *child, mother*, Excerpt 42), whereas specialised entities refer to specific concrete items used in specialised fields (e.g., *wind farm*, Excerpt 43).

42. However, Champion, Giles and Moore (2010) found that “**mothers** who followed less lenient food-related practices were more likely to have a **child** who was overweight/obese”. [Text 1]

43. Due to poor consultation and lack of information, there has been an increase in opposition to **wind farms**. [Text 6]

Metaphoric entities occurred least frequently in the student texts (i.e., 11%), occurring only 365 times. Of those metaphoric entities, 53% (194 instances) were Quality metaphors (e.g. *secure* as *security*, *viable* as *viability*, Excerpt 44) and 47% (171 instances) were process metaphors (e.g. *develop* as *development*, Excerpt 45):

44. Food **security** and thus economic **viability** can be achieved in developing countries through agricultural biotechnology. [Text 17]

45. In WaterAid's post-2015 framework for **development**, they themselves are not confident. [Text 12]

This overall preference for abstract entities contributes to the construction of technical, abstract meanings privileged in academic writing, especially those within the sciences. However, this reliance is not consistent across the nineteen texts. A closer examination of the entity preferences for each student reveals some variation.

Some texts demonstrate more valued entity reliance than others do. For example, 86% of the entities in Text 3 are abstract and only a few are concrete (i.e., 4%), whereas only 38% the entities in Text 15 are abstract and more 48% are concrete, as detailed in Figure 4.6.

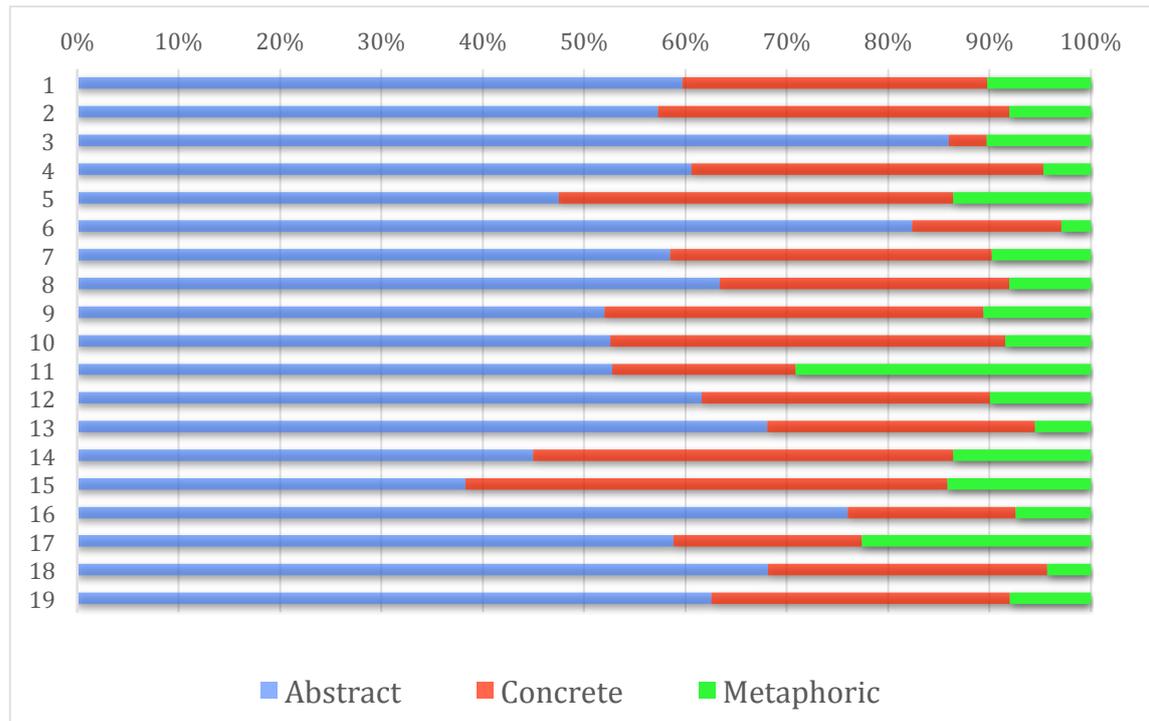


Figure 4.6 Proportion of entity types per text.

In summary, the findings presented in this section have shown the frequency and prevalence of the different types of entities deployed across the nineteen student texts. These findings reveal that the students in this study most commonly use abstract entities, suggesting the students' familiarity with appropriate lexis for this disciplinary context. The second most frequent type of entity deployed, however, is concrete everyday entities. Since the choice of entity creates the field and indicates text

formality, the considerable number of everyday, concrete entities shown in some texts may impact the academic formality of their writing.

4.2.1.3. Logical Relations

The third focus of the ideational metafunction analysis concerns the students' use of logical relations, examining how the students join their clauses using different relators. As discussed in Chapter 2, logical relations can be categorised into four different functions: addition, comparison, consequence, and temporal (see also Martin & Rose, 2007, pp. 123-124). Figure 4.7 illustrates the proportion of logical relators identified in the students' texts.

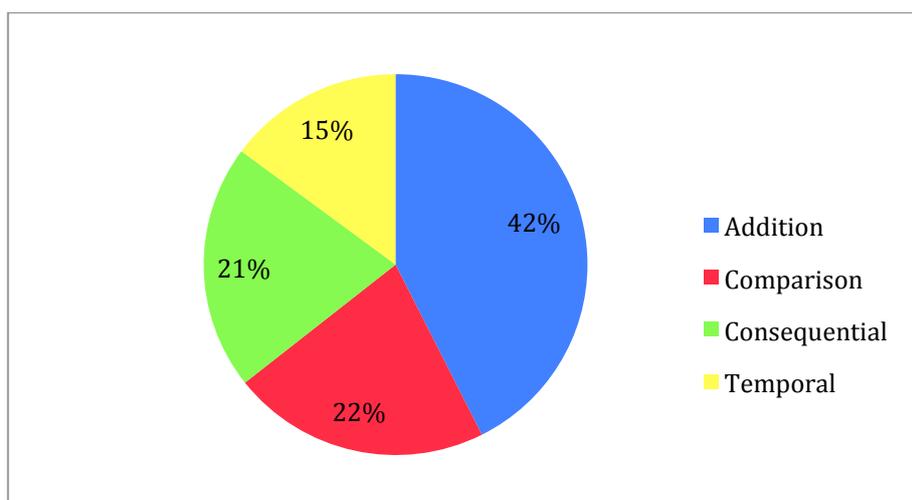


Figure 4.7 Proportions of logical relator types in students' texts

As presented in Figure 4.7, additive relators are the most frequently occurring type of logical relation, comprising 42% of the total number of relators. Additive relators in these texts are used to express expansion and add information. Addition is to be expected in academic texts; however, if it is used too frequently in close

proximity, it can create a sense of “stringiness” and errs towards becoming a run-on sentence. For example, in Excerpt 46, the relators *also* and *and* connect four consecutive clauses within a single sentence, achieving a somewhat grammatically intricate construction:

46. This can also be seen in Figure 1 where birth attendants have been provided and the mortality rates of children has been recorded and then compared to one another. [Text 5]

The second most common type of logical relation is comparative, comprising 22% of all logical relations deployed across the nineteen texts. These logical relations communicate similarity (e.g., *as*, *similarly*) and contrast (e.g., *in contrast*). Comparison is to be expected in academic texts; however, if it is used frequently and inappropriately, it can detract from the reader’s comprehension of the text. For example, in Excerpt 47, the relators *however* and *in contrast* occur within a single sentence, conveying a somewhat repetitive and confusing meaning:

47. It is generally assumed that if a parent is more lenient with their child’s food choices, the child will consume more unhealthy foods. **However, in contrast,** Champion, Giles and Moore (2010) found that “mothers who followed less lenient food-related practices were more likely to have a child who was overweight/obese”. [Text 1]

The third most common type of logical relation is consequence (i.e., 21%). These logical relations communicate cause (e.g., *because*), means (e.g., *by*), purpose (e.g., *in order to*) and condition (e.g., *if*). As can be seen in Excerpt 48, such relators construe the cause-and-effect relationships privileged in academic discourse.

48. Furthermore, obesity greatly impacts productivity in Australian workplaces, as obese employees have significantly higher absenteeism than non-obese

employees. **Therefore**, urgent action is required to reduce the burden of obesity in Australia. [Text 1]

The least frequently used type of logical relation is the temporal relator, comprising only 15% of all logical relations in the analysed texts. Such relators communicate succession (e.g., *then*, *before*) and simultaneousness (e.g., *while*). In Excerpt 49, the temporal relator, *after*, shows a time sequence linking clauses together. Such relations are more expected in recounts or procedures; as such, their infrequency in these reports is not unexpected:

49. This was proven to be wrong as almost immediately **after** the consumption of these soybeans severe allergic reactions were observed amongst these people.
[Text 2]

While Figure 4.7 above outlines the overall proportion of logical relation use, when examining the students' texts individually, there is some variation in their reliance on these four types of logical relations, as illustrated in Figure 4.8. For example, in Text 8, additive relators comprise 71% of all logical relations, while in Text 11-13 and 16, additive relations comprise less than one third of the relators used.

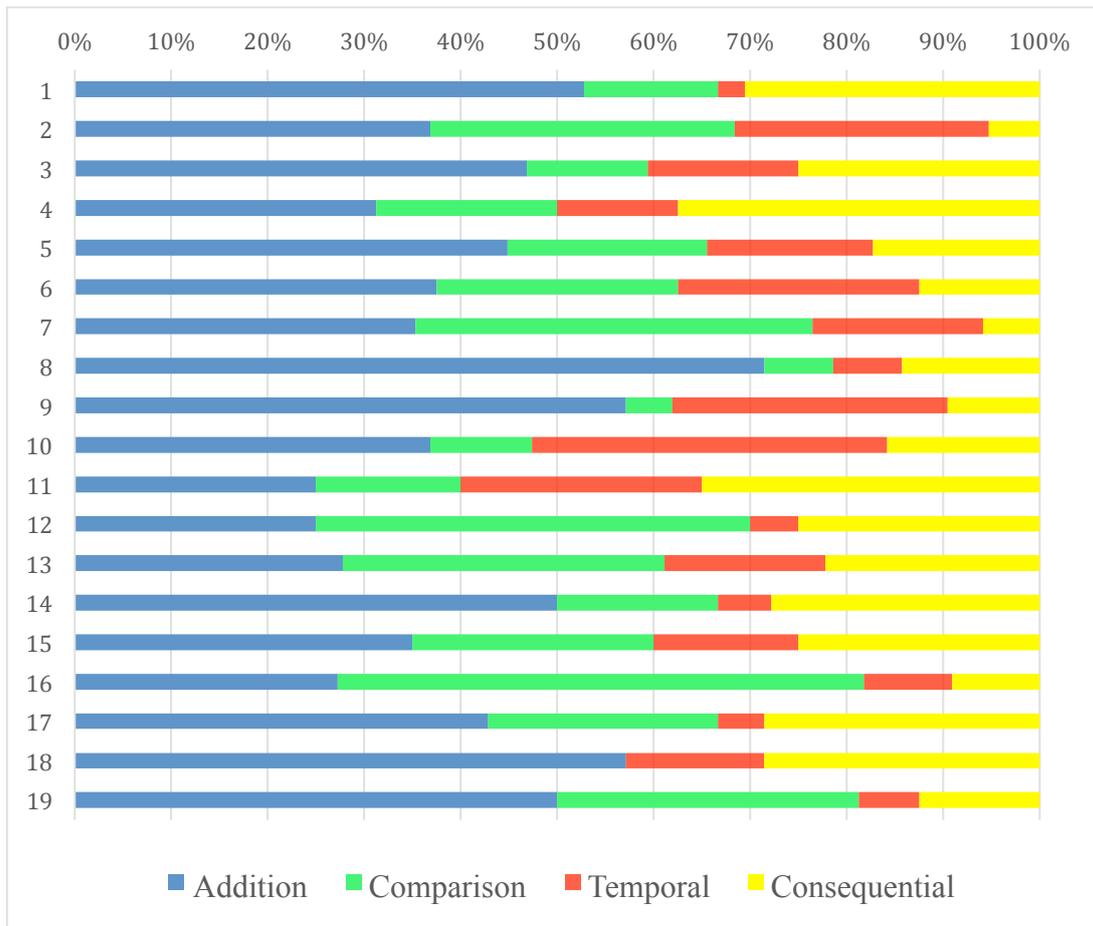


Figure 4.8 Proportions of logical relator types per text

In summary, the analysis of logical relations reveals the students' general reliance on additive and comparison relators when organising their texts. While this analysis is important for understanding how clauses are organised and connected, the frequency with which the students deploy logical relations may also indicate their over-reliance on such relators to organise their texts. To achieve the condensed, relationally-oriented structures valued in academic discourse, students may require some instruction on the tools of grammatical metaphor to further organise their texts. Notably, some students effectively integrated grammatical metaphors into their texts;

however, for purposes of scope, a full analysis of these constructions has not been conducted³.

4.2.2 Textual Meanings

The analysis of meanings construed in the textual metafunction allows for a deeper understanding of the structure and organisation achieved within and across clauses. Specifically, the analysis of clause and sentence-level organisation reveals how effectively the language is structured to communicate the meanings therein. Furthermore, an analysis of thematic progression is conducted to reveal the level of cohesion achieved across the texts. Section 4.2.2.1 analyses the structure and organisation of clauses and sentences, and identifies those structural infelicities most prevalent in the students' texts. Section 4.2.2.2 then examines the students' choices of themes and thematic patterns, identifying how effectively these patterns achieve the cohesion valued in academic discourse.

4.2.2.1 Clause and Sentence Structure

One of the key challenges with the organisation of clauses centres around the verbal group and its alignment to the Participant functioning as Subject in the given clause. In the present study, students struggle to achieve this alignment, otherwise known as "Subject-Verb Agreement" (hereafter, SVA). Beyond the clause, several infelicities with sentence construction are identified in the data. Overall in the data, 43 of infelicities are identified. Of these, the two most prominent types are run-ons and fragments, as illustrated in Figure 4.9.

³ As noted in Chapter 1, the present study functions as a pilot for a larger PhD study. Although SFL offers an extensive and detailed framework for analysis, the present analysis of the ideational metafunction is limited to congruent constructions.

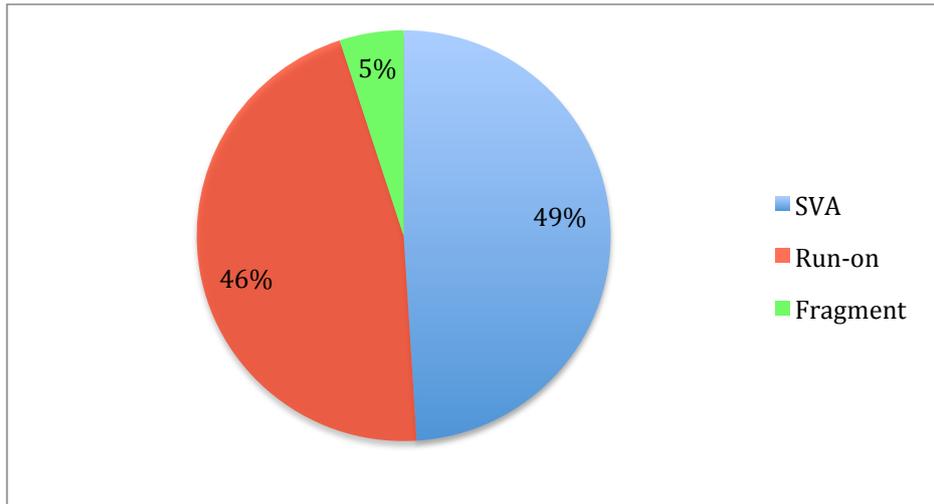


Figure 4.9 Proportions of clause and sentence structure

In general, subjects and verbs must agree with one another in number, taking into account the characteristics of mass and count nouns. Therefore, if a subject is singular, its verb must also be singular, and likewise for a plural. In the analysed texts, however, this system of agreement appears as one of the key writing challenges for the students in this study. As can be seen in Figure 9, SVA shows the highest proportion of errors (i.e., 49% of all errors found across the 19 texts), occurring 21 times, as illustrated in Excerpts 50-51:

50. Swinburn (2011) state overweight is classified with a BMI over 25. [Text 9]

51. Champion et al (2010), Daniel et al (2009), and OWG (2009) points out that children's unhealthy ... [Text 9]

In the first Excerpt, the 's' is omitted from the singular verbs in present tense (i.e., *states* as *state*); and in Excerpt 51, it is added to the plural verb (i.e. *point* as *points*). Therefore, students may require some instruction on the appropriate alignment of the verbal group to the Participant, to properly achieve SVA (i.e., rather than

‘disagreement’)

The challenges identified beyond the clause level involve appropriate sentence structure. The analysis reveals some sentences demonstrating a ‘run-on’ structure (i.e., two independent clauses joined together incorrectly and written as one sentence without proper punctuation) and fragmented sentences (i.e., the absence of a finite verbal group). As can be seen in Figure 4.9 above, run-on sentences occur proportionately similar to the rate of SVA errors, comprising 46% of students’ infelicities in relation to clause and sentence level construction. The run-on sentences are realised by fused sentences (i.e., two or more independent clauses joined together without any punctuation) and comma splices (i.e., two or more independent clauses joined together by only a comma). As illustrated in Excerpt 52, fused sentences link two or more independent clauses together in a single sentence through conjunction (i.e., *and*, *so*):

52. This problem can mainly be seen within third world countries and is a key aspect to other countries so people are trying to focus on the whole world at large and showing the same equality. [Text 5]

Similarly, comma splice ‘run-ons’ involve two or more independent clauses joined together with only a comma, as illustrated in Excerpt 53:

53. Furthermore genetically modified species produce higher quality crops due to pest resistance and species supremacy, this makes these crops more attractive to buyers [Text 15]

The third infelicity identified in the students’ texts is sentence fragments. Although sentence fragments are proportionately less represented in the students’ texts (i.e. only

two occurrences or 5%), they have an impact on reading comprehension and can lead to confusion, as illustrated in Excerpts 54 and 55:

54. From Heavy-metal removal such as lead, to Arsenic and Iron removal. [Text 12]

55. By contrast, after the tsunami in Indonesia, the ones. [Text 18]

In these excerpts, the sentences simply include dependent clauses without linking them to independent clauses to express a completed meaning.

This linking of two or three independent clauses into one long sentence and the omission of an independent clause to form a fragmented structure may obscure the focus of the main idea or confuse the readers (Thompson, 2013). The finding on sentence structure infelicities in this study thus indicates that some students are not fully in command of English written sentence structures.

4.2.2.2 Thematic Progression

The second key area investigated within the textual metafunction is Thematic Progression, or the flow of the messages. As discussed in Chapter 2, there are three types of Thematic progression: Constant (i.e., a Theme is picked up and repeated at the beginning of each clause), Zig-zag (i.e., the subject matter in the Rheme of the previous clause is taken up in the Theme of a following clause), and multiple Theme (i.e., a Rheme may include some different information which may be taken up as theme in a subsequent clauses) types. The analysis of thematic progression patterns is somewhat more nuanced than the quantitative analysis of infelicities or number of entity types. Therefore, these findings are presented more qualitatively, with examples illustrating the valued and less valued patterns identified across the nineteen texts.

In relation to the students' written texts, the analysis revealed very few examples of thematic progression. Of those found, most demonstrate the Zig-zag thematic progression. For example, in Excerpt 56, the Rheme *cotton*, the 'New' information in the initial sentence, is used as Theme for the second sentence; and in Excerpt 57, the Rheme or 'New', *genetic modification*, in the initial sentence becomes the Theme or 'Given', of the second sentence:

56. The most widely grown BT crop is **cotton**, mostly grown in Chinese and Indian areas. **Cotton** can be genetically modified to resist different parasites such as the American bollworm. This results in a reduction in pesticide use and cost. [Text 19]

57. Scientific academia presents the evaluation of long-term effects and economic viability of agricultural **genetic modification** in developing countries as an area that requires additional research. **Genetic modification** of crops has been the issue of debate regarding multiple areas. [Text 17]

As demonstrated in Excerpts 56 and 57, cotton and *genetic modification* are accumulated through a zig-zag pattern, showing how ideas are connected to each other. Such a pattern is most valued in academic writing for achieving text cohesion and facilitating the flow of information.

Some students in this study organised their themes into a Constant thematic pattern, a pattern less valued for scientific academic writing (Halliday & Martin, 2003). For example, Excerpt 58 presents the Theme 'parents' in a somewhat repetitive pattern that does not contribute to the flow of information.

58. **Parents** believed their children could discern between healthy and unhealthy food choices. **Parents** were concerned that advertising and marketing strategies made energy-dense foods appealing to children in spite of warnings

of their negative health consequences. **Parents** felt that they were not as informed as they needed to be, especially concerned about picking the right product when such a huge array is available. [Text 10]

In other words, in Excerpt 58 above, the Theme *parents* is repeated as the Theme in three consecutive sentences. While some of the constant Theme progression established is suited for describing the role of the participants, a greater use of the zig-zag Theme pattern might have increased the clarity and cohesion.

In short, the findings show that when students organise their texts with thematic progression, they tend to choose the pattern most valued in academic contexts (i.e., zig-zag pattern). However, it is observed that the application of this thematic pattern is restricted to two or three clauses, which leads to a limited string of cohesion across sections of text. The findings also indicate that some students struggle to organise their ideas and texts to build cohesion through thematic progression. As such, this is a key area for instructional intervention to help students understand and properly employ the thematic patterns valued in writing for academic contexts.

4.2.3 Summary of Text Analysis

This section first presented analyses of the types of processes, entities and logical relations that students most rely upon when constructing ideational meanings. Students in this study most frequently deployed Material processes, followed by Relational processes. This reliance on Material and Relational processes is somewhat to be expected in academic texts; however, students may need some instructional intervention to ensure their experiential meanings construe a mostly static, relationally-oriented field expected in most academic writing (i.e., through more frequent use of Relational processes).

The analysis of Entity types reveals that the students frequently used abstract entities, followed by concrete ‘everyday’ entities. The use of both abstract and concrete entities is somewhat expected in scientific academic texts; however, students may better construe the technical Fields of scientific discourse if they deploy more specialised concrete entities rather than everyday ones. Thus, students may benefit from explicit instruction outlining the types of entities required for scientific disciplines.

Furthermore, the analysis of logical meanings shows that the students in this study tended to rely on additive logical relators. Although the use of additive relators are generally accepted in academic writing and necessary in some cases to extend or join clauses, the excessive use of a particular relator across several clauses and sentences often leads to run-on constructions that can obscure the intended message, and which are often interpreted as informal academic expression in academic writing (Lee, 2013). Therefore, students may require additional instruction on alternative logical relations and, specifically, on the value of organising meanings into the more privileged cause-and-effect networks (e.g., through grammatical metaphor).

The analysis of the textual metafunction revealed students’ difficulties in constructing their meanings at both clause (i.e., SVA) and sentence levels (i.e., run-on sentences and sentence fragments). It also showed that in general, students infrequently organise their texts in thematic progression patterns. When they do, some students appeared to rely on constant thematic patterns. Although the use of this pattern is generally accepted in writing, it is perceived to have less value in scientific academic writing (Francis, 1990; Fries, 1995; Wang, 2007). Thus, students may

require explicit teaching of grammar and thematic progression patterns to achieve the cohesion and information flow valued in scientific disciplines.

Although these findings reveal specific areas in which the students are construing less valued and somewhat disorganised meanings, the analysis did reveal how students also frequently deployed the most valued forms. For example, the second most prominent type of process was Relational, the second most frequently deployed type of entity was abstract, and the common type of thematic progression was the Zig-zag pattern. Therefore, while improvement is necessary, students are already on the right path toward academic writing proficiency.

4.3 Discussion of Tutors' Perceptions and Text Analysis

The present study examined tutors' perceptions of their students' academic writing and analysed nineteen undergraduate science students' texts to identify how extensively the students' texts reflected the concerns noted in the tutor interviews. In review, in addition to concerns about their students' academic writing awareness. In short, the tutors identified six linguistic challenges students typically face when developing their AW: sentence structure, lexical choices, organisation and flow of ideas, writing mechanics, informal style, and referencing. The text analysis has focussed on the ideational and textual meanings that the students construe in their texts. Specifically, it has examined the choices of processes, entities and logical relations, to explore how these choices achieve the abstract, relationally-oriented Fields valued in scientific texts. It further examined clause and sentence-level organisation, as well as thematic progression across longer stretches of text, to explore how accurately and cohesively students are structuring their text at the level of the clause and beyond.

One key linguistic challenge that emerged from the interviews is the lack of lexical variation in the students' texts. This lack of variation can be seen in the analysis of the students' texts where students tended to rely on concrete, non-specialised (i.e., everyday) entities, rather than on more technical, abstract entities. Similarly, the analysis revealed a preference for Material processes over the more valued Relational processes. This preference for less valued processes and entities may be noted as a lack of lexical variation; and it may also detract from the impression of formality in these texts.

This lack of variation and the preference for less valued entities and Processes reflect the findings of similar studies investigating students' academic writing, noting that students are often unfamiliar with technical terms and lack the disciplinary vocabulary central to their specialised area (e.g., Kaur, 2013; Schleppegrell, 2001). This limited lexical repertoire, in turn, impedes students' overall writing development. Thus, these findings further reinforce the need for teaching lexical variation, and specifically, the value of using certain entities over others, to undergraduate students, to familiarise them with the lexis used in their specific discipline (Hyland, 2007, 2008; Nagy & Townsend, 2012).

Another key linguistic challenge that emerged from the tutor interviews focusses on the structure and organisation of ideas at the sentence level. This challenge is reflected in the text analysis through the examination of clause- and sentence-level structure. The structural infelicities can be seen through students' inability to align the verbal groups with the Head of the participants (i.e. SVA), in their incomplete expression of ideas with fragmented sentences, or through somewhat disorganised, run-on sentences. Such structural infelicities at the clause and sentence level can cause confusion and obstruct the intended message (Christie, 2004; Hudson,

2001; Myhill, Jones, Watson & Lines, 2013). The challenge of writing accurate and clear English sentences has been noted extensively in similar studies (e.g., Evans, Hartshorn, Cox & De Jel, 2014; Evans & Green, 2007; Singh, Singh, Razak & Ravinthar, 2017), confirming that many undergraduate students struggle with appropriate sentence construction and organisation of ideas.

These structural obstacles at the clause and sentence level are further elaborated in the analysis of thematic progression. In particular, tutors lamented the flow of information and overall disorganisation of students' texts. The thematic progression analysis reveals that some students rarely built cohesion through thematic patterns valued in academic contexts. When a clear thematic pattern was detected, it tended to be a constant theme pattern wherein a Theme is picked up and repeated at the beginning of each clause. Unfortunately, constant themes contribute little to the cohesion of a text and are the least valued pattern for organising the flow of information. Students would better achieve the cohesion and logical flow of information their tutors require if they reorganised their texts into the Zig-zag thematic pattern (i.e., Given-New) that is more highly regarded in academic settings (Ahmed, 2010; Wang, 2007; Wei, 2013). Thus, the organisation of texts into cohesive structures to achieve thematic progression patterns is a key area for instructional intervention to help undergraduate students understand how to build cohesive and logically organised texts.

In short, the analysis of the nineteen student texts has confirmed some of the linguistic challenges observed in the tutor interviews: students' limited lexical variation and structural organisation. However, as noted above, more valued Processes, entities and logical relations were used frequently in the students' texts (e.g., Relational processes, abstract entities and relators of consequence). Therefore,

while instruction encouraging students toward these more valued forms is important, the most critical area for intervention is structural organisation at the clause level and beyond.

Chapter 5: Conclusion

5.1. Introduction

This study has investigated tutors' perceptions of their students' academic writing in an undergraduate science communication unit, and compared these perceptions with an analysis of students' actual performance. Four major themes emerged from the tutors' interviews: the importance of academic writing in scientific contexts; students' academic writing awareness; common challenges the students face in developing their writing; and strategies used for overcoming these writing obstacles. The theme of 'linguistic challenges' was further explored through a linguistic analysis of nineteen students' texts.

This comparative investigation has revealed alignment between the teachers' perceptions and students' performance in three key areas: lexical variation, structural organisation (i.e., at the clause and sentence level), and flow of information (i.e., cohesion and thematic progression).

The lack of lexical variation was expressed, in the interview analysis, in terms of students' use of "not formal or academic" word choices, and reflected in the analysis of students' texts in the use of less valued process types (e.g., material) and entity types (concrete, non-specialised). Structural infelicities were understood in terms of "organisation of ideas", which were reflected in the analysed texts through students' inability to construct correct and complete sentences (i.e., SVA, fragmented and run-on sentences). Lack of text cohesion was identified by the tutors as, and reflected in students' texts in, the inability to build cohesion through thematic patterns valued in academic contexts (i.e., no thematical patterns or less valued patterns such as Constant theme).

This study contributes to the field of teaching academic writing through understanding the writing challenges science students face, from the perspective of tutors' perceptions and as evidenced in analysed student texts. It does this by interpreting the tutors' perspectives on the linguistic challenges in comparison to an SFL analysis of students' texts. For example, the analysis of experiential meanings provides greater insight into what the tutors meant by "informal language", and "incorrect grammar", by examining students' infelicities at clause level (i.e., Process, entity and logical relation types). On the other hand, the analysis of the textual metafunction enables us to understand how the students' texts reflect the tutors observations reflecting "organisation of ideas" and "incoherent text", by examining sentence structure and thematic progression.

By understanding the meanings of these perceptions, which were supported by the results from analysis of the students' texts, the present findings can benefit teachers in understanding students' difficulties, and thus can help them in teaching academic writing. These findings also inform a more focused pedagogy supporting the needs of science students struggling to achieve the levels of language accuracy, lexical sophistication, information density, and text cohesion demanded in academic contexts.

5.2. Limitations and Directions for Further Study

As discussed in Chapter 1, the present study serves as a pilot study for a projected larger (PhD) investigation into undergraduate students' writing in a science program. Due to the nature of the present project and related time constraints, this

study is limited in both data size and breadth of analysis. Among the limitations related to the size of the data is, firstly, that the study interviewed only four tutors and examined only 19 student texts, and left aside the students' perspectives on the challenges they face. This sample size limits the potential to generalise the results beyond the study's participants, towards the wider population of science students. Future studies may conduct a study with a larger data set and add a third dimension to the study: interviewing students to identify their perceptions of their own writing and how they need to improve. This third angle of analysis could better investigate alignment between the tutors' perceptions of the importance of AW, students' own awareness and interpretation of their tasks, and their actual texts, in producing recommendations for developing students' AW.

Secondly, among the limitations related to the breadth of analysis is that the study only focusses on meanings and infelicities found in students' texts related to some parts of the ideational metafunction (i.e. only Process, entity, logical relator types) and textual metafunction (i.e., sentence structure and thematic progression), and does not include any analysis of the interpersonal metafunction. Future investigations may extend to examine the meanings students' express across all three metafunctions and specifically, include an analysis of formal and informal language. More extensive analyses such as these would contribute to a more comprehensive understanding of students' challenges in writing for a scientific context. Due to these limitations, this investigation may be viewed simply as a pilot study for a larger examination of the specific linguistic and instructional needs of undergraduate science students.

5.3. Conclusion

In conclusion, through this comparative examination of students' writing and tutors' perceptions of this writing, the present thesis has contributed to an understanding of how accurately tutors' perceptions of their student writing aligns with students' actual performance. If teachers' beliefs affect their teaching practices, it follows that their perceptions of students' academic writing will inform their teaching practices. The present study builds upon these premises to investigate how extensively students' texts reflect the key challenges highlighted by their tutors. Such an investigation serves as an initial step towards understanding students' writing challenges in relation to their tutors' perspectives, and thus ensuring that classroom instruction accurately addresses the areas most critical for student success in an undergraduate science program.

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Appendices

Appendix A: Ethics Approval Letter



MACQUARIE
University

KHATMAH ALANAZI <khatmah.alanazi@students.mq.edu.au>

RE: HS Ethics Application - Approved (5201700362)(Con/Met)

2 messages

FHS Ethics <fhs.ethics@mq.edu.au>

Wed, May 3, 2017 at 3:17 PM

To: Cassi Liardet <cassi.liardet@mq.edu.au>

Cc: Ms Khatmah Samer N Alanazi <khatmah.alanazi@students.mq.edu.au>

Dear Dr Liardet,

Re: "Investigating first year undergraduate students' writing development of English for Medical Purposes" (5201700362)

Thank you very much for your response. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and approval has been granted, effective 3rd May 2017. This email constitutes ethical approval only.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

<https://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research>

The following personnel are authorised to conduct this research:

Dr Cassi Liardet

Mrs Khatmah Alanazi

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).
2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 3rd May 2018

Progress Report 2 Due: 3rd May 2019

Progress Report 3 Due: 3rd May 2020

Progress Report 4 Due: 3rd May 2021

Final Report Due: 3rd May 2022

<https://mail.google.com/mail/u/1/?ui=2&ik=0411435343&jv=Fall.6tud9M.en.&view=pt&q=ethics%20approved%20application&q=trm&search=query&th...> 1/4

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/current_research_staff/human_research_ethics/resources

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).

4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/current_research_staff/human_research_ethics/managing_approved_research_projects

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

<http://www.mq.edu.au/policy>

http://www.research.mq.edu.au/current_research_staff/human_research_ethics/managing_approved_research_projects

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of approval to an external organisation as evidence that you have approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely,

Dr Naomi Sweller

Chair

Faculty of Human Sciences

Human Research Ethics Sub-Committee

Appendix B: Tutor Participant Forms (Tutor Invitation Letter & Consent form)

DEPARTMENT OF
LINGUISTICS
Faculty of Human Sciences
Macquarie University
NSW 2109 Australia

Invitation Letter



Dear Tutor,

As part of this study investigating first year undergraduate students' writing development of English for Medical Purposes, we invite you to also consider participating by taking part in a short interview. The interview should only last between 15-20 minutes and will ask you questions about your experiences teaching first year undergraduate students in the Bachelor of Clinical Studies degree.

If you are willing to participate, could you please let us know via email (khatmah.alanazi@students.mq.edu.au) or in person and we will arrange a time that is suitable for you.

The interview questions are included below for your reference. Thank you in advance for your consideration.

Kind regards,

Dr. Cassi Liardét, Lecturer, Linguistics (Chief Investigator)

Khatmah Alanazi (Co-Investigator)

Interview Questions

1. Why is writing (i.e., academic writing) important to medical students?
2. In your experience, are medical students aware of the importance of academic writing to their field?
3. What writing challenges do your students encounter in the MEDI103 class? (i.e. Structure, academic expressions: cohesion, word choice, thematic)
4. Does their English proficiency level affect their academic writing performance?
5. Do the bachelor clinical studies' students tend to understand the guidelines and requirements of the course assignments and do they apply them? (E.g. *deadline, content, generic structure*).
6. Have you observed any distinction in the challenges English L1 students face versus those who speak English as an additional language (EAL)?

7. What advice or guidance do you give students who are struggling with writing difficulties? (E.g., extra writing tasks?)
8. Are there any further suggestions you would provide for medical students to overcome their writing challenges?

Department of Linguistics
Faculty of Human Sciences
MACQUARIE UNIVERSITY NSW 2109
Phone: +61 (0)2 9850 6704
Fax: +61 (0)2 9850 9190
Email: mqlc@mq.edu.au



Chief Investigator: Dr. Cassi Liardét, Lecturer, Linguistics

Co-Investigator: Khatmah Alanazi

Participant Information and Consent Form (Tutor)

Name of Project: Investigating first year undergraduate students' writing development of English for Medical Purposes

Dear Tutor,

You are invited to participate in a study of university learners' development of academic literacy. The purpose of the study is to explore how first year 'pre-med' students develop their academic writing and identify challenges medical students face in this development.

The study is being conducted by Cassi Liardét (Chief Investigator) and her co-investigator: Khatmah Alanazi from the Department of Linguistics, Faculty of Human Sciences, Macquarie University. This project is designed for Khatmah Alanazi's Masters by Research study under the supervision of Dr. Cassi Liardét of the Department of Linguistics. Contact details are as follows:

Dr. Cassi Liardét (Chief Investigator)
cassi.liardet@mq.edu.au
Bldg C5A, Rm. 537
Macquarie University, NSW 2109
Ph: +61 (0)2 9850 6704

Khatmah Alanazi (Co Investigator)
khatmah.alanazi@students.mq.edu.au
Department of Linguistics, Faculty of Human Sciences
Macquarie University, NSW 2109

If you decide to participate, you are invited to participate in a short, 15-20-minute face-to face interview in which we will ask you questions about your experiences teaching first year Bachelor of Clinical Studies students and to describe any challenges these students face in their development of academic communication, specifically, their development of English for Medical Purposes. With your permission, this interview will be audibly recorded to assist the interviewer with her note. If you would prefer not to be recorded, when the interviewer asks for your

permission to record the interview, please simply say 'no'. If you consent to the interview being recorded, the audio recording will be saved on the investigators' password protected desktops and only the research team will have access to these files.

Any information or personal details gathered in the course of the study are confidential, except as required by law. No individual will be identified in any publication of the results. Only the chief investigator (Cassi Liardét) and her co-investigator (Khatmah Alanazi) will have access to your name.

If you choose to participate, you will be assigned a number to protect your anonymity both in the collected interview data and in any related publications. A summary of the results of the data can be made available to you on request (via email).

Participation in this study is entirely voluntary: you are not obliged to participate and if you decide to participate, you are free to withdraw at any time without having to give a reason and without consequence.

I, _____ (*participant's name*) have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

I consent to have my interview audio recorded.

I do not want my interview audio recorded.

Participant's Name: _____
(Block letters)

Participant's Signature: _____ Date: _____

Investigator's Name: _____
(Block letters)

Investigator's Signature: _____ Date: _____

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics and Integrity (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

PARTICIPANT'S COPY

Interview Questions

1. Why is writing (i.e., academic writing) important to medical students?
2. In your experience, are medical students aware of the importance of academic writing to their field?
3. What writing challenges do your students encounter in the MEDI103 class? (i.e. Structure, academic expressions: cohesion, word choice, thematic)
4. Does their English proficiency level affect their academic writing performance?
5. Do the bachelor clinical studies' students tend to understand the guidelines and requirements of the course assignments and do they apply them? (E.g. *deadline, content, generic structure*).
6. Have you observed any distinction in the challenges English L1 students face versus those who speak English as an additional language (EAL)?
7. What advice or guidance do you give students who are struggling with writing difficulties? (E.g., extra writing tasks?)
8. Are there any further suggestions you would provide for medical students to overcome their writing challenges?

Appendix C: Student Participant Consent Form

Department of Linguistics
Faculty of Human Sciences
MACQUARIE UNIVERSITY NSW 2109
Phone: +61 (0)2 9850 6704
Fax: +61 (0)2 9850 9190
Email: mqlc@mq.edu.au



Chief Investigator: Dr. Cassi Liardét, Lecturer, Linguistics

Co-Investigator: Khatmah Alanazi

Participant Information and Consent Form (Student)

Name of Project: Investigating first year undergraduate students' writing development of English for Medical Purposes

Dear Student,

You are invited to participate in a study of university learners' development of academic writing. The purpose of the study is to explore how first year 'pre-med' students develop their academic writing and identify challenges medical students face in this development.

The study is being conducted by Cassi Liardét (Chief Investigator) and her co-investigator: Khatmah Alanazi from the Department of Linguistics, Faculty of Human Sciences, Macquarie University. This project is designed for Khatmah Alanazi's Masters by Research study under the supervision of Dr. Cassi Liardét of the Department of Linguistics. Contact details are as follows:

Dr. Cassi Liardét (Chief Investigator)
cassi.liardet@mq.edu.au
Bldg C5A, Rm. 537
Macquarie University, NSW 2109
Ph: +61 (0)2 9850 6704

Khatmah Alanazi (Co Investigator)
khatmah.alanazi@students.mq.edu.au
Department of Linguistics, Faculty of Human Sciences
Macquarie University, NSW 2109

If you decide to participate, you will be asked to send your assignments (Human Biology Paragraph, Video Analysis Paragraph, and Portfolio Critical Reflection) to the co-investigator via email to khatmah.alanazi@students.mq.edu.au. These three

texts will then be analysed for academic writing development (e.g., academic expression, structure, vocabulary, etc.). As an incentive, if you agree to participate in the study, you will be provided with a written feedback on your first assignment. This feedback will comprise 3-5 sentences identifying any weaknesses in structure, grammar and/or word use.

Any information or personal details gathered in the course of the study are confidential, except as required by law. No individual will be identified in any publication of the results. Only the chief investigator (Cassi Liardét) and her co-investigator (Khatmah Alanazi) will have access to your data.

If you choose to participate, you will be assigned a number to protect your anonymity both in the collected assignments and in any related publications. A summary of the results of the data can be made available to you on request (via email).

Participation in this study is entirely voluntary: you are not obliged to participate and if you decide to participate, you are free to withdraw at any time without having to give a reason and without consequence.

I, _____ (*participant's name*) have read and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Name: _____
(Block letters)

Participant's Signature: _____ Date: _____

Investigator's Name: ?? _____
(Block letters)

Investigator's Signature: _____ Date: _____

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics and Integrity (telephone (02) 9850 7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

PARTICIPANT'S COPY

Appendix D: Thesis Word Count

Table D. Words per chapter

Chapters	Words
Introduction	914
Literature Review	5653
Methodology	3486
Findings	7844
Conclusion	875
Total	18772

Note. Word counts include tables and figures. Footnotes are not included.