Is it feasible?
A comparison of industry and student engineering texts

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Abstract

Professional engineers must move easily between concretisation and abstraction in written communication such as feasibility studies, while remaining rooted in the context of the particular engineering problem to be solved. For example, a study into a solar power project must take into account the particular needs of the local community and requirements of the site. Engineering programmes often seek to use a replicated professional situation in order to prepare students for the workplace, however, there are questions as to how a decontextualised task prepares students for the language and knowledge requirements of the field. This study investigates this issue through a comparison of the executive summaries of two sets of engineering feasibility studies: publicly available industry texts and English as an Additional Language student texts from a Masters engineering program.

The comparison of the corpora of texts focuses on what knowledge looks like from the perspective of field, through analysis of genre staging, process types and discourse semantic entities from Systemic Functional Linguistics, as well as semantic gravity from Legitimation Code Theory. Entities are classified and used to plot the shifts in semantic gravity across genre stages. The findings show that while both corpora are similar in terms of genre and process types, there is a difference in terms of entities and semantic gravity. While the industry texts employ the full range of entity types and consistently make use of stronger semantic gravity, the student texts are dominated by entities that can be considered to have a weaker semantic gravity, suggesting that the student texts are less bound to the concrete reality of their project. This has implications for those working in disciplinary and professional literacies.

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1. Introduction

1.1 Context of the problem

Professional engineers must be able to apply and communicate technical engineering knowledge in real world, interdisciplinary spaces. Engineering problems are complex and require engineers to apply abstract principles to concrete situations while accounting for the varied contextual constraints surrounding the problem, both technical and non-technical (Engineers Australia, 2016). The need for recontexualisation of abstract knowledge for application in specific situations means that engineers must be fluent in moving up and down a relative scale of abstraction and concretisation, but ever be 'rooted in the concrete' (Wolmarans, 2016 p.1). A lack of ability to apply knowledge has been found to be one reason why graduate engineers may fail to gain employment (Wolff, 2017 p. 439). These graduates may be lacking in rootedness in the concrete. Engineering students from an English as an Additional Language (EAL) background can face additional challenges in developing problem solving and communication skills as the underlying structures of the discourses of engineering may remain opaque to them. A deficiency in communication and problem solving skills has been identified as contributing to poorer employment outcomes for international graduates in Australia relative to local graduates (Australian Education International, 2010). This study seeks to contribute to the task of making engineering discourse structures explicit, in order that they may be more accessible to EAL and non-EAL engineering students alike.

An understanding of the knowledge structures of engineering discourse and education is essential. The structures of knowledge itself have arguably been obscured in educational research (Maton 2014), as studies have focused either on the process of learning or the characteristics of the learner. This dichotomy has led to a 'knowledge blindness' and a lack of research into the way specific forms of knowledge can shape 'beliefs, actions and social relations of power' (Howard & Maton, 2011, p. 193). Knowledge is construed through language, by way of making meanings in particular contexts and this is the concern of Systemic Functional Linguistics (SFL). SFL takes a social semiotic perspective (Martin, 1992 p.

493), acknowledging that language makes meaning across different levels, and can be used to undertake analysis across the ideational, interpersonal and textual metafunctions (Halliday & Matthiessen, 2014). This study is concerned with the ideational metafunction, which considers the nature of the topic or focus of the social activity, or how experience is represented in texts (Eggins, 2004 p. 12).

Language is the means by which knowledge is construed, meaning is made, and social reality is constructed. Access to meaning-making resources is not equally distributed among all those within a social context, and those with access to the widest range of resources hold the most power (Martin & Rose, 2007 p. 16). Written discourses that enable engagement with social institutions such as the sciences, government and education are among those which are not equally accessible to all. Making the structures of these discourses explicit and accessible is a key aim of SFL (Martin & Rose, 2007 p. 16) and Legitimation Code Theory (LCT), in terms of making visible the unwritten organising principles of social fields of practice (Maton, Martin & Matruglio, 2016 p.3). A focus on education is therefore warranted, as Bernstein (2000) states:

> Education is central to the knowledge base of society, groups and individuals. Yet education also, like health, is a public institution, central to the production and reproduction of distributive injustices. Biases in the form, content, access and opportunities have consequences not only for the economy; these biases can reach down to drain the very springs of affirmation, motivation and imagination (p. xix).

Communication skills are vital for professional engineers, and this is reflected in the professional and personal attributes required of graduate engineers. These skills include preparation of a wide range of written documents, including 'progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations' (Engineers Australia, 2016). Contrary to some perceptions, writing documents can occupy a large portion of the working time of an engineer. One British study has found that engineers can spend at least 50% of their working time in writing (Sales, 2002 p.5). This study will focus on one particular type of engineering document, the feasibility study.

Historically, engineering programs have done little to develop the writing skills needed to succeed in the workplace (Knapp, 1984 p.10; Sales, 2002) and improvement in this area has become a focal point for the industry. Engineering education programs in Australia are accredited by Engineers Australia, in order to ensure academic programs consistently meet international benchmarks for the standards expected of professional engineers (Engineers Australia, 2018). Accreditation requires academic programs to prepare students to meet the Stage 1 Competencies, which include problem solving and communication skills. An emphasis on developing these skills throughout the education of engineers and before they enter the workplace is therefore necessary.

In order to prepare students for the professional world, education practitioners often seek to replicate an authentic industry context. For example, students may be asked to imagine themselves as part of an engineering team and to write assignments as if they were writing for this professional context. However, teaching students professional writing in an academic setting can pose difficulties due to the difference in context between the real-world industry and education. The context of education involves its own knowledge structures and social relations (Bernstein, 2000), distinct from a professional context. A professional text can be written for a range of purposes and for multiple and varied audiences such as clients, funding bodies and local governments. A student assignment is written for the purpose of demonstrating what they have learned and usually for a sole reader, the lecturer or marker. Understanding that language operates within its context (Halliday & Matthiessen, 2014, p. 32), the texts produced by students, even in the most realistic simulated professional situation, may be expected to display some differences to authentic texts.

1.2 Literature review: previous linguistic studies of engineering writing

There are considerable benefits of discipline specific academic language instruction for students in higher education. As these benefits have become more widely known, there has been an acknowledgement that applied linguistics has much to offer in collaboration with other fields. Language research can contribute to the ‘description, understanding, education

and practice of science, technology, mathematics and engineering' (Hanauer & Curry, 2014 p. xv). For example, a successful model of collaboration, informed by SFL, between postgraduate engineering researchers and language specialists at the University of Adelaide, South Australia is outlined by McGowan, Seton and Cargill (1996 p. 117). There has been linguistic research into the nature of writing for science, usually with a particular emphasis on pedagogy, which encompasses engineering within the field of science more generally. Both SFL and other linguistic approaches have been used. However, there has been a relatively small amount of research on engineering writing in particular.

There has been significant research in SFL into the language of science for several decades. Halliday and Martin's (1993) work in *Writing Science: Literacy and Discursive Power* investigates the nature of the discourse of science. Their approach conceives of science as 'inter-organistic practice, a linguistic/semiotic practice which has evolved functionally to do specialized kinds of theoretical and practical work in social institutions' (Halliday & Martin, 1993 p. x), and which can thus be deconstructed and made accessible. One of the particularly useful insights of this work is the demonstration of the fact that science texts contain higher levels of technical language than other disciplines, and that technicality depends on the linguistic resource of nominalisation (p. 249). The concept of technicality and the associated concept of abstraction will be further outlined in Chapter 2.

An investigation into the report genre in professional engineering discourse is undertaken by McKenna (1997), with a systemic functional approach utilising the work of Gosden (1993). McKenna focuses on how meaning is organized textually through the register variable mode. The concept of mode will be further outlined in Chapter 2. McKenna (1997) states that

> Engineering writing is an instrumentalist discourse that is epistemologically constructed by the scientific concepts that provide its intellectual foundation (its social construction of reality) and is socially embedded in the relations and shared understandings that exist between engineer and client (p. 192).

McKenna concentrates on the way in which analytical engineering reports linguistically reconstrue real world phenomena into scientific concepts and data, and back again (1997 p. 192-193). Through analysis of marked and unmarked Themes, McKenna's findings suggest

that ‘recontextualisation from common-sense events, processes and entities are at the heart of the professional engineer at work’ (p. 201), and that the intellectual task of the engineer is to take real-world phenomena into the engineering discourse domain for analysis and development (p. 201). The feasibility study is one document in which this task is reported.

Both SFL and other approaches, in particular English for Specific Purposes (ESP), have found the concept of genre to be highly useful in teaching discipline specific academic writing for engineering (Luzon, 2005 p. 292). Despite some differences in approach, SFL and ESP both view genre as ‘relatively stable forms’ which are used to help students achieve membership of a specific discourse community by way of the genres used in that community. Drawing on the work of Swales (1990), research has been undertaken into the ‘moves’, termed ‘stages’ in SFL, that are commonly used in engineering documents and highlighting disciplinary differences (Luzon, 2005 p. 286). Research has also examined how knowledge of the ‘moves’ and schematic structure of a report can be integrated into a pedagogical approach (Flowerdue 2000). More specific language features and their distribution across different sections, such as Abstract, Introduction, Discussion, Conclusion have also been investigated. For example, Farrokhi and Emami (2009) address the interpersonal meanings, termed ‘hedges and boosters’, that writers use to evaluate information and persuade their audience through analytical comparison of applied linguistics and electrical engineering research articles. A SFL approach to genre has proven successful in supporting engineering students learn the genre of lab report writing, in the environment of a writing centre at the University of South Carolina, USA (Walker 1999). Montemayor-Borsinger (2009) similarly emphasises the benefits of a SFL informed genre-based pedagogical approach. Montemayor-Borsinger acknowledges the ideational ‘content’ knowledge that the EAL physics and engineering researchers bring to their writing, and thus places particular emphasis on workshop activities to develop participants’ ability to use interpersonal and textual resources of meaning (Montemayor-Borsinger, 2009 p. 148). Genre analysis therefore has power to inform pedagogical practice.

In addition to genre pedagogy, engineering writing has also been the focus of some research by other linguistic approaches. An ethnographic approach is taken by Sales (2002) in her

dissertation investigating the discourse community of a British firm of design engineers. Sales argues that the engineers had been educated to write in a way that was at odds with the actual needs that they faced in the context of the workplace. The impact of context on engineering texts is highlighted in Poltavchenko (2013) in her dissertation which uses corpus linguistics to compare of student and professional engineering design reports, and utilises the ESP approach to genre in part of her analysis methodology. These studies draw attention to the need for research into the education of engineering communication skills, and the impact of contextual differences on writing.

Research into disciplinary writing has also combined SFL with LCT to provide a complementary lens with which to view data (Maton & Doran, 2017). In Hood's work on academic language (2011), SFL analytical tools are used to investigate how knowledge is construed in different disciplines, and underscores the need to understand these structures to enable effective instruction. In terms of the engineering discipline, however, work in LCT has focused on engineering curricula and the development of students' engineering knowledge and skills, for example Auret and Wolff (2017). Wolff also argues that there is an 'articulation gap' between the knowledge gained by engineering students in their studies in South Africa, and the requirements of the workplace they will hope to enter as graduates (Wolff 2017). Wolomaran's (2016) work utilised the LCT dimension of Semantics to investigate students' difficulties in applying of abstracted, technical knowledge to a concrete problem of mechanical design. This study seeks to investigate these aspects through analysis of written texts.

1.3 Focus and significance of this study

Linguistic study of engineering texts can further understanding of the way engineers construct knowledge, as revealed through written language. Analysis of student texts can also highlight similarities or differences between them and texts from a professional context. This study will compare the executive summaries of authentic engineering feasibility studies with those written in an education context by EAL engineering students. The primary focus of this comparison is on what knowledge looks like from the perspective

of the register variable of field, specifically in terms of shifts in concretisation and abstraction.

The methodology for this study is drawn from SFL, in particular the ideational discourse semantic system of ENTITY developed by Hao (2015). The system of ENTITY classifies the types of entities that may be present in a text, analysis of which can reveal how the field is construed. The texts will also be explored from the perspectives of genre in terms of the stages of the executive summaries, and lexicogrammatical structure in terms of process types. The theoretical underpinnings of these will be outlined in detail in Chapter 2.

LCT provides a complementary lens for conceptualising knowledge, and will be used alongside SFL in order to explain the similarities and differences between the two groups of texts. LCT has been developed by Maton and colleagues, building on the work of Bourdieu and Bernstein, and provides a multidimensional conceptual toolkit for analysis of data (Maton, 2014). This study will draw upon the dimension of Semantics, and the texts will be considered in relation to shifts in semantic gravity, which refers to the degree to which meaning is bound to its' context (Maton, 2016 p.15). LCT and Semantics will be further outlined in Chapter 2.

This study contributes to the understanding of knowledge construction in the discipline of engineering through a utilisation of SFL and LCT analysis techniques. It also demonstrates the application of the ENTITY system, developed in the context of academic writing in biology, in the discipline of engineering. The results of this study may be of use to engineering curriculum developers, educators and EAL practitioners supporting engineering students.

1.4 Organisation of this thesis

This thesis is organised into five chapters. The current chapter (Chapter 1) describes the relevance of research into the professional writing of professional and student engineers. This focus is situated within the exploration of knowledge through language, as instantiated in written text. Previous studies of engineering writing are surveyed to provide context, and SFL is introduced as the informing theory of this study, with LCT providing a complementary

viewpoint. The aim of this study is to describe differences and similarities between the two groups of texts.

Chapter 2 describes the theoretical underpinnings of the study. The relevant theoretical principles of SFL are outlined, with a focus on the construal of field through the discourse semantic system of ENTITY, as well as genre and the lexicogrammatical system of TRANSITIVITY. The concept of semantic gravity is introduced and the relationship to the linguistic theory is developed. The research question of the study is situated within this theoretical background.

Building on the theoretical underpinnings, Chapter 3 describes the methodological design of this study. The chapter outlines the methods of participant selection, data collection, and analysis techniques.

Chapter 4 details the results of this study. Firstly, the texts are compared in terms of genre staging. Secondly, the results of the process type analysis are given, followed by the primary investigation of the entities present is the texts. Finally, the entity types are used to construct profiles in the shifts in semantic gravity over the course of the texts.

To conclude this thesis, Chapter 5 summarises the findings that there are some significant differences between the industry and student texts, and briefly discusses their implications. The limitations of the study are considered and pathways for future research are outlined.

2. Methodological Framework

2.1 Introduction

This chapter outlines the theoretical foundations of this thesis. It will describe the principles of SFL which are relevant to the formation of the methodology used to investigate student and industry engineering feasibility studies. This chapter does not attempt a full description of the total architecture of SFL, which is complex and extensive, having evolved in order to manage the complexity of language itself (Martin & Rose, 2007 p.3). Section 2.2 outlines the relevant key SFL concepts, and Section 2.3 introduces LCT and the pertinent concepts of Semantics. In Section 2.4 the research questions of this study are specified.

2.2 Systemic Functional Linguistics architecture

SFL is predicated on the understanding that language is a social semiotic system. In this understanding, language is the means by which we make meanings. Instances of language use arise from choices made by the user of the language system, and are shaped by the surrounding context. This section outlines the key SFL concepts of axis, stratification, rank, genre, metafunction and discourse semantics.

2.2.1 Axis

Axis refers to the complementary relationship between systems of choices and the language structures which they enable. Unlike some other perspectives on language, SFL views language as systems of choices with which to make meanings, rather than rules with which to create structures (Martin & Rose 2008, p. 21). Functional structures of language are realised by the choices made from the available options in the system. The concept of foregrounding system, from which SFL derives its title of 'systemic', allows for investigation of the different systems and their availability to language users, such as students. Axis is the underlying principle for stratification and metafunction.

2.2.2 Stratification

According to Halliday and Matthiessen (2014), language is a stratified semiotic system, as meaning is made concurrently on different levels along a cline of abstraction. Stratification can be seen in terms of the relationship between the context of social reality and language: language is the form by which social reality is construed. SFL has further developed this into an understanding of the different levels through which language is structured. At the lowest level, sounds and symbols are organised in terms of phonology and graphology, which are then organised as words and structures at the strata of lexicogrammar, and these are in turn organised into texts through discourse semantics. Along the cline of abstraction, each level is both realised by the lower level, and realises the level above. This realisation can be articulated by the concept of metaredundancy, in which higher level meanings are made up of patterns of meaning at the lower level (Lemke 1984). Figure 2.1 highlights the stratification of language within its context.

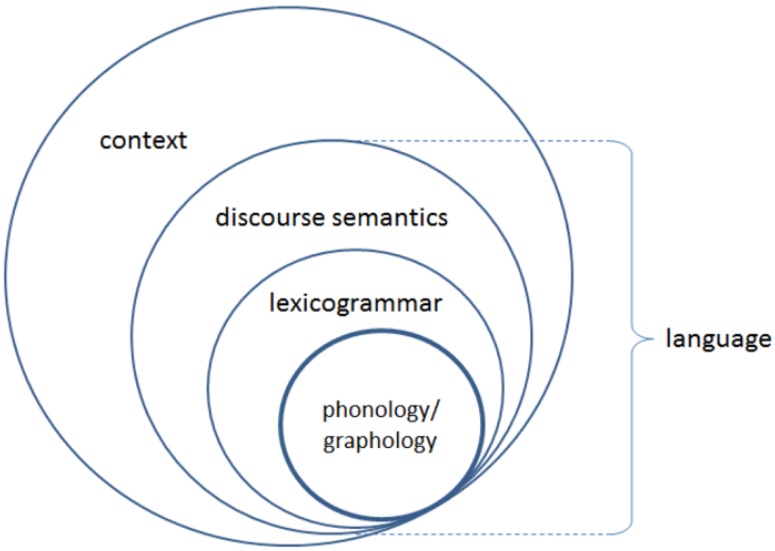

Figure 2.1 Stratification of language (Hao, 2015 p.12).

Understanding the stratification of language enables research into language use on different levels. Investigation of meanings that are made at the level of discourse semantics, for example, can be useful in making discourse structures explicit for students.

2.2.3 Genre

Strata can also be found at the level of context. Context can be divided into the stratum of genre and register, as in Figure 2.2. Genre is the most abstract level of stratification, and maps the 'system of social processes through which we live our lives' (Dreyfus, Humphrey, Mahboob & Martin, 2016 p. 35).

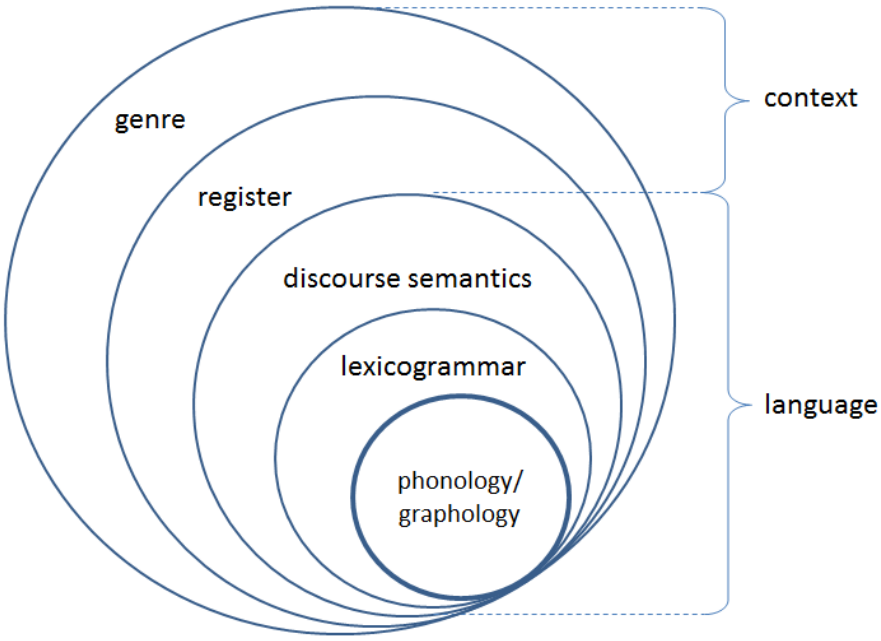

Figure 2.2 Stratification of context and language (Hao, 2015 p.13).

SFL genre theory defines genres as 'staged goal-oriented social processes' (Martin & Rose, 2008). Genres form the basis of institutionalised discourse, and are the means by which social processes are undertaken. Access to and command over the preferred genres of a particular discipline or institution is vital for success, whether in education or in the workplace (Dreyfus et al., 2016 p.7).

Throughout the 1980s and 1990s, genre theorists identified and differentiated different genres used in the school settings, which are organised into the system presented in Figure 2.3.

Figure 2.3 Genres at school (Rose & Martin 2012, p. 128).

Building on the foundation of school genres, tertiary education apprentices learners into the genres preferred by particular disciplines.

The stages of a genre can be identified as recurring pattern which must or may be present in order to fulfil the purposes of the genre. When describing generic stages, the symbol '^' indicates 'followed by'. As an example, a simple narrative genre contains the following stages: Orientation^Complication^Evaluation^Resolution^Coda. Of these stages, only the orientation, complication and resolution are compulsory (Martin & Rose, 2008 p. 50). Of particular interest to engineering feasibility studies are the families of genres that characterise science: reports, explanations, procedures and procedural recounts.

2.2.4 Rank

The organisation of language from a SFL perspective also takes place on a rank scale, in terms of the size of unit that is being classified (Dreyfus et al., 2016 p.29). For example, at

the level of lexicogrammar, a clause may be composed of groups of words. Figure 2.4 gives an example of the rank scale at the stratum of lexicogrammar.

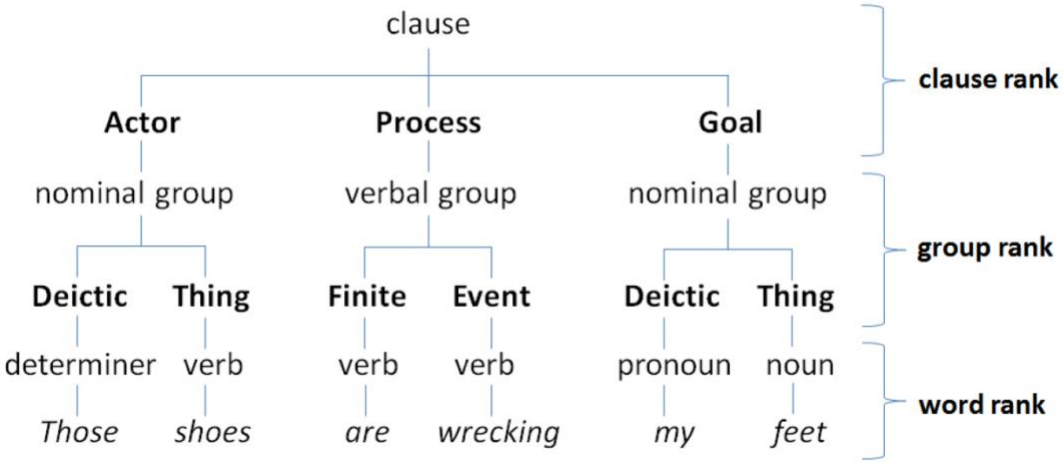

Figure 2.4 An example of rank scale in terms of lexicogrammar (Hao, 2015 p. 25, adapted from Martin, Matthiessen & Painter, 2010 p. 16).

Each rank provides an entry point for systems at different strata, and as such is foundationally important for systems such as TRANSITIVITY and ENTITY.

2.2.5 Metafunction

Metafunction is foundational in SFL as it acknowledges that language in use makes different meanings simultaneously. Any text can concurrently make meanings across three metafunctions: ideational, interpersonal and textual (Halliday & Matthiessen, 2014). The three metafunctions operate at all levels of the strata, and in both system and structure (Martin & Rose, 2008 p.24), and together can be broadly mapped to the variables that make up register, field, tenor and mode, as seen in Figure 2.5.

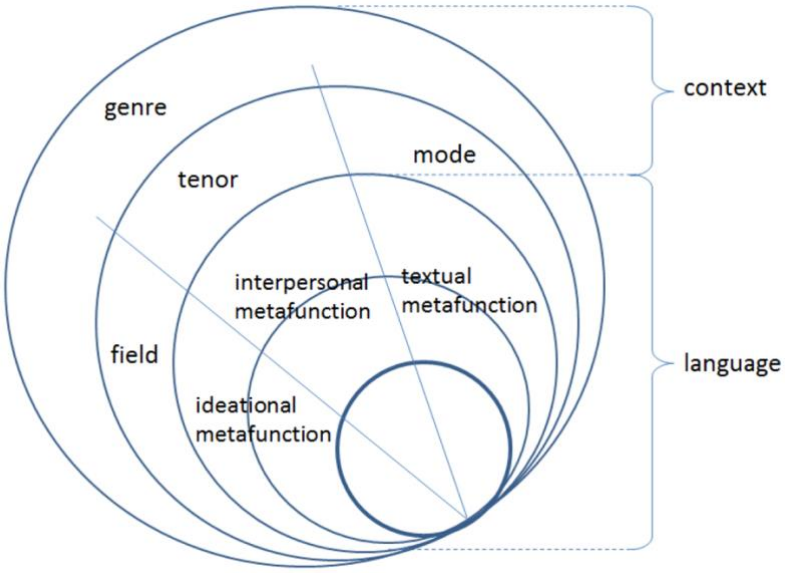

Figure 2.5 Metafunctions across stratum of context and language (Hao, 2015 p. 15)

Field refers to the representation of experience in language, and may be glossed as the topic, or focus of activity. Field is concerned with what is happening, who is involved, and the details of relations between activities, things and people. Tenor is related to the interpersonal, social meanings that are being created. The social and emotional relationships that are enacted throughout language are the focal point in tenor. Mode, which employs textual resources, is concerned with the logical flow of information, both ideational and interpersonal, and how connections are made within texts and with other modalities. Metafunction enables the linguistic study of texts from any of the three levels of meaning making.

As this study is concerned with the construal of knowledge in engineering texts through language, an emphasis is place on the perspective of field, addressing what is happening in the texts, and who is involved.

2.2.5.1 A focus on field

The field, or focus, of a text dictates the kinds of language used within it. According to Eggins, field varies along a continuum from technical or specialised to everyday (2004 p. 107). The position of a text along this continuum will impact on the language used. Highly technical or specialised texts will contain technical terminology that is assumed knowledge within the field, and is likely to involved extensive taxonomies (see section 2.2.6.1 below). In

contrast, everyday situations involve 'common knowledge': little will be presented as assumed, and if technical terms are used, they are more likely to be explained (Eggins, 2004 p. 109).

2.2.5.2 The system of TRANSITIVITY

Within each metafunction, there are systems that allow analysis of the meanings particular to that metafunction. Within the ideational metafunction at the level of lexicogrammar, the focus of analysis is on how the grammar of the clause makes a representation (Eggins, 2004 p. 213). Field is concerned with the ideational side of language, the events that are happening, and the people and things involved, and this can be analysed through the grammatical system of TRANSITIVITY. Transitivity provides 'the lexicogrammatical resources for construing a quantum of change in the flow of events as a figure- as a configuration of elements centred on a process' (Halliday & Matthiessen, 2014 p. 213). Transitivity describes the functions of processes, participants and circumstances; the full system of TRANSITIVITY is given in Figure 2.6.

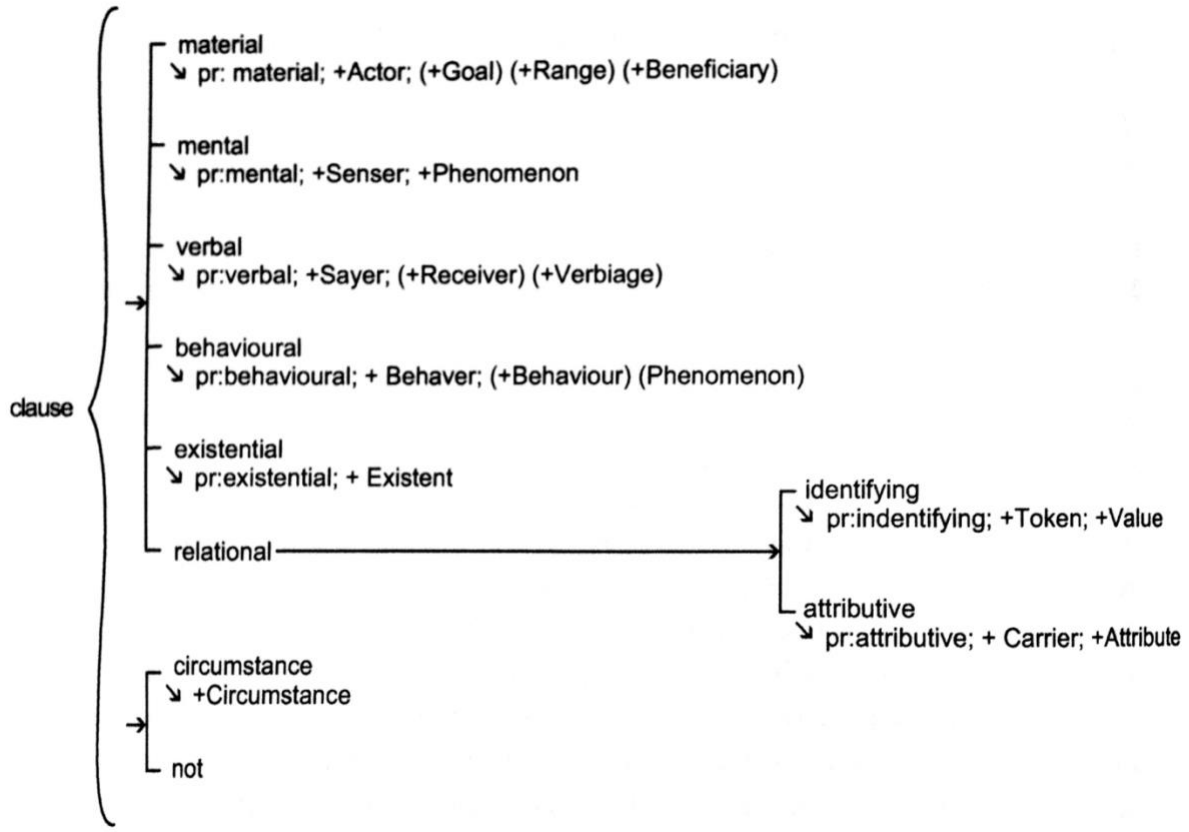

Figure 2.6 The system of TRANSITIVITY (Eggins, 2004 p. 214).

Process types, determined by the main lexical verb (Gwilliams & Fontaine, 2015 p. 2), are categorised as to the type of experience they represent: material, mental, verbal, behavioural, relational and existential; each process type behaves differently grammatically. Table 2.1 gives the type of meanings construed by each process type with an example.

Table 2.1 Definition of process types

Process type	Type of meaning	Example (process underlined)
Material	doing, happening	She fell
Mental	sensing, seeing, thinking, wanting, feeling	She thought
Verbal	saying	He said
Behavioural	behaving	He sneezed
Relational	being, attributing, identifying	The table is wooden
Existential	existing	There was a chair

It is acknowledged that at the boundaries of each category there is some indeterminacy, where an instance may present features that are consistent with more than one category (Gwilliams & Fontaine, 2015 p. 3), and this can lead to difficulty in analysis in some cases. For example, the verb 'reject' may can operate as a material process or as a verbal process (Gwilliams & Fontaine, 2015 p. 3). This indeterminacy emphasises the idea that language is operates on multiple levels, making multiple meanings at once, and that this must be accounted for in analysis.

For each process type, there are associated participant types. For example, the potential participants in a material process are:

- an Actor, the 'doer' of the process,
- a Goal, the 'done to' of the process,
- a Range, a participant that is involved but not affected by the process, and
- a Beneficiary, the participant which benefits from the process.

These participants are not necessarily present in every clause centred on a material process, but represent the options available. Along with process and participants, a circumstance may also be present in a clause, providing additional or contextual information. The following is an example of a clausal analysis using transitivity.

on the oval	*the girl*	*threw*	*the ball*	*to him*
Circumstance [Location]	Participant [Actor]	Process: [Material]	Participant [Goal]	Participant [Beneficiary]

Identifying the transitivity roles played by elements of a clause can reveal the type of experience being construed in the text. For example, if a text is dominated by relational processes, it can be seen to be focused on describing and defining things. However, a text including more verbal, mental and behavioural processes conveys a more social reality in which feelings and communication are involved. Identification of participant types can be used to analyse the agency of participants. In the example above, *the ball* is an inanimate object being thrown; in the goal position it is the 'done to' participant while *the girl* is given agency by initiating the process in the actor position.

In this study, transitivity is used to investigate the types of processes used in the texts, which reveals the type of experience emphasised in each one.

2.2.6 Discourse Semantics: Ideation

At the more abstracted strata of discourse semantics, lexicogrammatical resources are organised into patterns of meanings. Within the experiential metafunction, IDEATION systems focus on 'sequences of activities, the people and things involved in them, and their associated places and qualities, and on how these elements are built up and related to each other as a text unfolds' (Martin & Rose, 2007 p. 73). In this section, the concepts of taxonomic relations, grammatical metaphor and technicality and abstraction are described as they are foundational to the system of ENTITY, a primary analysis tool in this study.

2.2.6.1 Taxonomic relations

There are three IDEATION systems which construct relations between lexical elements: nuclear relations, activity sequences and taxonomic relations. Nuclear relations involve how more or less central elements are to the unfolding of the process. Activity sequences concern the nature of the unfolding of events from one to another (Martin & Rose, 2007 p. 76). The primary interest of this study is the third category, taxonomic relations, which track

the way texts build taxonomies of entities: people, things and places, typically realised as nouns, and their qualities. (Martin & Rose 2007). Taxonomies can represent the knowledge that constitutes a field (Eggins, 2004 p. 107), and as such are a useful way to explore knowledge building. Taxonomies may be constructed in different ways, as shown in Figure 2.7.

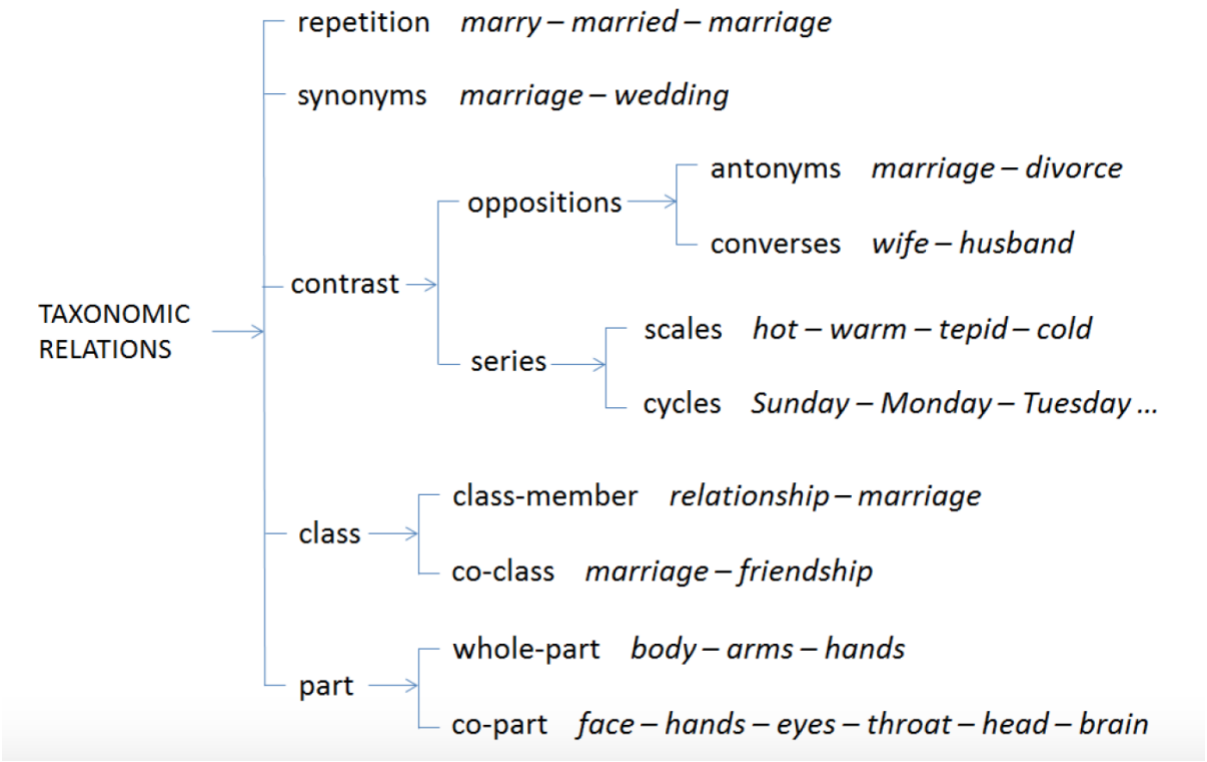

Figure 2.7 Taxonomic relations (Martin & Rose, 2007 p. 81)

As outlined above, taxonomies may differ in texts depending on the field. In technical or highly specialised fields, it is likely that taxonomies will be 'deep' rather than 'shallow', involving detailed classification of sub-types (Eggins, 2004 p. 107). These deep taxonomies of technical terminology can be daunting to those who are not familiar with the discourse, as Halliday and Martin write:

> problems with technical terminology usually arise not from the technical terms themselves but from the complex relationships they have with one another. Technical terms cannot be defined in isolation; each one has to be understood as part of a larger framework, and each one is defined by reference to all the others (Halliday & Martin, 1993 p. 78).

Thus, an understanding of the way taxonomies are built up throughout a discourse, and may vary in different contexts is valuable in terms of informing education practices.

2.2.6.2 Grammatical metaphor

A grammatical metaphor involves the transference of meaning from one kind of element to another (Martin & Rose, 2007 p. 110), and may be interpersonal or ideational. For example, an interpersonal metaphor may involve the use of a question such as "*could you turn on the light please?"* to realise a command "*turn on the light".* Grammatical metaphor is of considerable importance to the understanding of academic and other specialised discourses (Dreyfus et al., 2016 p. 68). The development of its resources has expanded the set of available language choices and enabled the expansion of the discourses of the sciences, humanities and bureaucracies (Martin & Rose, 2007 p. 110). The interest of this study is in the ideational metaphor by which processes or qualities can be reconstrued as things (p. 110). Martin and Rose write that

> 'In the general drift of meaning, by means of grammatical metaphor, has been from reality as processes involving people and concrete things, to reality as relations between abstract things, as with the transference from *marrying* as process to *marriage* as a thing. Part of the reason for this shift has to do with the greater potential for expanding the meaning of things - numbering, describing, classifying and qualifying them. For example the process of *marrying* can be expanded with another process, such as *marrying to forget*, or a quality such as *marrying well.* But *marriage* as a thing can be expanded with a whole series of potentially evaluative qualities, classes and qualifiers, as in an *extremely short marriage to someone else*.' (2007 p. 110).

By way of ideational metaphor, processes and qualities of processes can be turned into things and can thus be treated as classes of entities in a text (Martin and Rose, 2007 p. 113).

There are a variety of models by which grammatical metaphor has been conceptualised (see Simon-Vadenbergen, Taverniers & Ravelli, 2003 for example); this study follows Hao's work (2015) which emphasises that grammatical metaphor exists in the relationship between discourse semantics and lexicogrammar, allowing semantic meaning to be mapped onto non-congruent lexicogrammatical forms. A figure, which is a configuration of elements centred on a process in a clause, may be mapped onto a single nominal group. In this way the figure '*we began a relationship*' may be referred to in the following text as '*the beginning'*.

Ideational metaphor enables the production of complex taxonomies and the development of technicality within a discourse. It also allows the management of logical reasoning by packaging previous meanings in a way that enables them to be positioned as things in relation to other things. Grammatical metaphor contributes to the characteristics of lexical density and ambiguity in scientific discourse (Halliday & Martin, 1993 p. 78) and is a powerful resource for students being apprenticed into a discipline such as engineering.

2.2.6.3 Technicality and abstraction

Technicality and abstraction are features of academic discourse. Technicality characterises scientific discourse, while abstraction is often a feature of writing in the humanities, used to scaffold the production of a text (Halliday & Martin, 1993 p. 292). While they can be used differently, both technicality and abstraction are the products of grammatical metaphor (p. 249), often relying on nominalisation to change verbs into nouns, distilling knowledge into a technical term that can be defined (p. 292). Martin and Rose (2007) distinguish between concrete and abstract entities, and argue that this division reflects the difference between everyday and specialised fields (p. 113). They also separate concrete and abstract entities from metaphoric entities, which are instances of grammatical metaphor, as shown in the table below.

Table 2.2 Kinds of entities (Martin & Rose 2007 p. 114)

indefinite pronouns	*some/any/nothing/one*	
concrete	everyday	*man, girlfriend, face, hands, apple, house, hill*
	specialised	*mattock, lathe, gearbox*
abstract	technical	*inflation, metafunction, gene*
	institutional	*offence, hearing, applications, violation, amnesty*
	semiotic	*question, issue, letter, extract*
	generic	*colour, time, manner, way, kind, part, cause*
metaphoric	process	*relationship, marriage, exposure, humiliation*
	quality	*justice, truth, integrity, bitterness, security*

However, the lack of clarity around the linguistic differences between abstract entities, metaphoric entities and grammatical metaphor has led to the development of the ENTITY system.

2.2.6.4 The system of ENTITY

Building on the work of Martin and colleagues (Halliday & Martin 1993, Martin and Rose 2007), Hao's 2015 doctorate establishes a discourse semantic system of ENTITY, through exploration of entities in undergraduate Biology texts. Under this system, entities can be categorised into types and sub-types, and simultaneously can be defined ostensively and linguistically, as shown in Figure 2.8 below.

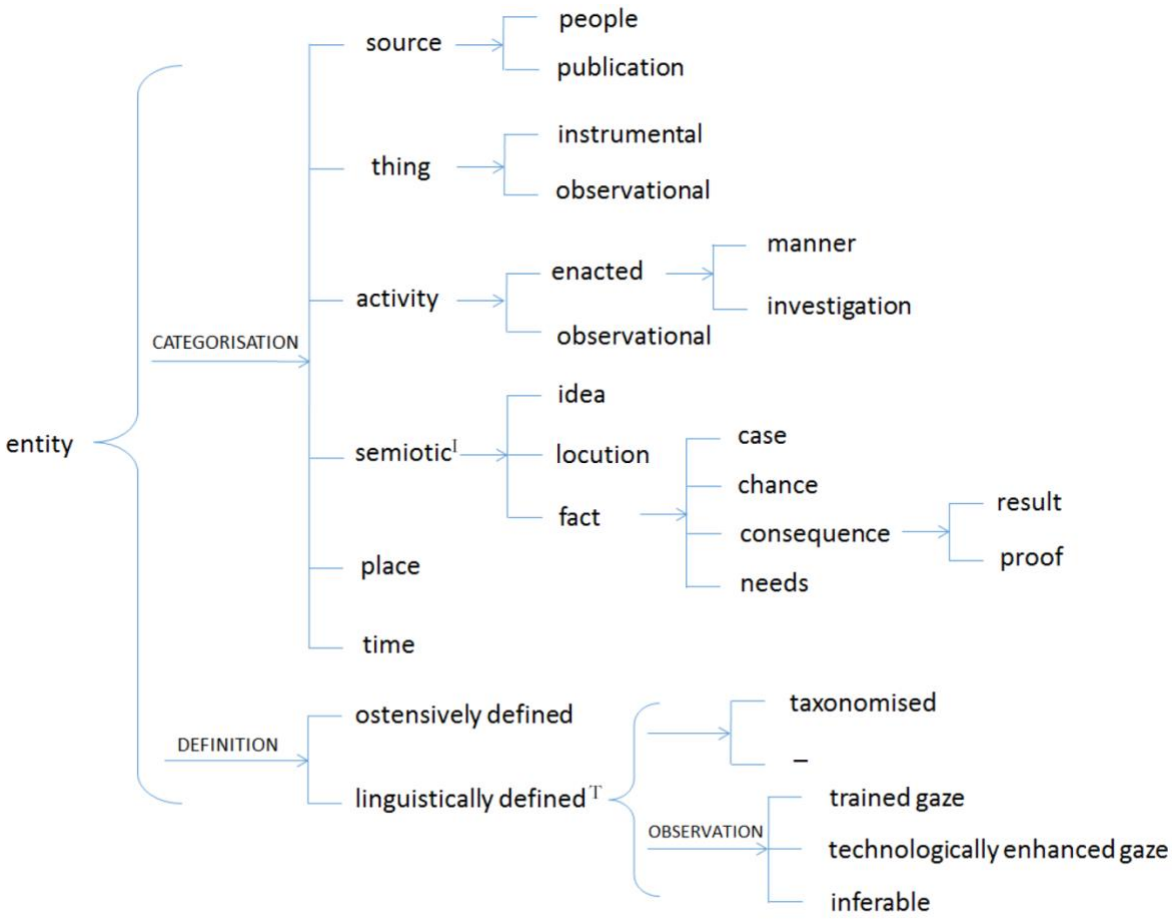

Figure 2.8 Entity types in Biology (Hao, 2015 p. 135).

This framework provides a useful analytical tool for exploring how field taxonomies are construed in texts (Hao, 2015 p. 151) Hao clarifies that field taxonomies are realised by discourse semantic entities and their elaborations, and that these in turn are realised by lexicogrammatical structures through the TRANSITIVITY system. Hao then demonstrates how the ENTITY system can be used, showing how the use of entities suggest the progression of knowledge building in the apprenticeship into the discipline of Biology (Hao, 2015 p. 189); thus, this system can provide similar insight in the discipline of engineering.

2.3 Legitimation Code Theory

2.3.1 Background to Legitimation Code Theory

In recent decades, LCT has developed from the sociological theories of Bourdieu and Bernstein, while also incorporating insights from other disciplines such as linguistics. A key focus of LCT is to overcome the segmentalism that is common in educational research (Maton, Hood & Shay, 2016) and provide researchers with models that offer increased explanatory power. From Bourdieu's work is drawn the concept that a 'new gaze' or way of seeing is required in order to perceive the underlying structures or principles that order social practices (Bourdieu and Wacquant 1992, p. 251; Maton et al. 2016, p.8). LCT also builds on a range of Bernstein's concepts, including the utilisation of 'codes' and 'devices' in pedagogy and combinations of strengths of boundaries to explore the constructions of the generating principles of particular systems (Maton et al. 2016, p.10). LCT develops the concepts of horizontal and vertical discourses in intellectual fields, as outlined by Bernstein (1999). In Bernstein's work, horizontal discourses are characterized by highly segmented knowledge structures, specific to and dependent on their context. Horizontal discourses may be considered as everyday knowledge. Vertical discourses, however, are 'specialised symbolic structures of explicit knowledge' (Bernstein, 1999, p.161), which he further categorises as either hierarchical knowledge structures and horizontal knowledge structures (p. 162), and may be consider as intellectual or non-common sense knowledge. LCT provides what Bernstein (2000) calls an 'external language of description'; that is, a range of concepts and analytical tools with which to undertake substantive research. LCT is currently organised into five 'dimensions': Specialization, Semantics, Autonomy, Temporality and Density. Of these, specialization and semantics are the most developed and utilised in research (Maton et al., 2016).

2.3.2 Semantics

The dimension of Semantics involves the concepts of semantic gravity and semantic density. Semantic gravity refers to the extent to which meanings are bound to their contexts (Maton, 2016 p.15). When semantic gravity is stronger (SG+), meanings are highly

dependent on their context. When semantic gravity weaker (SG-), meaning is more independent of its context. Semantic gravity can also be analysed as weakening (SG↓) and strengthening (SG↑). For example, moving from a specific case study to generalisation can be analysed as weakening semantic gravity (Maton, 2016 p.15), while moving from a concept such as 'commercial viability' to the details of a particular instance in which the concept is applied can be described as strengthening semantic gravity.

Semantic density refers to the extent to which meanings are condensed within practices. When semantic density is stronger (SD+), more meanings are condensed, and when weaker (SD-), less meanings are condensed. Semantic density can also be strengthening (SD↑) or weakening (SD↓). For example, strengthening semantic density may involve moving from a simply understanding of a 'bond' being a connection between two things, to the more complex concept of an 'electrical connection between two metallic surfaces established to provide a low-resistance path between them' (Hanifan, 2014) in the discipline of Electrical Engineering.

Semantic gravity and semantic density can be used independently or in conjunction to trace the semantic profile of a practice across time, or throughout the unfolding of a text. Figure 2.9 presents three types of simplified semantic profiles and their associated semantic ranges.

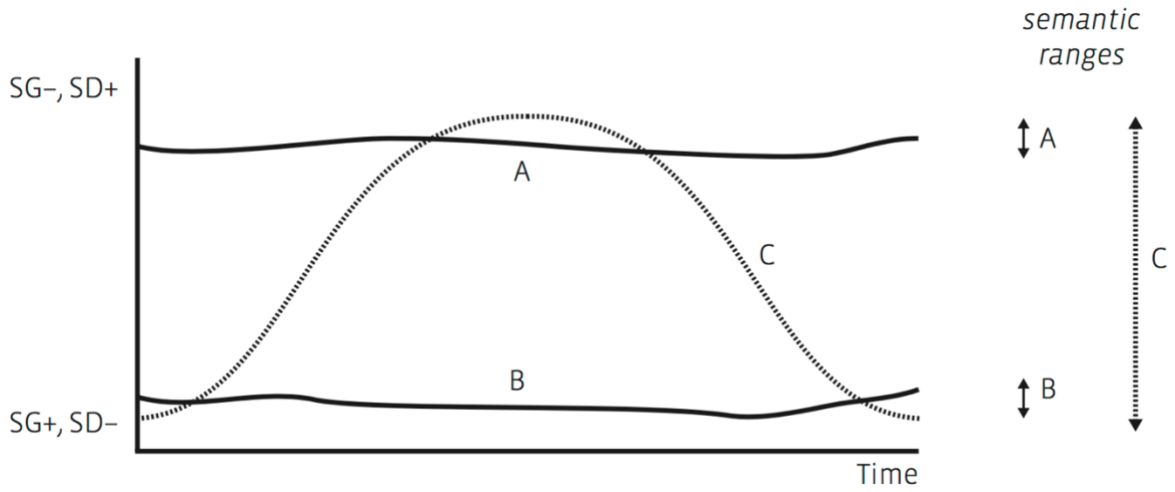

Figure 2.9 Semantic profiles (Maton et al., 2016 p.17)

The ranges of these three simple profiles can be respectively described a high semantic flatline (A), a low semantic flatline (B) and a semantic wave (C). Semantic profiles such as these are valuable in revealing knowledge structures that form the basis of achievement in different educational practices. Semantic wave profiles have been shown in multiple studies to be the most effective in enabling cumulative knowledge-building (see for example Blackie, 2014; Clarence, 2016; Macnaught, Maton, Martin & Matruglio, 2013).

In addition to profiling the semantic movements of a practice or text, the variation in strengths of semantic gravity and semantic density can be combined to reveal the semantic code of a particular practice. Maton outlines the four semantic codes, or principal modalities, which are:

- *rhizomatic codes* (SG-, SD+), in which the basis of achievement comprises relatively context-independent and complex stances;
- *prosaic codes* (SG+, SD-), in which legitimacy accrues to relatively context-dependent and simpler stances;
- *rarefied codes* (SG-, SD-), in which legitimacy is based on relatively context-independent stances that condense fewer meanings; and
- *worldly codes* (SG+, SD+), in which legitimacy is accorded to relatively context-dependent stances that condense manifold meanings (Maton, 2016 p. 16).

These four semantic codes can be mapped on to axes to create the semantic plane, as shown in Figure 2.10.

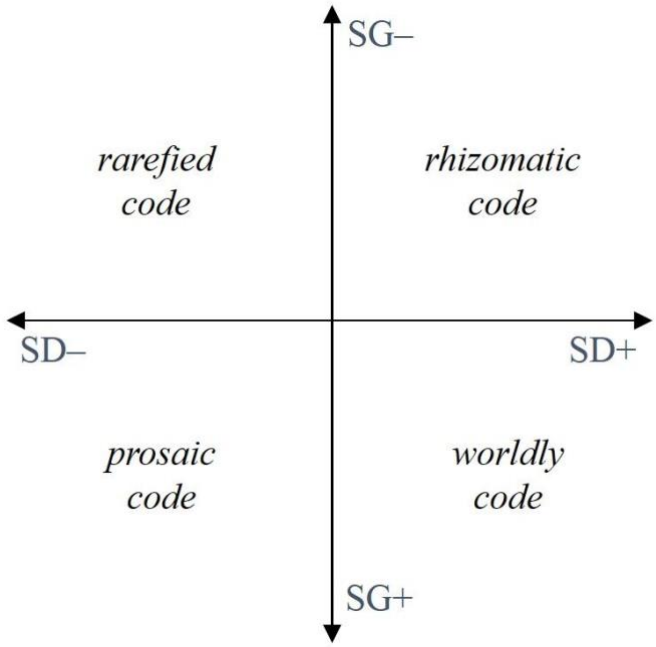

Figure 2.10 The semantic plane (Maton et al., 2016 p.16)

As stated in Chapter 1, it is important for engineering to be rooted in the concrete, in the particular needs and constraints of the physical problem at hand. This suggests that stronger semantic gravity is an important feature of engineering practices, and in which engineering students need to be embedded, (Wolff & Luckett 2012; Wolmarans 2016; Wolff 2017). Both prosaic and worldly codes are characterised by stronger semantic gravity. A practice such as engineering design of a product also needs to take into account complex ideas, but as Wolmarans argues, this 'complexity is related to the context, rather than in abstracted principles' (2016, p.99). The need for both context dependant and technical knowledge suggests that the aim of engineering education, arguably, should be to move students from a prosaic code (SD-, SG+), to a worldly code (SG+, SD+), beginning with real-world phenomena and integrating increasingly complex and condensed concepts. More abstracted and conceptual principles, such as those from Mathematics or Physics, are also necessary for engineering (Wolff and Lucket 2012; Wolff 2013; Wolmarans 2016). The disciplines of Mathematics and Physics are often characterised by abstracted, generalised principles independent of context, and a high degree of condensed, technical meaning: a rhizomatic code (SG-, SD+). Therefore it can be argued that the progression of engineering education should progress from a prosaic to worldly code, while also making use of elements of a rhizomatic code in the service of the worldly code. Figure 2.11 depicts this

idealised progression on the semantic plane, the red arrows representing the progression and integration of knowledge.

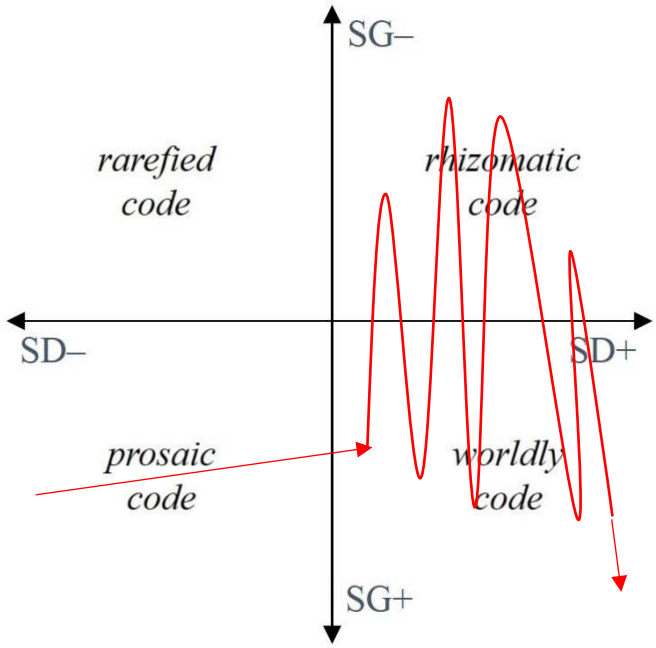

Figure 2.11 Proposed progression of engineering education.

This study will use the concept of semantic gravity to investigate the extent to which the industry and student texts are bound to their context.

2.4 Research Question

This study seeks to investigate the following questions: overall, what are the similarities and differences between the executive summaries of industry and student engineering feasibility studies? In particular, what are the similarities and differences in terms of genre structures, choices of transitivity process types, use of entities and semantic gravity profiles?

2.5 Summary

In this chapter, I have presented the conceptual elements of SFL that are relevant to the methodology adopted by this thesis. SFL conceptualises language as a stratified system from which structures are derived as choices of meanings across different metafunctions. The construal of field through taxonomy building can be explored through discourse semantic entities, which are realised through lexicogrammatical constructions. LCT can provide a

complementary perspective on knowledge-building, with semantic gravity offering tools to conceptualise the extent to which meanings are bound to their context. The following chapter will describe the methodology of this study, combining analytical tools from SFL and LCT.

3. Methodology

3.1 Introduction

This chapter describes the methodology used in this study. Two corpora of texts are compared: those of students and those of industry. Section 3.2 outlines the details of the selection of texts for analysis, student participant selection and their educational context. Section 3.3. then outlines the techniques used to analyse the texts and compare the two groups.

3.2 Context of the study

3.2.1 Motivation for this study

The initial impetus for this study arose from my experience working with the Engineering Communication Unit (ECU) at the University of Adelaide. The unit is made up of linguistically trained academic language specialists, and provides teaching in a variety of undergraduate and postgraduate courses. A large amount of the work undertaken by the ECU is with EAL international students, however local students are also provided with academic language instruction at the undergraduate level. Through my exposure to the variety of engineering courses and different types of engineering discourses, I became interested in how the students' texts might compare to a real-world text, and thus how the students were being prepared for the communication requirements of the engineering profession.

3.2.2 Data collection

Because of my employment with the ECU, I have access to students' written assignments. This rich source of data provided a variety of choices in terms of researching student engineering discourse. I approached Catherine Irving, the Course Coordinator of one of the courses in which the ECU is involved, along with other relevant staff members at the university, to discuss options for accessing student texts for research. These approaches were received favourably, and I moved ahead with the project. I decided to focus on one particular type of document, the feasibility study, in which I had spent a considerable

amount of time assessing student achievement. The feasibility study also offers the possibility of comparison to professional industry texts that a more academic research paper would not.

3.2.2.1 Context of the student texts

The feasibility study is taught as part of the Engineering Communication and Critical Thinking (ECCT) course in the Masters of Engineering program. The purpose of this course is to prepare students for the communication requirements of their field. The course is taught by an engineering lecturer, with support in the area of language from lecturers and markers from the ECU.

The feasibility study assignment is given in a simulated professional context. The assessment guidelines are presented as a Statement of Work, and the information the students need to write the assignment is given in the guise of simulated company documents. The students must then follow these instructions and convert the given information into a feasibility study for the simulated engineering project, using a template. The context of the simulated project is that of a private firm developing a product for the commercial market. Language support materials are provided online, along with some face-to-face workshops run by ECU lecturers. The students submit a draft for assessment, on which feedback is given to inform their final submission.

The eight student texts analysed in this study were collected over two semesters of the ECCT course. This was to allow for some difference of topic within the student group, as the ECCT course uses a different simulated engineering project in each semester. The topics for these semesters involved Automated Driver Assistance Technology (ADAT), and a Mining Communication and Autonomous Service (MCAAS). There were also some slight differences in the nature of the language instruction given in each semester. In the first semester, some instruction was given in terms of how to create nominalisations, with particular reference to their use in headings. In the second semester, the students were taught to unpack nominalisations taken from one of the company documents into more active language. (Irving, C., personal communication, November 09, 2017).

Four highly graded papers (graded at 75% or above) from each semester were selected. The choice of highly graded papers was made in order to reveal the types of language and knowledge construction valued in the context of the course (Hao, in press p. 20).

Ethics approval for this study was obtained from the Monash University Human Research Ethics Committee in order to contact the University of Adelaide students to request consent to use their assignments as research data. Once consent was obtained, the texts were formatted for analysis and any identification of the students was removed.

3.2.2.2 Context of the industry texts

The real-world, industry based texts consist of four, publicly available publications which were accessed through the internet. The industry feasibility studies were written for a variety of projects, including on behalf of community groups, companies and local governments. The following table 3.1 includes the details of the four texts, including the titles given to the texts for the purposes of differentiation within this study. Complete details for these texts can be found in the References.

Table 3.1 Industry texts

Title	Type of project	Type of authorship
Community Energy for Goulburn (CE4G)	Community owned solar farm	Community group, with professional financial and technical advice
Kellogg	Water recycling for industrial use	CSIRO project team
Southern Councils Group (SCG)	Potential community-based wind power projects	Council Working Group, based on industry sources
Moonambel	Water supply	Consultancy firm

It is acknowledged that there is a difference in the context of the industry texts and the simulated context of the student texts. The industry texts were chosen as they provided the closest possible comparison to the student texts and were publicly available. The industry texts are about real world situations, such as energy production and water supply, for which

a solution is needed. The authorship of the texts varies, but all rely on technical advice and give detail regarding the needs of the project. It may be that any differences found between the two groups of texts derive from the difference in contexts. A closer comparison in terms of the context of the simulated professional context would have been provided by feasibility studies that are written for the purposes of product development within an engineering firm, and only intended to be read within that context. However, access to this type of text was not available, and the industry texts chosen provide a valuable comparison.

3.3 Data analysis

A range of analytical techniques drawn from SFL and LCT were used in the comparative analysis of the texts. Primarily these techniques were used qualitatively, but the study also used quantitative statistical analysis.

3.3.1 Executive summaries

Once the student and industry texts had been chosen, it was necessary to select a portion of each text for comparative analysis. The student texts are on average around 16 pages, while the industry texts range from 36 to 85 pages. Analysis of the entire documents was not possible given the scope of this project. The executive summary (ES) was chosen as it provides a cohesive representation of the language and content of the whole documents, while also presenting a manageable portion of text for analysis. The purpose of the ES in a feasibility study is to present a summary of the entire document, and, as will be outlined in the Results chapter, often mirrors the genre structure of the whole document. Thus, the ES can afford a useful insight into the language and knowledge structures of the whole text.

3.3.2 Genre analysis

After the texts and a section of the document had been selected, a broad survey of the genre structures of the whole document was conducted to establish that each followed the same genre patterns overall. A genre stage analysis of each ES was subsequently undertaken, following Martin and Rose (2008). The genre stage analysis allowed each ES to be divided, and comparisons between stages could then be made within and between texts in terms of the analyses that follow.

3.3.3 Transitivity analysis

The second stage of analysis used the system of TRANSITIVITY in a top-level clausal analysis. The main clauses were analysed, rather than a full analysis of embedded or projected clauses. As lexicogrammatical structure is not the primary focus of this study but rather a complementary analysis to the main entity analysis, it was decided that analysing only the main clauses would give sufficient insight into any differences between the groups of texts. In analysis, sentences were broken into clauses and the process types and their associated participants and circumstances were identified. As stated in Chapter 2, some processes can display characteristics of more than one process type (Gwilliams & Fontaine, 2015), which meant that some difficult analytical choices needed to be made. For example, the verb 'investigate' could be considered either a material or mental process. In this body of texts, it was decided to analyse 'investigate' as a material process, as the investigation would have involved action as well as mental consideration.

The purpose of this analysis was to determine whether there were differences between the groups of texts in terms of lexicogrammatical structure. I had also planned to use the transitivity analysis to investigate the relationship between discourse semantic entities and their construction in terms of transitivity participants. However, initial attempts to map these did not provide any noteworthy findings. The final statistical analysis was limited to the types of processes. The six process types were counted and compared in terms of their percentages at each genre stage and across each whole text. The individual texts could then be compared individually and as groups. An Excel spreadsheet was used to undertake the statistical comparisons.

3.3.4 Entity analysis

The central analysis methodology of this study was entity analysis. An initial analysis of the CE4G text was used to refine the techniques of identifying and classifying discourse semantic entities. These techniques were then applied to all texts.

Following the work of Hao (in press; 2015) and Martin (1992; Martin & Rose, 2007) entities were identified as being mapped onto nominal groups. The central semantic core of the nominal group is the Thing, which may be realised by a common noun, proper noun or

pronoun (Halliday & Matthiessen 2014, p. 383). Nominal groups that realise entities can take different structures, which are:

- (Classifier^{n})=Thing (*regular sea urchin*)
- Focus=Thing (*a kind of sea urchin*)
- possessive Deictic=Thing (*the rainforest's canopy*) and
- elaborating nominal group structures (Hao 2015, p. 99).

Possessive Deictic=Thing structures are based on an ownership relationship between two entities such as *the rainforest* and *the canopy.* These structures are thus analysed as two entities rather than one (Hao 2015, p. 99). Hao also notes that in 'elaborating nominal group complexes, a (Classifier^{n}=) Thing structure may be used to subsume its elaboration, which may itself realise one or more entities: as in 1 *B-galactosidase, =2 an enzyme which breaks down lactose'* (p. 99). In the analysis of texts for this study, the individual entities within elaborating nominal group complexes were included in the total calculation.

Having identified the entities in each text, each instance was classified according to the six main categories of entities in Hao's system: source, thing, activity, semiotic, place and time. During analysis of this data set, it was soon noted that the source entities consisted entirely of the subtype of people entities, rather than publication entities as in Hao's data (Hao, 2015). Therefore, the source entities may be read in this study as classifying either individual people, collective groups of people or institutions. Table 3.2 describes each entity type and gives examples of each as found in the texts.

Table 3.2 Entity types with descriptions and examples

Entity Type	Description	Description and Examples
Source	In this data set the source entities are people entities, including individuals, human collectives and institutions.	*community, committee, Council employees, renewable energy specialists, board of directors, company, CSIRO, Kellogg, clean energy retailer*
Thing	Thing entities are physical, concrete and non-conscious objects.	*water, waste water, solar farm, wind turbine, tool, disinfection system, technology, equipment, meter, funds, $1.2M, grant, scrubbers, Aerobic membrane bioreactor, 0.2 micron filter*

Activity	Activity entities are acts.	*project, study, major task, investment, community energy initiative, operation, irrigation, microfiltration, value proposition analysis, wind power generation, wind power developments, interviews*
Semiotic	Semiotic entities are facts, locutions and ideas.	*opportunity, option, value, guidance, relevant regulatory requirements, cost, benefit, risk, assumption, data, results, value proposition, approach, model, project scope, regulations*
Place	Place entities name places.	*site, Goulburn City, Crown Land, Botany NSW, food manufacturing areas, surrounding parklands*
Time	Time entities name times.	*April 2015, stage [of the project], first phase [of the project]*

A complex aspect of the classification of entities was differentiating between ideational grammatical metaphors and activity entities. As discussed in chapter 2 above, grammatical metaphor is the process by which figures can be turned into things, for example through nominalisation. This transcategorisation may serve the function of organising the logical structure of a text by condensing previous meanings. However, the other function of grammatical metaphor is to distill meanings into a single technical term. The complexity is that both functions may be realised by the same word, often a nominalisation. Hao (in press) gives the example of '*government',* which can mean both 'a group of people who govern' and 'the act of governing'. The first meaning is a discourse semantic source entity: a 'dead' grammatical metaphor. The second meaning is what is referred to as a 'live' grammatical metaphor, construing a figure in a non-congruent form, and cannot be classified as an activity entity. Decisions regarding the status of nominalisations in the data for this study were based on Hao's investigation of the linguistic distinctions between 'live' and 'dead' metaphors: between grammatical metaphor and activity entities (Hao, in press), including the argument that once a term has been given a linguistic definition within a field, it can be classified as a discourse semantic entity (Hao, in press). An example of a 'live' grammatical metaphor, the meaning of which is recoverable from its co-text, is underlined in the following extract from the CE4G text:

> In April 2015 The Goulburn Group (TGG) appointed a committee, Community Energy for Goulburn (CE4G) to apply for a grant under the NSW Government's Community Energy Feasibility Grants Program. This application was successful […].

Once the entities in each text had been identified and classified, they were counted. The types and numbers of entities in each stage of each text, as well as across the whole texts, were recorded. An Excel spreadsheet was used to calculate the percentages of entity types at each stage and across the whole text, which enabled a comparison between stages within texts, between texts and between groups of texts.

3.3.5 Semantic gravity analysis

Once the entity analysis had been completed, it was possible to undertake a qualitative semantic gravity analysis. The types of entities were positioned on the semantic gravity continuum according to the extent to which they are bound to their context. In this case, the context of the text was taken to be the physical realities of the nature of the project: the concrete nature of things involved. For example, in the CE4G text, the context involves the physical locations, objects and people involved in the community solar power project. These elements are not easily transferred to other contexts as more general concepts and activities are. Therefore, the source (people), thing, place and time entities were placed at the strong end of the semantic gravity range. Activity entities were considered in the mid-range, as they can directly involve and impact on the more stronger semantic gravity entities, but are less strongly bound to this context. Semiotic entities, involving concepts, facts and locutions, were considered the least strongly bound to their context and placed at the weak end of the range. Table 3.3 places the entity types on the semantic gravity range.

Table 3.3 Semantic Gravity range with corresponding entity types

Semantic Gravity Range	Entity Type
SG- ↕ SG+	Semiotic
	Activity
	Source (people) Thing Time Place

The breakdown of entity types into weak, medium and strong semantic gravity categories enabled a statistical analysis of the strength of semantic gravity in each text, and within each text at each stage. The more context dependent entities were added together, and the levels of weak, medium and strong semantic gravity were calculated and compared using the Excel spreadsheet.

Based on the types and numbers of entities present, the shifts between stronger (SG+) and weaker (SG-) semantic gravity were qualitatively noted alongside the text. It was also noted where semantic gravity could be considered to be strengthening (SG↑) or weakening (SG↓). Complete versions of these analyses can be found in the Appendices. These analyses were then used to create a semantic profile of each text, an example of which is given in Figure 3.1.

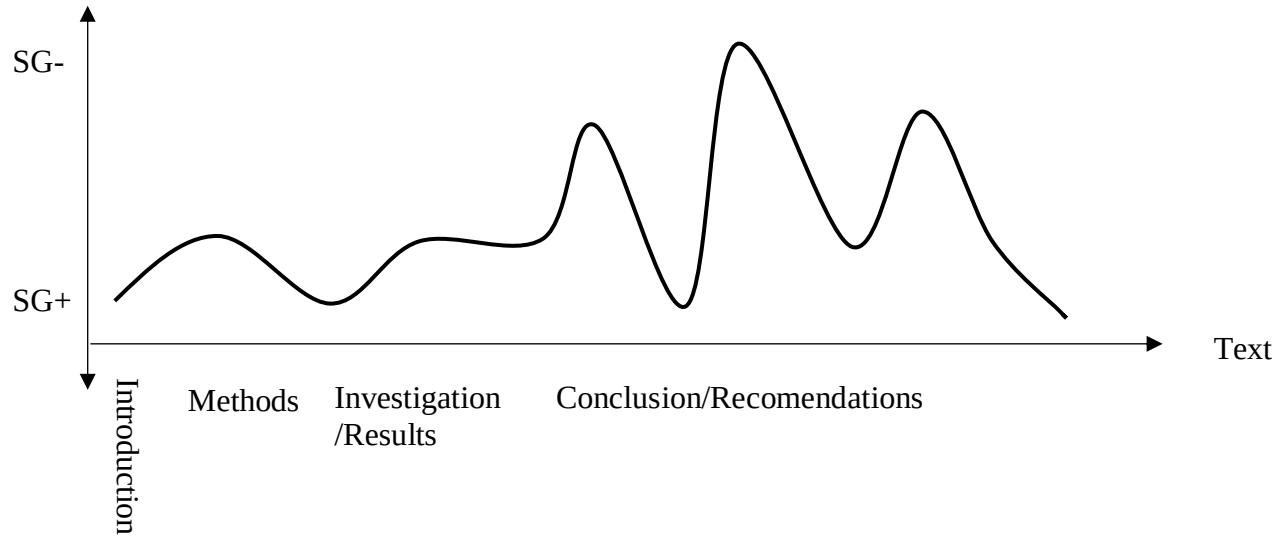

Figure 3.1 CE4G semantic profile

The semantic profiles were then used to compare the differences and similarities between texts, in terms of the shifts between concretisation and abstraction, and where they occur.

3.4 Summary

This chapter has outlined the methodology used in this study. The context of the study has been given by describing the motivation for the study and data collection methods, including the contexts of the different corpora of texts. The methodologies for analysis of this data have been detailed, the results of which will be given in the following chapter.

4. Description and Discussion of Results

4.1 Introduction

This chapter describes the results of this study. First, the results of the genre analysis are outlined and details are given on each genre stage. Second, the process types used in the two groups are compared. Third, the results of the central entity analysis are given. The types of entities used in the different texts are described, then analysed comparing the percentages of entity types at each genre stage and across the whole texts. Particular attention is given to genre stages that reveal significant differences between the industry texts, and within the student group. Finally, the results of the semantic gravity analysis are given. The proportions of strong, medium and weak semantic gravity are compared between groups of texts in terms of genre stages and whole texts. The semantic profiles of each text are also given, and comparisons made. The implications of the results are subsequently discussed.

4.2 Genre

The results of the genre analysis revealed that the stages of each ES followed the structure of a Technical Note, a subtype of Procedural Recount. These stages are: Introduction^(Optional Methods)^Investigation/Results^Conclusion and Recommendations (Martin & Rose 2008, p. 200). The Introduction stage outlines the issue or problem under investigation, along with some context. The optional Methods stage is used to recount the process of the research, which may not be necessary depending on the intended audience. The results of the research are described in the Results/Investigation stage, and are then interpreted in the Conclusion accompanied by Recommendations (Martin & Rose 2008, p. 201). While all the texts met the basic genre structure of a Technical Note, there were some differences in terms of how the student and industry texts used these stages.

4.2.1 Introduction stage

The industry texts used the Introduction stage to introduce the context of the project. In different texts, this may have involved describing the people or groups involved in initiating

and overseeing the project, the physical locations, the need or impetus for the project, the details of the project and the aims of the project. For example, the following extracts are from the Introduction stages of the four industry texts.

> **CE4G:** […] CE4G proceeded to coordinate and deliver a twelve month feasibility study into a 1 MWp (1 Megawatt peak) community solar farm on a site three kilometres from the centre of Goulburn city.
>
> **Kellogg:** CSIRO is undertaking a project for the Australian Water Recycling Centre of Excellence (AWRCoE) to support the reduction of fresh water use in the Agri-food sector by increasing the amount of water that is being recycled. Kellogg has a water treatment plant at its manufacturing facility in Botany, NSW.
>
> **Moonambel:** Moonambel is situated within the Pyrenees region of Victoria, approximately 200 km north-west of Melbourne and 90 km north-west of Ballarat. The region is home to a number of successful vineyards that attracts tourists for day visits or overnight stays. The township is not connected to a reticulated water supply, nor is it within a water district.
>
> **SCG:** The objective of the South Coast Community-Based Wind Power Concept Study was to conduct a high-level preliminary investigation of a community–based wind-power generation on the South Coast.

Of the industry group, the SCG text contains the least information about the location and people involved, and the physical details of the project. It seems likely that this is due to the fact that the SGC study is a preliminary investigation to survey potential options, while the other three projects were more advanced.

In contrast to the industry texts, the student texts used the Introduction stage to introduce the document itself, rather than the project, though in some the aims of the project are included. In four of the student texts, the Methods stages is briefly included within the Introduction, as in the following example from Student Texts (STs) 1 and 6.

> **ST1:** The purpose of this document is to evaluate the feasibility of the ADAT system by analysing the goals of the project, the proposed functions of the ADAT, the current market and the market trends. Based on the analysis, the findings and the recommendations are provided at the end of the document.
>
> **ST6:** This document evaluates the feasibility of the Mining communication and Autonomous Service (MCAAS) project for Communication Systems and Services Limited by explaining the goals and objectives of the study, describing the proposed system, discovering the findings, and making recommendations for the system, while

> the current system and process, market consideration, market strategy, schedule, and financial projections are excluded.

The inclusion of the Methods within the Introduction appears to be determined by the students' choice of grammatical structure, outlining how the feasibility of the project is to be analysed through the inclusion of 'by analysing' or 'by explaining'.

In addition to the differences between the student and industry groups, there are also some differences within the student group. STs 5-8 include more references to the company running the project, as well as other companies involved. These four texts also include slightly more detail on the actual project. Out of STs 1-4, only ST4 makes one brief mention of the company:

> **ST4:** This report ascertains the feasibility of Advanced Driver Assist Technologies (ADAT) for Electromotive Vehicle System Ltd (EVS).

Overall, the Introduction stages of STs 5-8 are somewhat more similar to the industry texts in terms of what information they include.

4.2.2 Methods stage

A difference between the industry and student groups in terms of genre staging is in their inclusion of the optional Methods section. Each of the industry texts includes a Methods stage, covering the sources used and processes of gathering the information used in the study. In the student group, only ST3 includes a brief Methods stage, while STs, 1, 2, 6 and 8 briefly integrate their Methods into the text of the Introduction stage. The included Methods stages in the student texts only outline the sections of the documents through which the feasibility will be analysed, not the sources of the information used, as in the example below from ST3. STs 4, 5 and 7 do not include Methods stages.

> **ST3:** Four main elements were examined to determine the feasibility of the proposed system: goals and objectives of the system, technology and function feasibility, market and market trend feasibility, and rational recommendations.

4.2.3 Investigation/Results and Conclusion/Recommendations stages

Both the Investigation/Results and Conclusion/Recommendations stages are broadly similar across the industry and student texts. The focus is on summarising the content of the

document by outlining the relevant key points. The main point of difference is that the industry texts approach this summary in considerably more detail.

4.3 Process types

The analysis of process types reveals that there are no significant differences between the groups of texts in terms of lexicogrammatical structure. The dominant process types of all twelve texts are relational and material, indicating that the texts are primarily focused on defining what things are, and on events that occur. Each text is either dominated by relational or material processes, but there is no correlation with whether the text is in the industry group or the student group. The SCG and Moonambel texts are dominated by relational processes, while the CE4G and Kellogg texts are dominated by material. This is shown below in Figure 4.1.

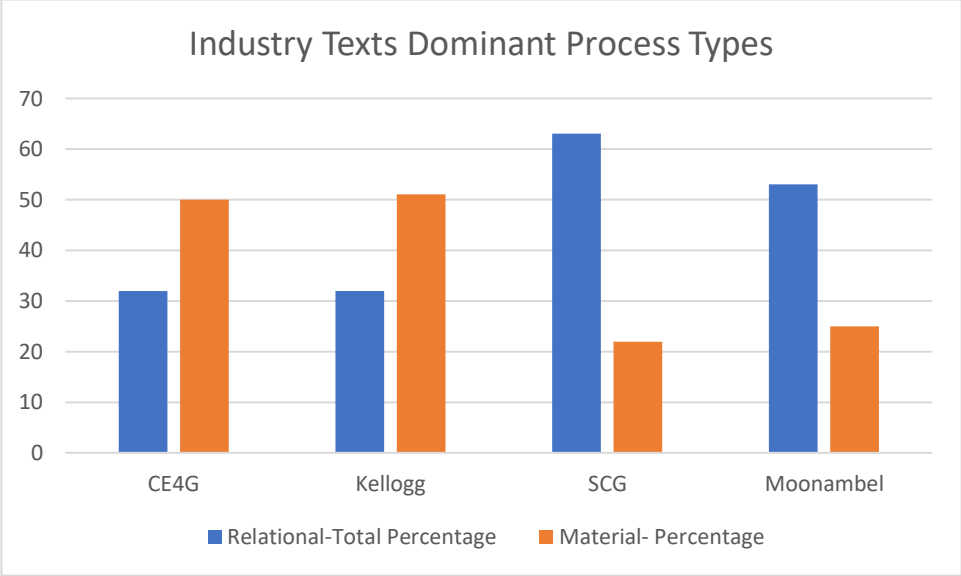

Figure 4.1 Industry texts dominant process types

In the student group, STs 1, 3 and 7 use a higher number of relational processes, while STs 2, 4, 5, 6 and 8 use more material processes, as shown in Figure 4.2.

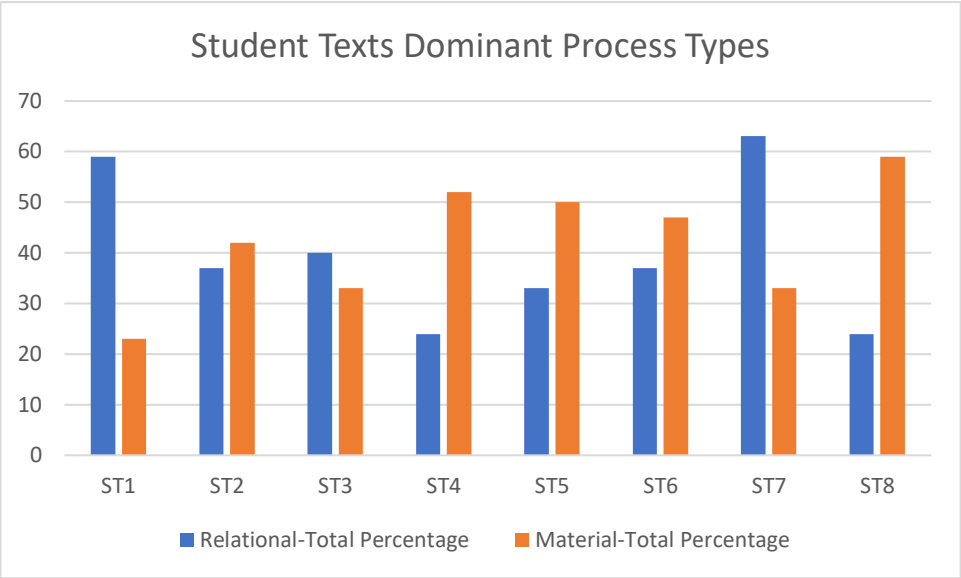

Figure 4.2 Student texts dominant process types

The lack of significant differences in terms of lexicogrammatical structure show that it is unlikely to be the students command of English grammar that drives any differences between the two groups of texts in terms of the type of experience they construe, though their developing competency in the type of discourse may have an impact.

4.4 Entity

The entity analysis reveals that there are some significant differences between the industry and student groups, and also within the student group. These differences are centred on the range of types of entities used within the texts, and the proportions in which they are used. In this section, the entities used in each of the industry texts, and in the first and second halves of the student group will be described and examples given. Secondly, the groups will be compared in terms of the percentages of entities used in each text.

4.4.1 Description of entities used

4.4.1.1 CE4G

The project under investigation in the CE4G text is a community owned solar farm, which is found to be feasible and highly likely to proceed. The text utilises the full range of entity types. The semiotic entities used mostly relate to advice, information or ideas taken into

account in the study, or to agreements or contracts that will be needed. Activity entities are often used to refer to the feasibility study itself as an act of investigation, as well as the actual solar project. Acts that will be required in order to further the project are also represented as activity entities. The source entities are made up of the group undertaking the study, as well as the individuals and groups that were consulted or provided advice for the study. The thing entities often name the components that will be needed in construction of the solar fam, such as 'PV panels', but also the money required to finance the project. The place entities name the places at which the solar farm is planned to be situated. A small number of time entities are used to describe the timeline of the feasibility study. Examples of each of the entity types used in the CE4G text are given in Table 4.1.

Table 4.1 Entities in CE4G

Entity Type	Examples
Semiotic	*advice, regular updates, a Power Purchase Agreement, information, governance requirements, underpinning assumptions, EPC (Engineering Procurement Construction) contract*
Activity	*a twelve month feasibility study, project, finance modelling, commercial developer investment, minimum 51% community ownership, operation, a major task, investigations*
Source	*The Goulburn Group (TGG), a committee, Community Energy for Goulburn (CE4G), a technical team, consultants, business groups*
Thing	*dedicated community energy website, solar farm, PV panels, $2.7 million, community fund,*
Place	*a site, the centre, Goulburn City, Southern Region, Crown Land, Goulburn Correctional Centre*
Time	*April 2015, strategic points (of the study), the time (of the study)*

4.4.1.2 Kellogg

The purpose of the Kellogg text is to investigate the feasibility of recycling waste water for use in the Botany Kellogg plant, as well as possible local irrigation. This project is considerably further from realisation than the CE4G project, and the Kellogg report recommends a significant amount of further research. As in the CE4G text, the full range of entities are utilised. Many of the semiotic entities refer to the regulations and other factors that impact on the feasibility of the options under consideration. The activity entities

include processes that are part of the act of recycling the water, such as 'microfiltration', as well as acts that are part of the process of investigation. Source entities refer to groups that are involved in undertaking the study, as well as other stakeholders such as the 'local Council', 'local community' and possible 'third party users' of the water. The thing entities used in this text are mostly equipment related to the processes of treating the water. Place entities name the location and possible sites for use of the water. Finally, the few time entities refer to the period of use under consideration, as well as time periods for measuring water usage. Table 4.2 lists examples of the entities in the Kellogg text.

Table 4.2 Entities in Kellogg

Entity Type	Examples
Semiotic	*opportunity, required quality standards, possibility, interest, existing regulations, compliance requirements, selected technology options, expertise, site constraints, guidance, factors, scenarios*
Activity	*reduction, irrigation, applications, water treatment, appropriate technologies, in-plant recycling, project activities, proposed use, evaluating, microfiltration, anaerobic digestion, conversion, value proposition analysis, microbiological testing*
Source	*CSIRO, Australian Water Recycling Centre of Excellence (AWRCoE), Kellogg, the local Council, a team (from CSIRO), the local community, suppliers, relevant state health and environmental regulators, third party users,*
Thing	*water, treatment plant, manufacturing facility, waste water, a tool, 0.2 micron filter, aerobic membrane bioreactor, existing equalisation tank 1, disinfection system, aeration tank, sewer, associated equipment*
Place	*Botany, food manufacturing areas, local parks, non-food areas, various points (in the plant), Botany plant, Kellogg site, irrigation sites*
Time	*20-year period, year*

4.4.1.3 SCG

The project under investigation in the SCG text is a preliminary concept study of the possibilities for community-based wind power in the region of the NSW South Coast. Many of the semiotic entities are similar to those in the Kellogg text, referring to regulations and factors impacting on the potential of the project, while also including entities that name the information used in the study and entities referring to portions of the document itself, such as 'objectives' and 'conclusions'. Similar to the CE4G text, the activity entities used in the SGC text name the study itself or aspects of it, as well as some acts that would be part of the

project once underway, such as ‘construction’. The source entities name groups that provided advice or information for the study, as well as the group undertaking the study, and potential groups that would be needed to further the project. The thing entities are few, and quite general, referring to some components of a possible wind power project, such as ‘turbines’, but also to the money that would be needed to fund the project. The place entities name potential locations for wind farms in the area, as well as places such as ‘overseas’, from which information was sourced. There is a sole time entity, referring to a non-specific ‘stage’ of the project. Examples of these entities are given in Table 4.3.

Table 4.3 Entities in SCG

Entity Type	Examples
Semiotic	*objective, approach, necessary input, list, information, principal environmental considerations, well established guidelines, environmental argument, concept, outline business case, indicative development timeline, best-practice project management principles, options, preceding conclusions, benefits, cooperative model*
Activity	*South Coast Community-Based Wind Power Concept Study, high-level preliminary investigation, community-based wind-power generation, small-scale wind power developments, construction, wind-turbine operation, proposed project, preliminary risk assessment, Stage 1 [of the project], Pre-Feasibility Study*
Source	*agencies, large investors, financial institutions, experienced wind-power developers, incorporated business entity, formally constituted Project Board, Southern Councils Group, Concept Study Working Group*
Thing	*commercial wind power, turbines, power, $25M, funding*
Place	*South Coast, high potential sites, Shellharbour, Kiama, Wingecarribee, Shoalhaven, LGAs (Local Government Areas), overseas, Australia*
Time	*stage [of the project]*

4.4.1.4 Moonambel

The Moonambel text investigates options for enhancing water supply to a region in Victoria. As in the previous texts, the semiotic entities in this text name factors impacting on the project, information used in the study and also name the scenarios or options under consideration. The activity entities refer to the study itself, the acts undertaken as part of gathering the information needed, as well as acts such as ‘connections’ and ‘boring’ that would be part of the project. The source entities name stakeholders, such as the funding bodies for the study, as well as potential general beneficiaries of the project, such as

'tourists' and 'nearby customers'. The thing entities include components of the potential water supply system, such as 'non-potable water tanks', as well as local assets to which the water would be supplied. These local assets, buildings such as 'wineries', a 'hotel' and a 'school', could have been analysed as place entities, however since the emphasis was on their nature as properties located within the region, they were analysed as thing entities. Place entities name the area and locations which are used to establish its location. Some specific time entities are used in relation to the timing of the study.

Table 4.4 Entities in Moonambel

Entity Type	Examples
Semiotic	*growth scenarios, 25 year projection, additional information, issues, water supply options, reservations, 2011 Census data, shortlist, options, criteria, costs, ongoing tariffs, capital cost estimates, risk, scope, enhanced water supply solution, uncertainties, issues, approvals, environmental and cultural heritage considerations*
Activity	*study, growth, engagement, public information session, discussions, clarification, water supply upgrade investigations, good pressure, jobs, food production, local groundwater (potable) supply, onsite improvements, collection, connections, boring, product rebates scheme, further consideration, assessment, capital funding*
Source	*tourists, Victorian State Government, Regional Development Victoria, Pyrenees Shire Council, Central Highlands Water, nearby customers, community, Project Control Group, Marsden Jacob Associates, business community*
Thing	*vineyards, reticulated water supply, wineries, accommodation/cafés/restaurants, general store/café, hotel, school recreation reserve, churches, hall, CFA, following table, good tasting, low salinity, highly reliable and affordable drinking water, network, median weekly household income, $675, non-potable rainwater tanks, pipeline, local groundwater, Avoca system, rooms, related tourism facilities*
Place	*Moonambel, Victoria, Melbourne, Ballarat, region, township, zone, rural living area, study area, Avoca*
Time	*16th February 2015, 19th March 2015*

4.4.1.5 Student Texts 1-4

STs 1-4 were written during the same semester, and each relate to the topic of the ADAT system. This system combines various technologies designed to aid the driver of a vehicle, such as hands-free parking. The semiotic entities used in these texts largely relate to the document itself, such as the 'purpose', 'goals', 'findings' and 'advantages' and

'disadvantages'. Some texts also include information impacting on the feasibility of the project, such as 'regulations', similar to several of the industry texts. The activity entities include acts that impact on the development of the project, as well as acts that will be performed by the ADAT system. The source entities are mostly general groups of people who will be users of the system, such as 'drivers', and occasional references to the company developing the project. As stated above, only ST4 names this company specifically as 'Electromotive Vehicle System Ltd (EVS)'. The few thing entities are also quite general, referring to non-specific 'components' of the ADAT system, or 'hardware' that will be required. Only ST2 includes any place entities, referring to places in which other automated driving technology systems are being developed. The time entities name times related to the market for an ADAT system, as well as general goals for the 'short term' and 'long term'. Examples of entities used throughout STs 1-4 are given in Table 4.5.

Table 4.5 Entities in Student Texts 1-4

Entity Type	Examples
Semiotic	*purpose, document, goals, proposed functions, benefits, objectives, approved user needs, road and traffic condition, requirements, information, regulations, issues, constraints, market situation, data, market considerations, modular and expendable design, risk factors, assumptions, bright market perspective, market projections, description, study results, problems, competitive advantages, disadvantages*
Activity	*ADAT (Automated Driver Assistance Technology) system, ADAT, current market, market trends, project, detecting, avoiding, sensor installation, dataflow, full manual control, network attacks, hacker intrusions, 3,200,000 unit shipment, market research, autonomous parking, driving habits*
Source	*company, pedestrians, customers, drivers, business, Electromotive Vehicle System Ltd (EVS)*
Thing	*obstacles, components, luxury vehicles, products, hardware*
Place	*U.S, Europe, Japan*
Time	*present, long term, (a) long period, 2024, 2018, 2028, next decade, future*

4.4.1.5 Student Texts 5-8

STs 5-8 were written in the subsequent semester to the ADAT topic, and relate to the simulated investigation into the feasibility of MCAAS project. The purpose of the Service is

to control autonomous truck undertaking haulage on a mine site. The semiotic entities used in these texts are very similar to those used in the ADAT texts, though some are included that name pieces of information that will be conveyed through the MCAAS system. The activity entities mainly name actions that will be performed by the system, as well as some that relate to the development of the system, such as 'design'. Also included in some MCAAS texts are more specific source entities than the ADAT texts, including the specific name of the company and other companies involved in the project and a wider range of people that will be needed in the project. The thing entities include several objects that will be used in the MCAAS project, including 'mining trucks', 'backup generators' and 'trailers'. The place entities used refer to non-specific sites in the mine and the general 'environment'. Time entities are used in STs 5 and 7 in relation to timeframes for the capacity of the system, and scheduling of activities. Examples of the entities used in STs 5-8 are given in Table 4.6.

Table 4.6 Entities in Student Texts 5-8

Entity Type	Examples
Semiotic	*document, goals, objectives, financial benefits, fully autonomous mode, maintenance status, conclusion, mining haulage efficiency and safety situations, findings, recommendations, market strategy, schedule, financial projections, needs, requirements, Work Health and Safety regulations, characteristics, limitations, issues, assumptions, extreme situation, operation log, requests, report, environmental standards, daily task plan, constraints, result*
Activity	*Mining communication and Autonomous Service (MCAAS) project, current mining haulage system, technologies, haulage, 24/7 monitoring, communication, web-based communication system, experience, managing, maintaining, damage, losses, autonomous haulage control, autonomous control industry, sustainable development, mining process, accidents, inner network, future use, emergencies, design*
Source	*CSSL, company, authorised human operators, maintainers, support personnel, staff, stakeholders, manager, labourers, consultation firms, BHP Billiton, Komatsu, engineers,*
Thing	*autonomous mining haulage fleet, mine-site monitoring station, Operational Control Centre, mining trucks, manual, software, control tower, backup generators, hybrid excavators, routers, trailers, hardware*
Place	*mine site, maintenance centre, environment,*
Time	*year, two days*

4.4.2 Proportions of entities used

4.4.2.1 Whole texts

A comparison of the proportions of the types of entities used across the whole texts reveals some differences between the sets of texts. Figure 4.3 shows the percentages of entity types across each text.

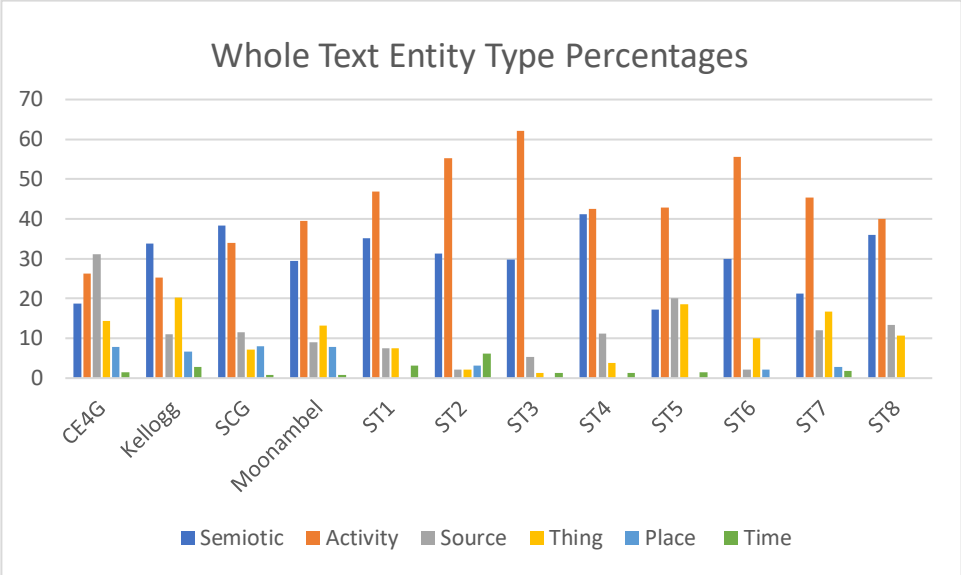

Figure 4.3 Percentages of entity types across whole texts

Overall, the industry texts use a more even spread of entity types than the student texts. In the CE4G text, the most dominant entity type are the source entities, while Kellogg and SCG use slightly more semiotic entities than any other type. The Moonambel text is dominated by activity entities, which make up 40% of the entities. In contrast, the student texts are dominated by a high proportion of activity entities, with STs 2, 3, 5, 6 and 7 showing a significant difference between the prevalence of activity entities and any other type. ST3 is particularly high at 62% activity entities. Additionally, the industry texts all include some place entities, while STs 1, 3, 4, 5 and 8 do not include any.

As can be seen in Figure 4.3, there are also some significant differences within the student text group. On average, STs 1-4 use a proportionally smaller amount of source and thing entities. ST 4 is the only text in the first half of the student group to use more than 10% source entities, while STs 5, 7 and 8 all include this level or higher. None of STs 1-4 use more than 7% thing entities, while STs 5-8 all use more than 10%.

4.4.2.2 Introduction stages

While the differences in proportions of entity types are significant when the texts are considered as wholes, there is more disparity when genre stages are compared individually. A comparison of the Introduction stage reveals some highly significant differences.

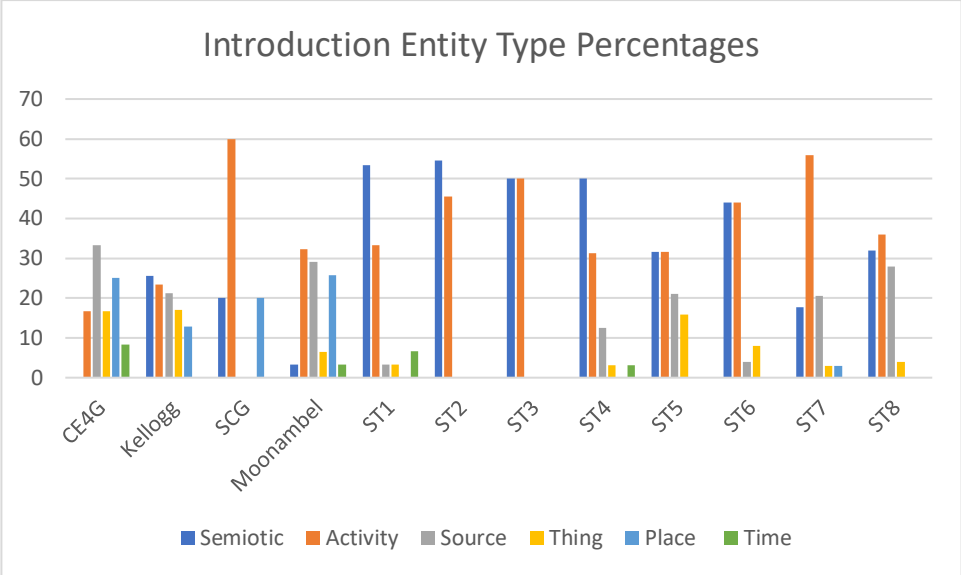

Figure 4.4 Percentages of entity types across Introductions

As shown in Figure 4.4 above, the CE4G and Kellogg show a moderately even spread of entity types, though CE4G does not include any semiotic entities in the Introduction, and Kellogg does not include any time entities. The Moonambel Introduction uses all entity types, but is proportionally dominated by activity, source and place entities. The Introduction of the SCG text is dominated by 60% activity entities, and only uses semiotic and place entities in addition to these.

In contrast to the industry texts, STs 1-4 are dominated by 50% or more semiotic entities, with activity entities making up the large portion of the remaining entities. STs 2 and 3 do not use any other types of entities. However, while the Introductions of STs 5-8 are still dominated by semiotic and activity entities, the proportional differences are not as extreme, and they include more source and thing entities. ST7 and SCG are similar in terms of their dominance by activity entities in the Introduction stage.

4.4.2.3 Methods stages

As stated above in the findings relating the genre, ST3 is the only student text to include a distinct Methods stage. Thus, an effective comparison of Methods stages is not possible. As shown in Figure 4.5 below, the Industry texts make use of different amounts of most of the entity types, though the SCG text is largely dominated by semiotic entities. ST3, however, includes only activity and, to a lesser extent, semiotic entities.

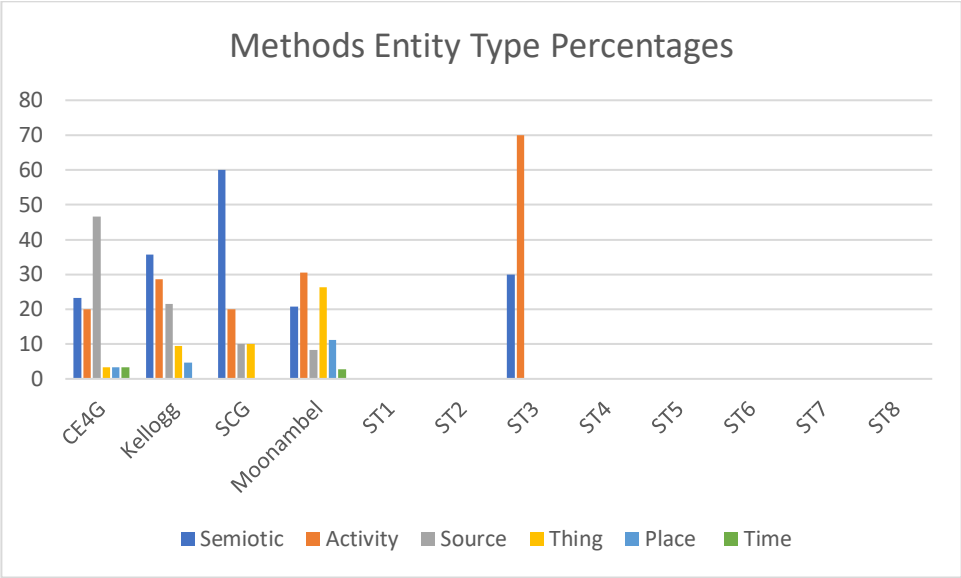

Figure 4.5 Percentages of entity types across Methods

4.4.2.4 Results stages

As in the Introduction stage, analysis of the Results/Investigation stages in terms of the proportions of entity types used reveals some differences. As shown in Figure 4.6, the CE4G and Kellogg texts utilise thing entities in relative balance with activity and semiotic entities respectively. Though there are these differences within the Industry group, the proportions of entity types use are more relative to each other than in the student group. STs 1-4 are strongly dominated by activity entities, then semiotic entities, then 11% or less of other entity types. STs 5 and 7, however, show use of a higher amount of thing entities, and are somewhat more comparable to the industry texts.

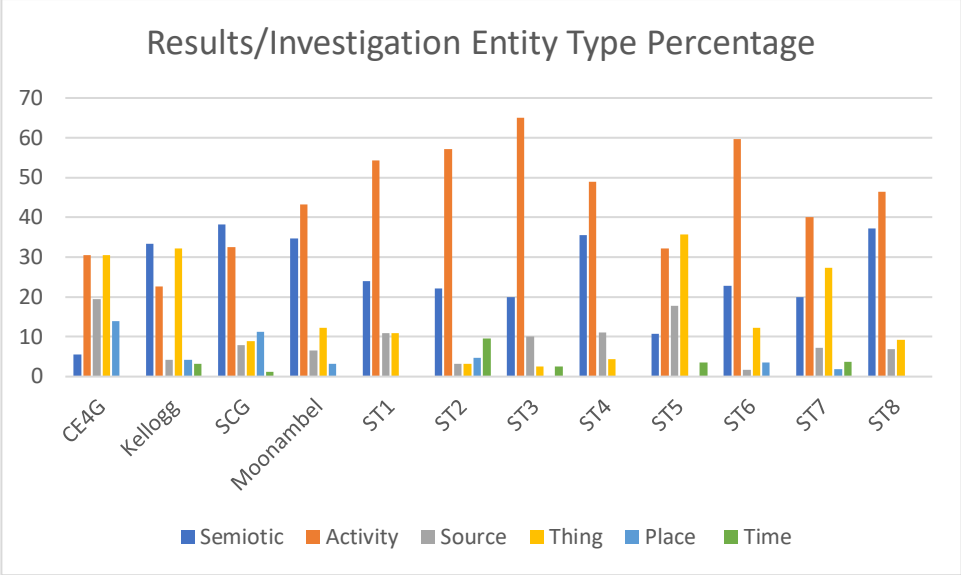

Figure 4.6 Percentages of entity types across Results

4.4.2.5 Conclusion stages

The Conclusion sections arguably reveal the least significant differences between the industry and student groups. All the industry texts except for CE4G are dominated by semiotic and activity entities, and this is also true for the student texts except for ST8. However, the dominance of activity and semiotic entities is more pronounced in the student texts, as is the fact that the activity entities are more highly used. Four of the student texts also do not use any other entity types. However, ST8 uses 43% thing entities, equal to the amount of semiotic entities.

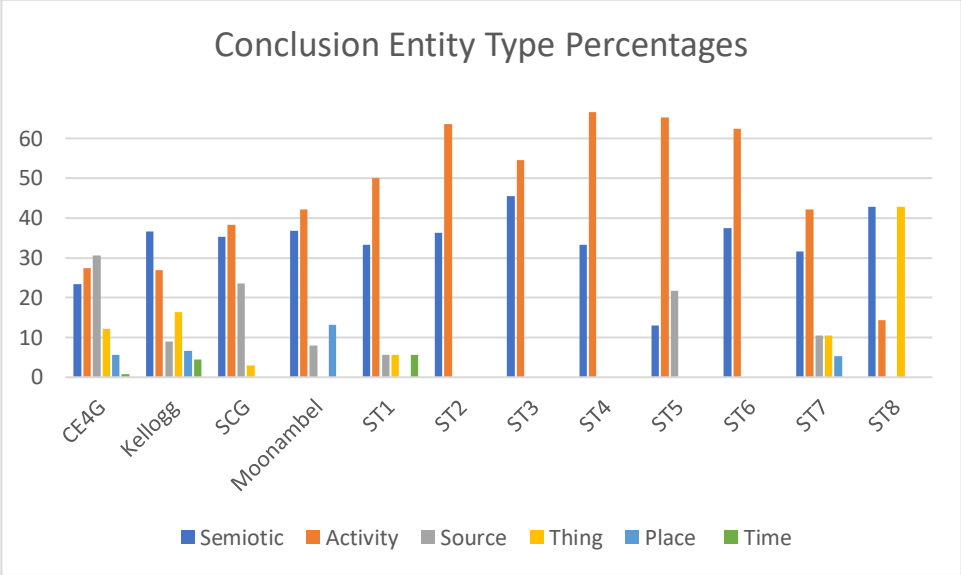

Figure 4.7 Percentages of entity types across Conclusions

4.5 Semantic gravity

In this section, the results of the semantic gravity analysis are outlined. As described in Chapter 3, the analysis consisted of placing the entity types against the scale of strong, medium and weak semantic gravity. Semiotic entities are considered to possess weaker semantic gravity, activity entities are considered to be medium and source, thing, place and time entities are considered stronger. A statistical breakdown of each text and then each stage is given below, revealing differences in semantic gravity across the groups.

4.5.1 Percentages of strong, medium and weak semantic gravity entities

4.5.1.1 Whole texts

When compared as whole texts, it can be seen that there are significant differences between the industry and student groups. Figure 4.8 shows the breakdown of entity types in terms of semantic gravity. In the industry group, CE4G and Kellogg are dominated by stronger semantic gravity entities, and the SCG and Moonambel texts are relatively balanced across the range. STs 1-4, however show a greater portion of medium semantic gravity entities, followed by weaker semantic gravity entities and a low amount of strong semantic gravity entities. Though ST6 is similar to STs 1-4, STs 5, 7 and 8 show more balance across the range, including a higher proportion of entities at the stronger end of the range.

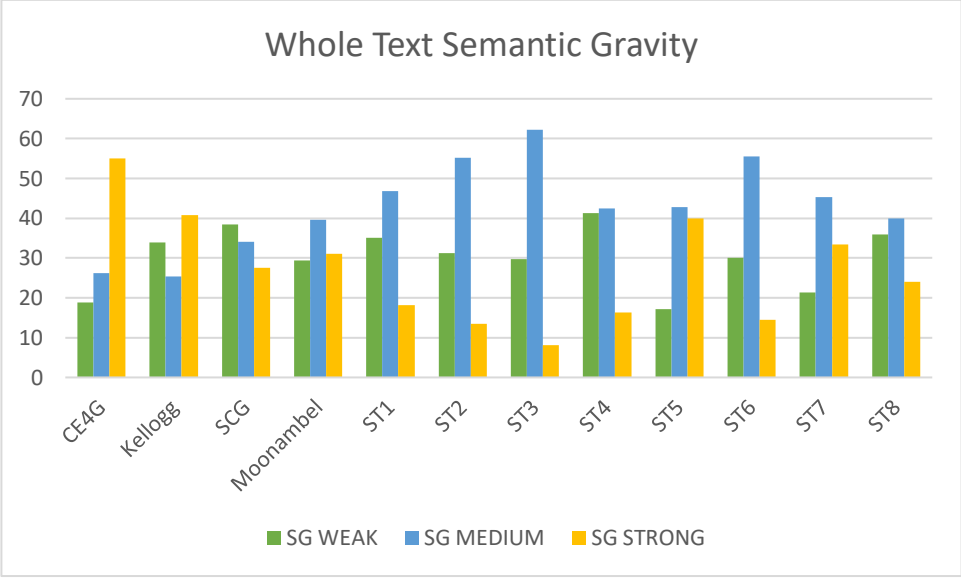

Figure 4.8 Whole text semantic gravity percentages

4.5.1.2 Introduction stages

In the Introduction stages, the dominance of the more concrete is more pronounced in the CE4G, Kellogg and Moonambel texts, with the SCG text remaining more balanced in the medium range. STs 1-4 show a spread of semantic gravity towards the weak and medium end of the range, while STs 5-8 are overall more balanced, except for ST6.

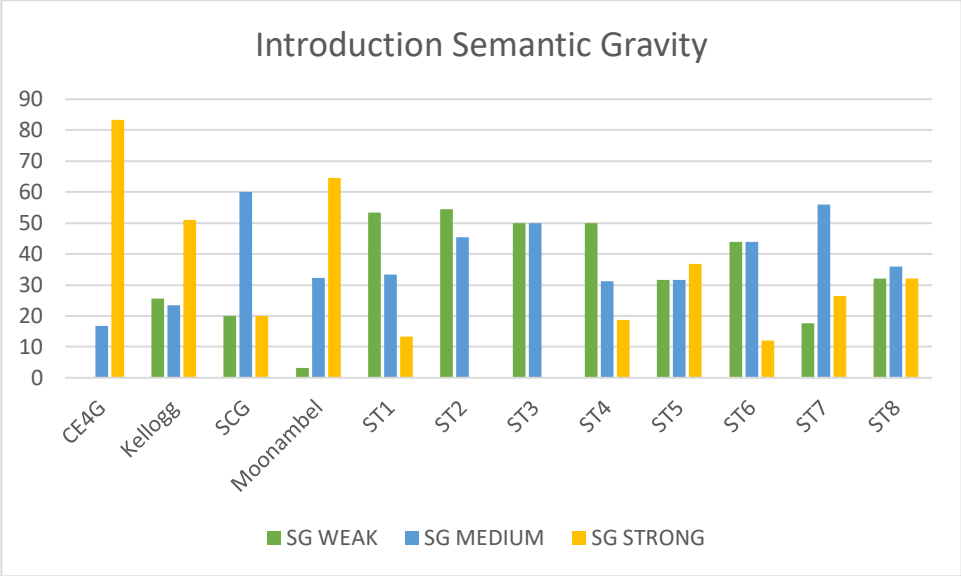

Figure 4.9 Introduction semantic gravity percentages

4.5.1.3 Methods stages

As mentioned above, the student texts do not present Methods sections to be compared to the industry texts. However, the Methods sections of the industry texts tend towards the stronger end of the range in the CE4G and Moonambel texts and towards the weak end in the SCG. The Kellogg text is evenly balanced. ST3, however, is dominated by medium with some weaker semantic gravity and no stronger semantic gravity. This breakdown is shown in Figure 4.10.

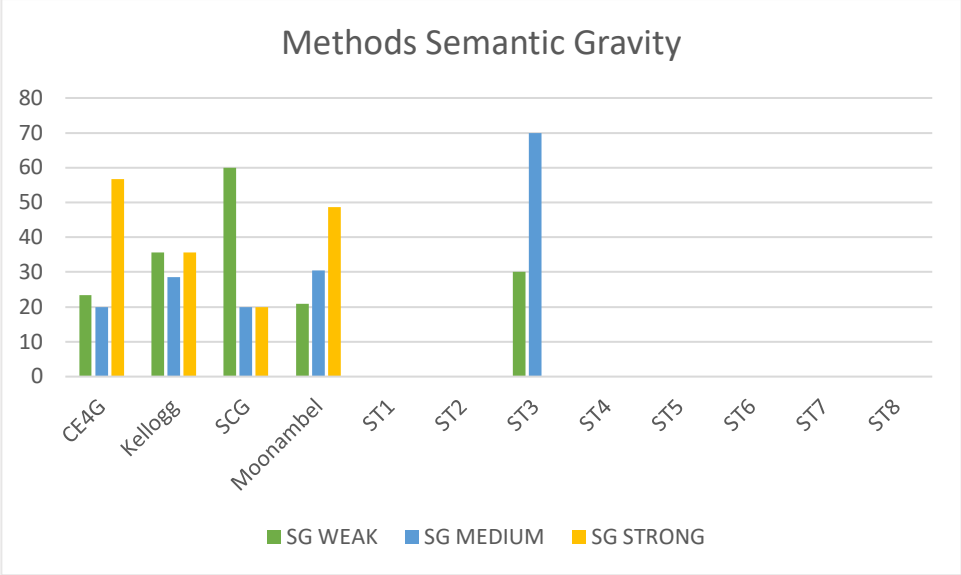

Figure 4.10 Methods semantic gravity percentages

4.5.1.4 Result/Investigation stages

Due to the proportions of entity types, the semantic gravity breakdown of Results/Investigation are similar to the comparison of the Introduction stages, as shown in Figure 4.11.

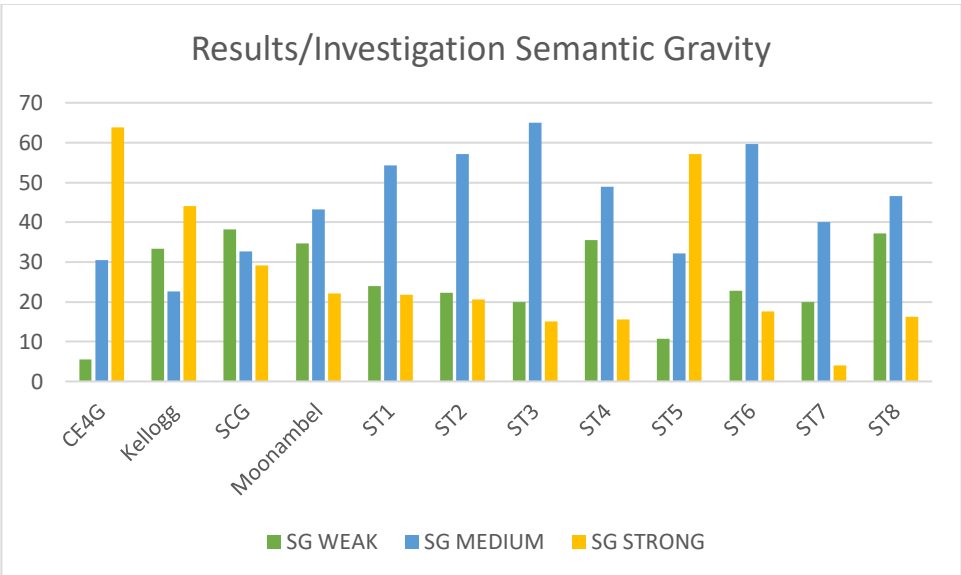

Figure 4.11 Results/Investigations semantic gravity percentages

The industry texts are either dominated by stronger semantic gravity, or are relatively balanced. In contrast, STs 1-4 are strongly dominated by medium semantic gravity, accompanied by a comparatively closely balanced spread of weaker and stronger. This is

also the case for ST6 and to a lesser extent ST8. However, ST5 reveals a higher proportion of context dependency, comparable to the breakdown of CE4G. ST7 also shows a more context dependence, evenly balanced with the proportion of medium semantic gravity.

4.5.1.5 Conclusion stages

In the conclusions sections, it can be seen that the industry texts either reveal stronger or balanced proportions of semantic gravity, in the CE4G and Kellogg texts, or at least include over 20% of more concrete entities. Of the first semester's STs 1-4, only ST1 includes any stronger semantic gravity, and this is below 20%. ST 6 also follows this pattern. In contrast, STs 5, 7 and 8 all include more than 20% stronger semantic gravity, with ST8 rising over 40%. The analysis of the conclusion sections is shown in Figure 4.12.

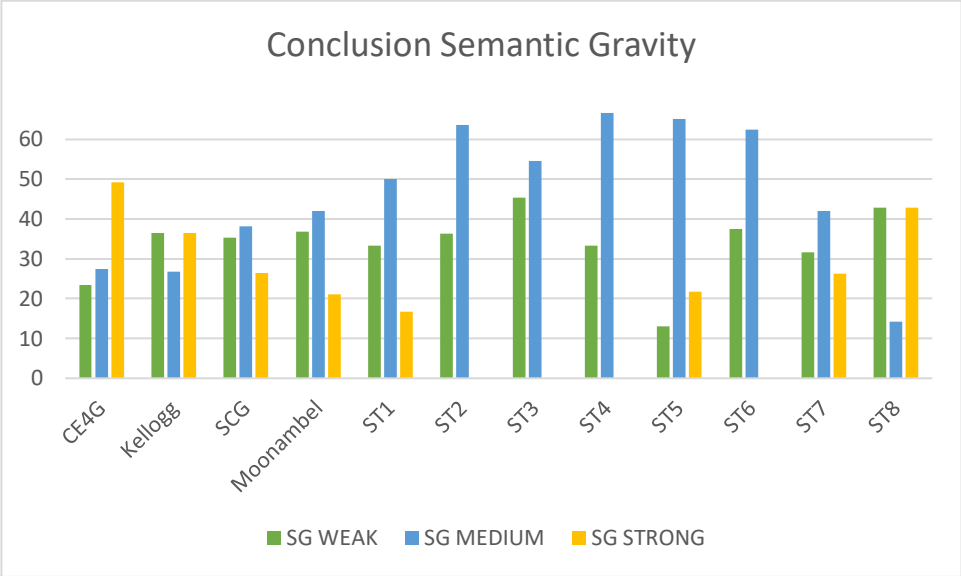

Figure 4.12 Conclusions semantic gravity percentages

4.5.2 Semantic profiles

In the previous section, the semantic gravity of the texts was presented in terms of the proportions of entities as classified as strong, medium and weak semantic. In this section, a qualitative interpretation of the shifts in concretisation and abstraction across each text in the form of a semantic gravity profile will be given. The profiles are created based on the analyses which can be found in the Appendices. The profiles are accompanied by a description and comparison of the profiles. Firstly, the profiles for the four industry texts are shown in Figures 4.13-4.16.

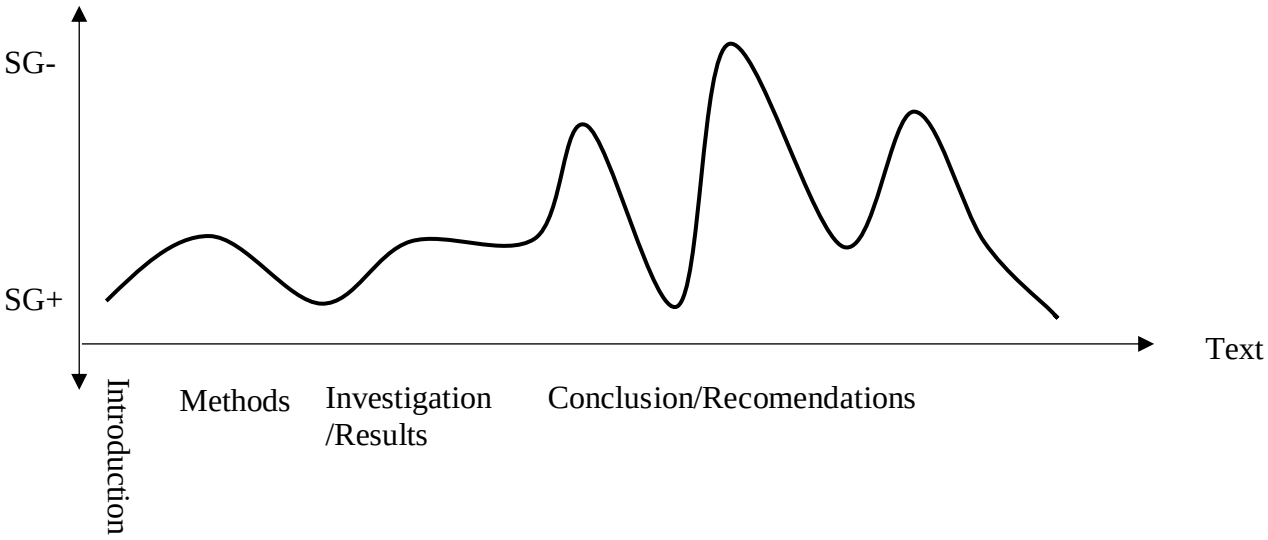

Figure 4.13 CE4G semantic gravity profile

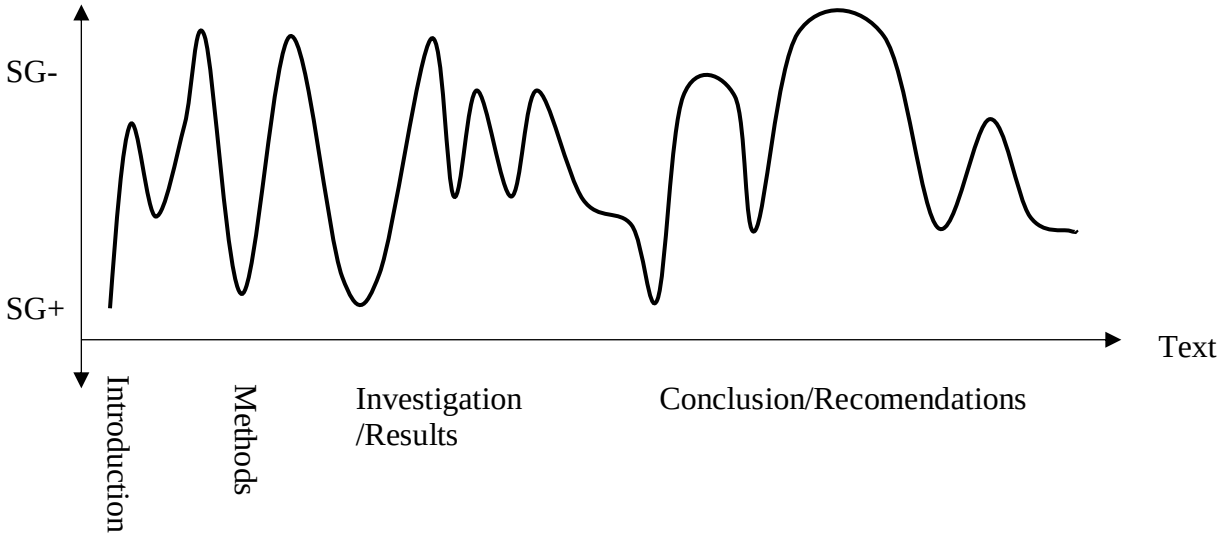

Figure 4.14 Kellogg semantic gravity profile

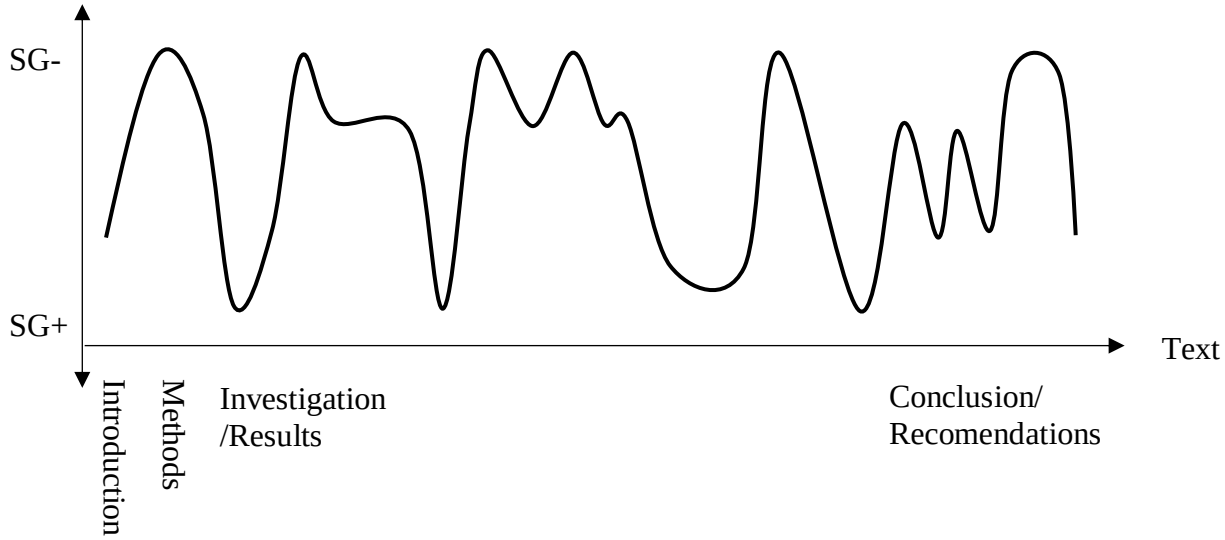

Figure 4.15 SCG semantic gravity profile

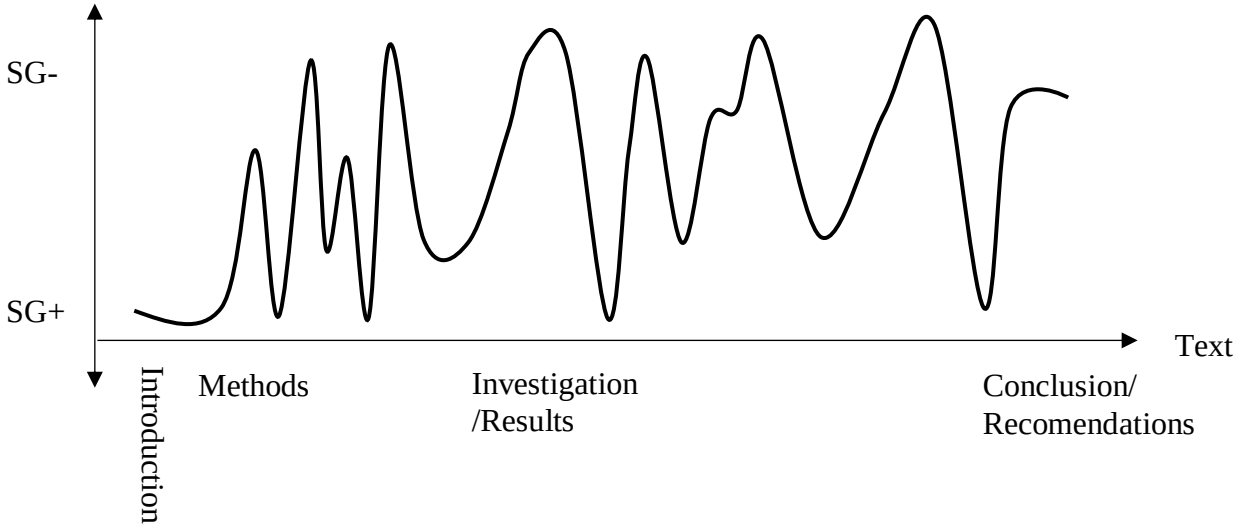

Figure 4.16 Moonambel semantic gravity profile

As revealed in Figures 4.13 to 4.16, the semantic profiles of the industry texts are characterised by frequent and wide ranging movements across the semantic range. Each of the profiles of these texts begin with stronger semantic and return to the strong end of the range several times. The CE4G text reveals the strongest profile overall, only moving into the weaker end of the range in the Conclusion/Recommendations stage. Similarly the Moonambel text remains stronger in the Introduction stage, weakening through the Methods stage. The other industry texts utilise the weaker end of the range throughout each stage, and remain there for some portions of the text.

The following Figures 4.17 to 4.20 show the profiles for STs 1-4.

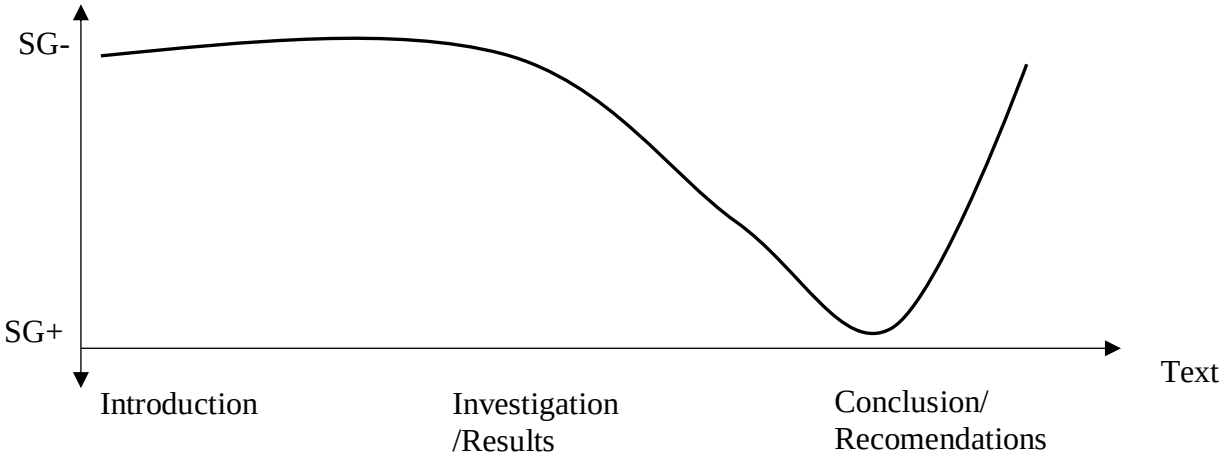

Figure 4.17 Student Text 1 semantic gravity profile

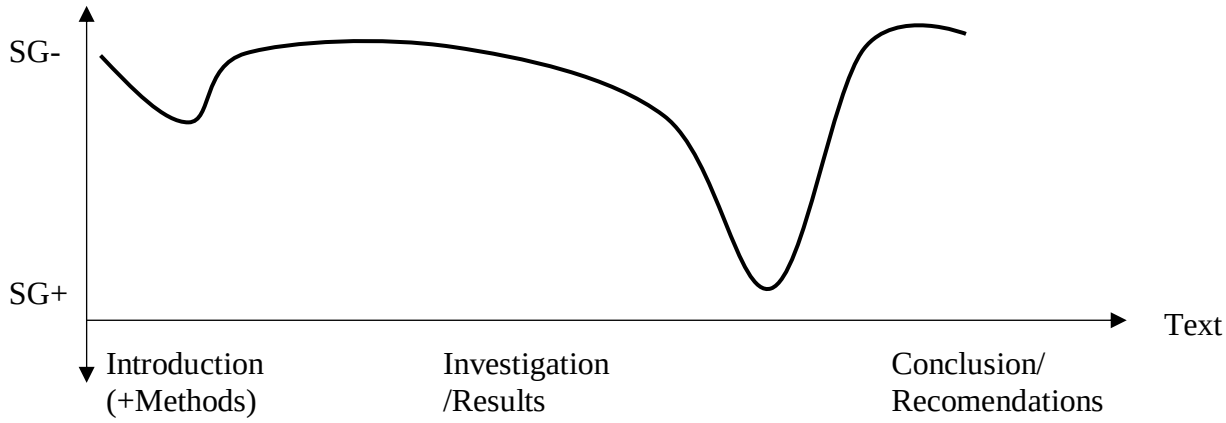

Figure 4.18 Student Text 2 semantic gravity profile

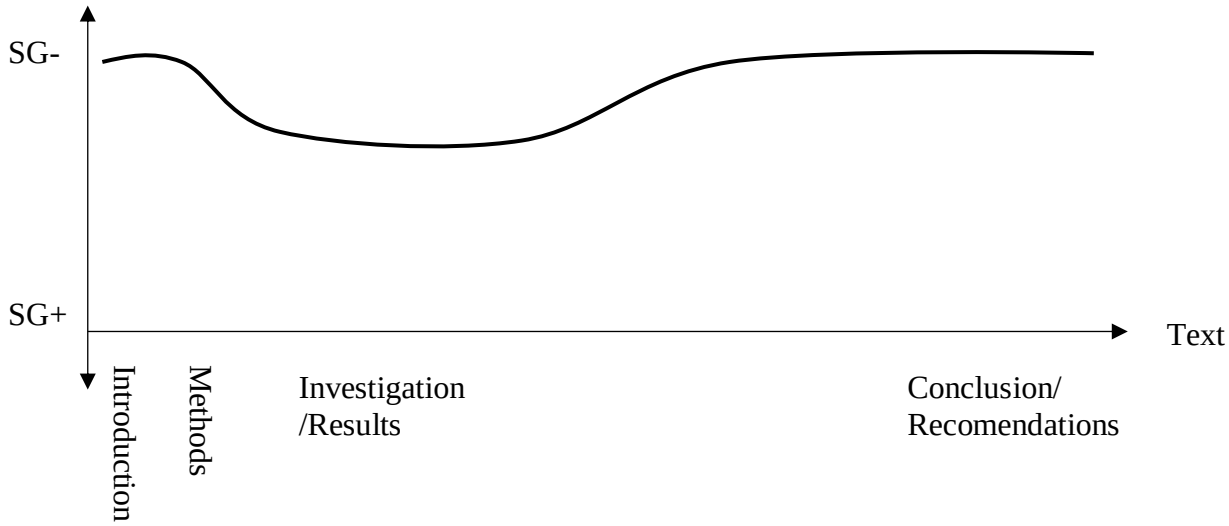

Figure 4.19 Student Text 3 semantic gravity profile

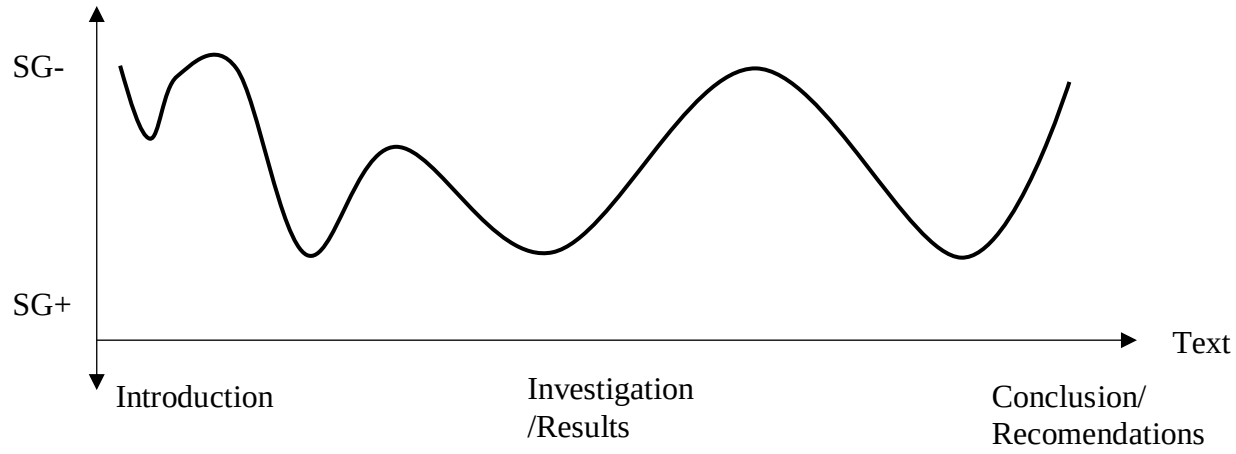

Figure 4.20 Student Text 4 semantic gravity profile

The profiles for STs 1-4 each begin in the weaker end of the spectrum, in contrast to the beginnings of the industry SG profiles. There is significantly less movement across the range in these profiles, and STs 1-3 can be characterised as being dominated by a high flatline. STs 1 and 2 both include a dip towards concretisation towards the end of the Investigation/Results stage or in the Conclusion/Recommendations stage. The ST4 profile includes the most movement through the middle of the range, but does not fully come down to the stronger end.

The SG profiles for STs 5-8 are shown in the following Figures 4.21 to 4.24.

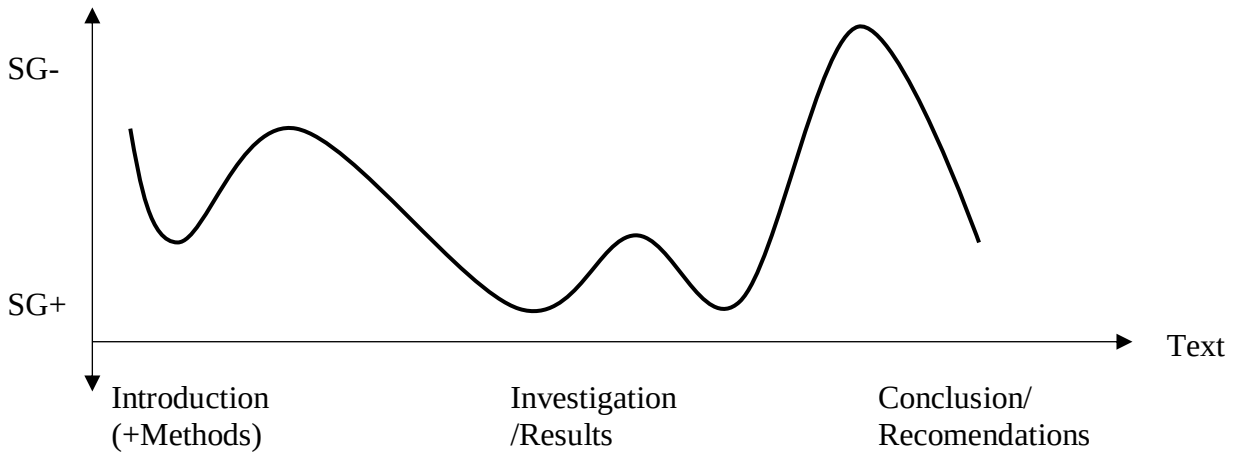

Figure 4.21 Student Text 5 semantic gravity profile

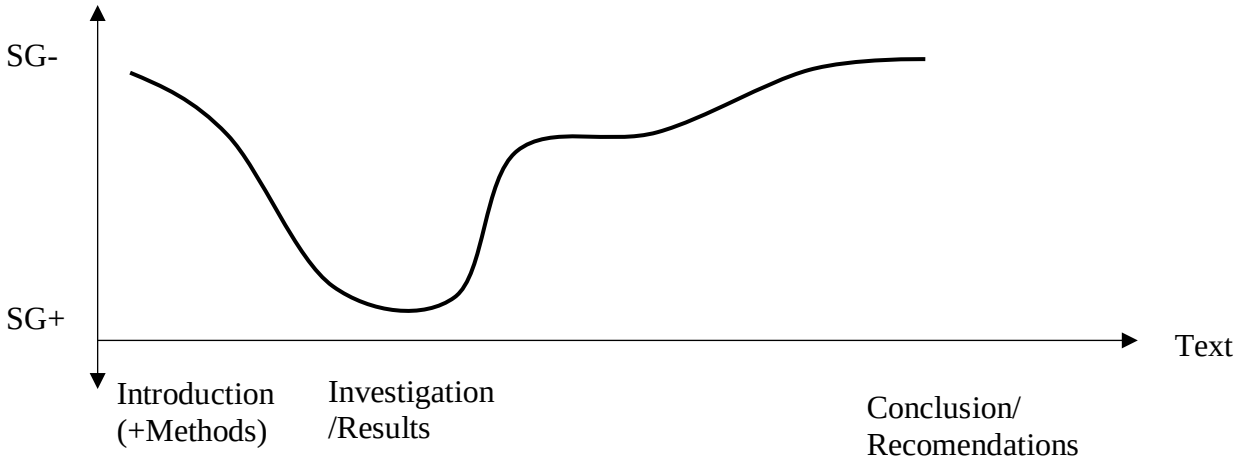

Figure 4.22 Student Text 6 semantic gravity profile

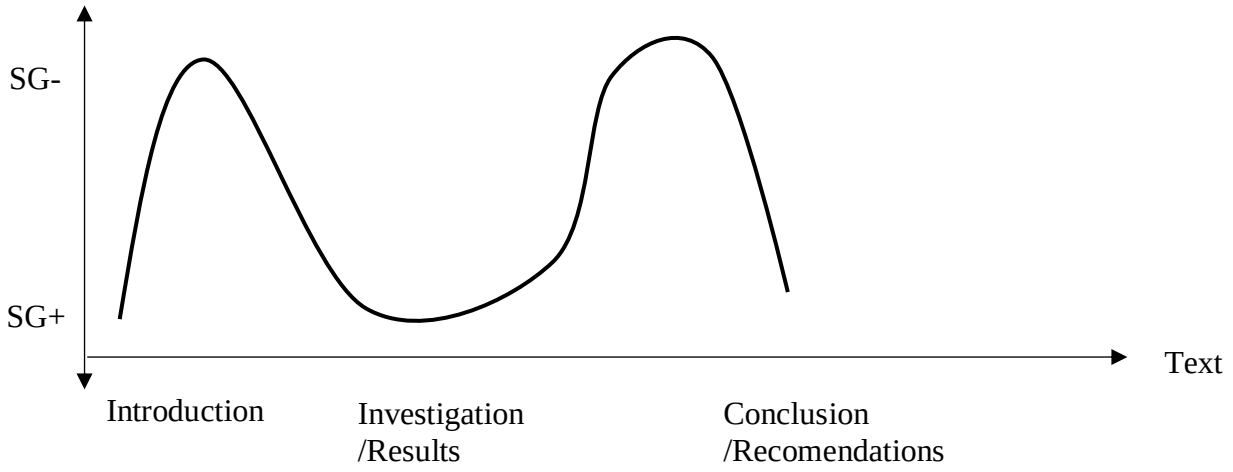

Figure 4.23 Student Text 7 semantic gravity profile

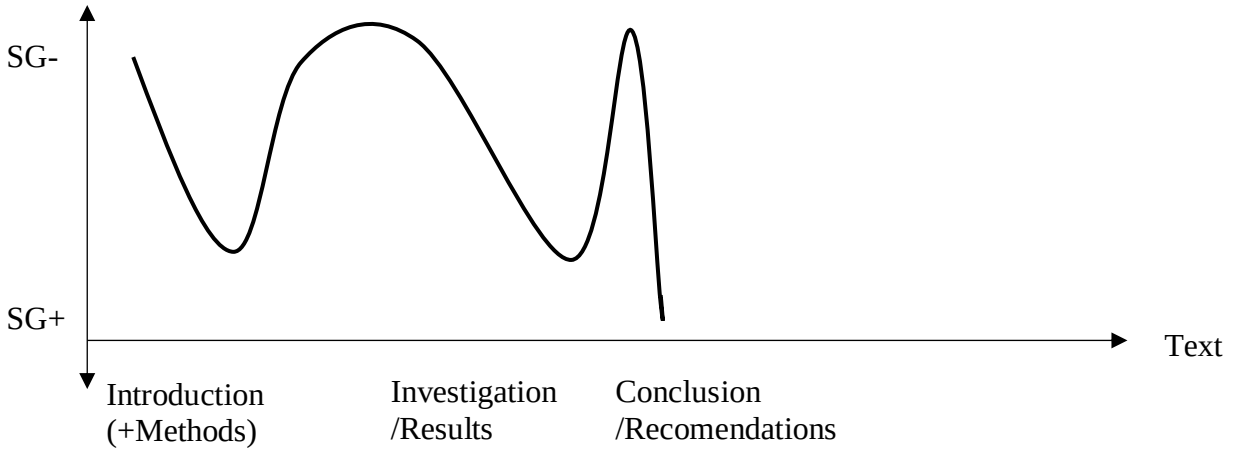

Figure 4.24 Student Text 8 semantic gravity profile

Compared to STs 1-4, STs 5-8 include more movement across their profiles. STs 5, 6 and 8 still begin in the weaker end, but ST 7 begins in the stronger. The profiles for STs 5-8 reveal more defined movements towards stronger semantic gravity, and spend more of the text in that end of the range. Therefore, the profiles for STs 5-8 can be said to bear closer resemblance to those of the industry texts.

4.6 Discussion

The results of this study have shown some significant differences between the industry and student groups, and also within the student group. These results will be discussed in this section, incorporating some hypothesis as to the reasons for the differences.

The study results indicate that there are minor differences in the use of genre staging, and no significant difference in terms of process types used. The most significant disparities found were in the area of entity use and semantic gravity. The industry texts use a broader range of entity types when compared to the student texts. This difference is clear when the proportions of entities are compared across the whole texts, but even more pronounced in some genre stages, particularly the Introduction. The industry texts also make greater use of more entities with stronger semantic gravity. These differences are apparent once the shifts in semantic gravity are plotted as profiles. Overall it can be concluded that the industry texts convey meanings that are more strongly bound to their context. These meanings incorporate more references to specific objects, places and people related to the particular project: while drawing on more abstract concepts, they are rooted in the concrete.

The differences shown between the industry and student texts may be due to a range of factors. The industry texts are from a real context while the student texts are simulated, and there is a difference in the nature of the project involved. As outlined in Chapter 3, the industry texts are about public or community funded projects. They are related to real, specific situations such as water supply for a particular district in the Moonambel text. There is therefore a definite need to refer to these particular places and the needs of the local people. All the industry texts also relate to established technology. It is the application of the technology in the particular contexts that is the question of feasibility. The student

texts, however, relate to a context within an engineering firm. The projects are to be developed for application in the widest range of situations in order to maximise profit for the company. The projects are more speculative in nature as they involve the feasibility of potential new technologies that are not yet in established use. This difference in contexts may account for some of the differences in entity use and semantic gravity, as it could be argued that there is more need for specific, concrete meanings in the contexts of the industry texts.

Due to the difference in the nature of the projects, there is also a difference in the assumed audience of the two groups. The industry texts are written for a relatively broad audience, and are published publicly for anyone to access. They are intended for funding bodies such as governments and councils, or community groups. Industry groups may also have an interest, as well as the general public, particularly those who have a connection to the location. It can be argued that this audience may need a greater amount of specific, concrete detail in order to understand the potential project. In contrast, within the fictional world of the student texts, the intended audience would be more limited to company management, the design team or other stakeholders such as collaborating companies. While it is not assumed that the audience is made up of professional engineers, it would be assumed that the reader had some working knowledge of the industry and the potential project. It may be that this assumed audience has a lower need for concrete detail, at least in the executive summary.

The results of the genre analysis also give some insight into the cause of the differences between the industry and student groups. The industry texts use their Introduction stages to introduce the project itself, while the student texts focus on introducing the document itself. This focus may explain to some extent the tendency of the student texts towards semiotic and activity entities.

As shown in the breakdown of the results, there are also differences within the student group. Taken as a group, STs 5-8 come closer to the industry texts in terms of entity use and SG than STs 1-4. This may be due to the different topic used as a simulated topic. The MCAAS project as a topic is arguably easier to relate to a specific context than the ADAT

project. The students may have been more able to imagine the specific situation of a mine site, including places onsite and the trucks and ore. The ADAT project, however, lends itself more to use of activity entities in particular, with its focus on the functions of the technology such as assisting 'parking'. The term 'technology' itself, the central idea of the project, functions as an activity entity in this set of texts. The MCAAS project scenario is also set out as a collaboration between companies, which encourages the use of more source entities. Though the difference in topic may be perceived to be slight, it may be that this small difference in the nature of the topic has affected the student's writing.

In addition to the difference in topic, the altered focus in terms of the teaching of nominalisation may have played a role in the differences within the student group. Students 1-4 were taught to package up information into nominalisations in order to create headings. This may have contributed to the prevalence of activity entities such as 'sensor installation'. Students 5-8 were taught to unpack nominalisations they found in the simulated company documents. In doing this they would have needed to reconstrue an activity entity such as 'fully autonomous unloading' as 'unload the ore automatically' (ST6) which may explain their use of more thing entities such as 'ore', 'mining trucks' and 'trailers'.

To summarise, it may be argued that based on the results of this study, the writing task based on a simulated professional situation allowed the students to write texts similar to industry texts in terms of genre and lexicogrammatical structures. This means that once in the workplace, the students would be familiar with the language needed for a professional feasibility study. However, analysis of their texts has revealed that the students mostly did not incorporate the concrete, physical nature of the imagined project, though they achieved a high grade in the assignment. It may be that the nature of the task itself did not enable them to. In terms of the knowledge structure of the texts, the students were unable to fully access the range of meanings needed to explore the experiential dimension of their topic. The texts produced by these students were not 'rooted in the concrete'; in these texts the students do not progress towards the worldly semantic code described in Chapter 2. The factors discussed above may go some way to explaining this lack, but it may also be that the simulated task did not offer the students the depth of understanding and familiarity with a field provided by a real-life situation.

4.7 Summary

This chapter has formed the body of this study, detailing the results of the analyses. The groups of texts have been found to be broadly similar in relation to genre and process types, but to have some significant differences in the types of entities used and their semantic gravity profiles. Possible contributors to these differences have been presented.

5. Conclusion

5.1 Summary of the study

This study has compared the structuring and meanings that are made in the executive summaries of student and industry engineering feasibility studies. Eight texts written by Masters level EAL engineering students have been compared with four publicly available texts relating to a range of real-world projects. The student texts were chosen as they were graded at 75% or higher, which means they represent the type of writing that is valued in the course. Texts from two semesters were included to provide some difference in topic.

The methodology used in analysis of the texts was drawn from a combination of SFL and LCT, with a focus on the construction of knowledge through shifts in abstraction and concretisation. These analyses have led to the finding that while the texts revealed little substantial difference in terms of genre structure and process types, the meanings that are created in relation to discourse semantic entities and semantic gravity differ significantly across the texts. When compared to the industry texts, the student texts have been found overall to use less entities that are strongly bound to the context of the project, and more entities that are abstracted from their context. Within the student corpus there was also a variation between the texts from the first and second semesters during which the texts were written. The second group was shown to be closer in similarity to the industry texts than the first.

The reasons for these differences have been considered to be potentially related to the nature of the project involved and the difference in context between a feasibility study written for a wide-ranging audience and one written for use only within an engineering firm. However, the experiential difference between a real-world context and a simulated task employed for educational purposes must also be taken into account when considering the disparity between the industry and student texts. In Chapter 1 it was stated that engineers must be ‘rooted in the concrete’ (Wolmarans, 2016 p.1). Viewing the results of this study from that perspective, it may be concluded that the students struggled to write in a way that was ‘rooted in the concrete’ in the way that the industry writers did. It may be argued that while the simulated task was able to give the students experience in the genre

structures and lexicogrammar needed for a feasibility study, it was less able to give them access to the reality of the project. This lack is evident in their writing.

5.2 Strengths and limitations

This study has demonstrated a number of strengths. The analysis of real-world industry texts contributes to the understanding of how professional engineers communicate in their written documents. Additionally, the comparison of industry and student texts may have relevance in the considerations around the preparation of engineering students for the workplace, and the development of learning tasks that facilitate this. From a theoretical perspective, this study has demonstrated the usefulness of Hao's system of ENTITY for practical analysis of texts that can lead to meaningful findings. Combining the entity analysis with semantic gravity analysis from LCT has added explanatory power to the findings of the linguistic analysis, potentially contributing to the growing number of studies using tools from both SFL and LCT.

The limitations of scope in this study have constrained the number of texts included and the depth of analysis. The twelve texts provided sufficient breadth for this study, but a larger scope would have allowed for the inclusion of more texts and thus greater strength to the findings. In particular, inclusion of texts from another semester would have allowed for greater exploration of the influence of the topic on the student's writing. With regards to analysis, the system of ENTITY contains layers of sub-classification, which when used in analysis would lead to greater delicacy of understanding of the use of entities in the texts.

5.3 Implications and opportunities for further research

This study has raised questions and ideas that warrant further research. The findings imply that the simulated professional task may not have enabled the students to fully access the range of meanings needed to develop the writing and problem solving skills needed in the industry. Further research into this area could be undertaken, through deeper investigation of simulated tasks and the different forms they may take. Observation of classroom

discourse and analysis of course texts could be avenues for deeper understanding of the way tasks are run, and how students engage in this context.

The student texts analysed for this study were written by EAL students. It may be that comparative to native-speaker students, EAL students face additional challenges in accessing the meaning-making resources necessary for moving across the semantic gravity range. The findings of this study therefore may not be representative of a wider group of students. Further research into the writing of non-EAL engineering students would provide insight into the experience of 'traditional' students and allow comparison with EAL students in this area.

During the survey of literature on engineering writing, it was found that there has been relatively little linguistic analysis of engineering texts, particularly from an industry context. This is perhaps due to the difficulty in sourcing such texts. Further research into the nature of engineering writing and the kinds of meanings that are made would be beneficial to engineering educators and students.

In terms of SFL, this study has raised opportunity for further research into the sub-types of people entity, which as yet have not been formally added to the ENTITY system. During the analysis, it was anecdotally noted that people entities could be divided into individuals and groups, and that the groups could be further divided into institutional and non-institutional. The limitations of this study prevented a closer analysis of these potential sub-types in these texts. A further study could examine the use of people entities in Engineering and other fields.

This study began by considering the need for engineering students to develop the communication and problem solving skills that are necessary for the workplace they seek to enter. Engineering educators seek to cultivate these skills by providing a task simulating the requirements of this workplace. However, the context of education can hamper the students in fully experiencing the reality of the task. In the texts investigated in this study, the restricted range of meanings that the students were able to communicate was evident when compared to the texts of those engaged in the reality of real-world projects. The

students were able to produce the forms of the communication, but not necessarily the actuality of the project they were asked to imagine. These findings raise questions of the value of simulated professional tasks and ways in which they may be improved. Further research is needed to build on the findings of this study and enable a deeper understanding of the way engineers construct knowledge in their written texts, and how students may be supported to develop the ability to do the same.

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Appendices: Text Analyses

Appendix A: CE4G

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or Projected clauses]]	Semantic Gravity
Introduction	(Location: Temporal:) In April 2015 ***time*** (Actor:) The Goulburn Group (TGG) ***source*** (Process: Material:) appointed (Goal) a committee, Community Energy for Goulburn (CE4G) ***source***, (Cause:) to [[apply for a grant ***thing*** under the NSW Government's ***source*** Community Energy Feasibility Grants Program]] ***activity***. (Token:) This application (Process: Relational: Identifying) was (Value) successful and (Actor) CE4G ***source*** (Process: Material:) proceeded to coordinate and (Process: Material) deliver (Goal:) a twelve month feasibility study ***activity*** into a 1 MWp (1 Megawatt peak) community solar farm ***thing*** on a site ***place*** three kilometres from the centre ***place*** of Goulburn city ***place***.	SG+
Methods	(Actor:) CE4G ***source*** (Process: Material) brought together (Goal:) a technical team ***source*** (Cause:) to provide advice ***semiotic*** (Location Temporal:) in the early stages ***activity*** of the study ***activity***. (Carrier:) The input ***semiotic*** from these renewable energy specialists ***source***, Council employees ***source*** and local businesses ***source*** (Process: Relational: Attributive:) was invaluable (Cause:) in [[setting the study parameters ***semiotic***]]. (Location: Temporal:) At strategic points ***time*** in the study ***activity***, (Actor:) CE4G ***source*** (Process: Material:) contracted (Goal:) consultants ***source*** with finance, energy and communications expertise ***semiotic*** (Cause:) to [[conduct more detailed investigations ***activity*** and provide expert advice ***semiotic***]]. (Sayer:) CE4G ***source*** (Process: Verbal:) consulted (Target:) the community ***source*** (Location: Temporal:) throughout the study ***activity*** (Cause:) to [[identify the level of community support ***semiotic*** for the project ***activity***]]. (Manner:)Through a dedicated community energy website ***thing*** (Actor:) CE4G ***source*** (Process: Material:) provided (Range:) regular information updates ***semiotic*** (Beneficiary:) to [[approximately 600 stakeholders ***source*** including individual residents ***source***, business groups ***source*** and decision makers ***source*** across the Southern Region ***place***]].	SG↓

Investigation /Results	(Location:Temporal:)During the twelve month study ***activity***, (Actor:) advances in PV technology ***thing*** and adjustments to the proposed site ***place*** (Process: Material:) increased (Goal:) the capacity of the solar farm ***thing*** (Manner: Degree:) to 1.2 MWp. ***thing*** (Actor:) CE4G ***source*** (Accompaniment: Additive:) also (Process: Material:) identified (Range:) a possible future expansion of the project ***activity*** (Cause:) to [[take advantage of Crown Land ***place*** adjacent to the Goulburn Correctional Centre ***place***]]. (Actor:) A potential Stage Two project ***activity*** (Process: Material:) will deliver (Goal:) [[0.5MWp additional electricity capacity ***activity*** sold behind the meter ***thing*** to the Correctional Centre ***place***]]. (Carrier:)Preliminary discussions ***activity*** with Corrective Services ***source*** (Process: Relational: Attributive:) look (Attribute:) promising (Cause:) for this future solar farm ***thing*** expansion. (Carrier:) Stage One ***activity*** of the project ***activity*** (Process: Attributive:) will cost (Attribute:) approximately $2.7 million ***thing***. (Carrier:)The solar farm ***thing*** (Process: Relational: Attributive:) will host (Attribute:) 4000 PV panels ***thing*** (Location: Spatial:) on a site ***place***, with suitable zoning ***activity*** and grid connection ***activity***. (Existent:) A Power Purchase Agreement ***semiotic*** (Process: Existential) will be negotiated (Accompaniment:) with a clean energy retailer ***source*** (Location: Temporal:) in the development phase ***activity***. (Range:) Preliminary discussions (Process: Material:) have commenced (Accompaniment:) with [[two potential clean energy retail partners ***source*** able to purchase the electricity ***thing*** from the solar farm ***thing*** as part of their renewable energy portfolio ***activity***]]. (Actor:) Goulburn residents ***source*** (Process: Material:) will be able to support (Goal:) the solar farm ***thing*** (Manner:) by [[becoming a customer ***source*** of the selected clean energy retail partner ***source*** through a white label agreement ***semiotic***]].	SG+ SG↓
Conclusion +Recommendations	(Sayer:) This feasibility study ***semiotic*** (Process: Verbal:) confirms (Verbiage:) that [[the Goulburn Community Solar Farm ***thing*** is feasible based on the information ***semiotic*** available at the time ***time*** of the study ***activity***]]. (Sayer:) CE4G ***source*** (Process: Verbal:) recommends (Verbiage:) that [[the project ***activity*** progress to the development phase ***activity*** facilitated by the establishment of CE4G Inc ***source***]]. (Token:) A major task ***activity*** of CE4G Inc ***source***. (Process: Relational: Identifying:) will be (Value:) to [[raise funds ***thing*** to establish the legal entity ***source*** and investment vehicle ***semiotic*** for the solar farm ***thing***, and undertake development work ***activity*** required prior to construction]].	SG↓

	(Carrier:) The proposed community solar farm ***thing*** (Process: Relational: Attributive:) will have (Attribute:) a minimum community ownership ***activity*** of 51% and (Process: Relational: Attributive:)be constituted (Attribute:) as a public company (unlisted) ***source***. (Goal:)The solar farm ***thing*** (Process: Material:) will be governed (Manner:) by a Board of Directors ***source*** (Cause:) to [[represent community shareholders ***source*** and ensure that community ***source*** remains the primary driver ***activity*** of the business model ***semiotic***]]. (Range:) This Report ***semiotic*** (Process: Behavioural:) must be read (Accompaniment:) in conjunction with the attached Reports ***semiotic*** that [[provide details of the finance modelling ***activity***, technical investigations ***activity***, legal and governance recommendations ***semiotic***]].	SG-
	(Token:) Community Energy for Goulburn ***source*** (Process: Relational: Identifying:) will transition (Value:) to a community energy association (CE4G Inc.) ***source***, independent of TGG ***source***, (Cause: to [[drive the next phase ***activity*** of the community solar farm project ***activity*** and kick start future community energy projects ***activity*** in the Goulburn Region ***place***]]. (Phenomenon:) It (Process: Mental:) is pleasing to see (Phenomenon:) that [[the project ***activity*** has the potential to expand to a Stage Two ***activity***, adding a further 0.5MW capacity ***activity***]]. (Range:) This (Process: Material:) can only further benefit (Beneficiary:) investors ***source*** and the wider Goulburn community ***source***.	SG+
	NB: (Range:) This study ***semiotic*** (Process: Behavioural:) must be read (Accompaniment:) in conjunction with[[the Reports ***semiotic*** in Attachments 4 and 5 ***semiotic*** that provide details ***semiotic*** and underpinning assumptions ***semiotic*** for the finance modelling ***activity*** as well as advice ***semiotic*** on legal and governance issues ***semiotic***]].	SG-
	Summary of Recommendations: 1. (Actor:) The Goulburn Community Solar Farm ***activity*** (GCSF) (Process: Material:) progress (Location: Temporal:)to the next stage ***activity***. 2. (Token:) CE4G ***source*** (Process: Relational: Identifying:) transition (Value:) to an incorporated community energy association (CE4G Inc.) ***source*** (Cause:) to [[facilitate the next phase ***activity*** of the GCSF ***activity*** and explore additional community energy projects ***activity*** for the Goulburn Region ***place***]].	SG+

	3. (Goal:) A minimum 51% of project equity ***semiotic*** (Process: Material:) be sourced (Manner:) from the community ***source***. 4. (Carrier:) Commercial developer investment ***activity*** (Process: Relational: Attributive:) is limited (Attribute:) to 49% of the equity ***semiotic*** in the project ***activity***. 5. That (Actor:) CE4G ***source*** (Process: Material:) pursue (Goal:) funding ***thing*** and/or finance ***thing*** (Cause:) to [[progress the development phase ***activity***]]. 6. That (Carrier:) [[any community investment ***activity*** raised prior to signing the EPC (Engineering Procurement Construction) contract ***semiotic***]] (Process: Relational: Attributive:) be held (Attribute:) in trust ***semiotic*** (Location: Temporal:) until [[development milestones ***activity*** are complete]]. 7. (Token:) The preferred customer ***source*** for the GCSF ***thing*** (Process: Relational: Identifying:) is (Value:) a 'white label' arrangement ***semiotic*** with a progressive clean energy retailer ***source***. 8. (Existent:) A public unlisted company ***source*** (Process: Existential:) be established (Role:) as [[the legal entity ***source*** to progress the GCSF ***activity***]]. 9. (Carrier:) The GCSF ***thing*** (Process: Relational: Attributive;) will have (Attribute:) a minimum 51% community ownership ***activity*** and (Process: Material:) be managed (Manner:) by [[a Board of Directors ***source*** drawn from the regional community ***source***]]. 10. (Actor:) CE4G ***source*** (Process: Material:) facilitate (Goal:) the formation of a suitable board ***source*** (Manner:) by [[approaching possible candidates ***source*** through personal and professional networks ***source***]]. 11. (Actor:) CE4G ***source*** (Process: Material:) facilitate (Goal:) the establishment of a legal entity ***source*** for the GCSF ***thing*** [[including the organisational structure ***semiotic***, rules ***semiotic***, decision-making parameters ***semiotic*** and business model ***semiotic***]]. 12. (Range:) Community investment ***activity*** (Process: Material:) will be sourced (Location: Spatial:) from specified areas ***place*** (Manner:) in a hierarchy ***semiotic*** of preference ***semiotic***. 13. (Range:) A sufficient pool of investors ***source*** (Process: Material:) will be drawn (Location: Spatial:) from the specified area(s) ***place*** (Cause:) in order to [[satisfy the requirement ***semiotic*** of a minimum 51% community ownership ***activity*** of the GCSF ***thing***]]. 14. (Actor:) The newly constituted CE4G Inc. ***source*** (Process: Material:) investigate (Range:) opportunities ***semiotic*** for community projects ***activity*** that [[can directly benefit low	SG- SG↓

	income households ***source*** experiencing energy poverty **semiotic**]]. 15. (Token:) The CE4G website ***thing*** (Process: Relational: Identifying:) continue (Value:) as an information hub ***thing*** for updates ***semiotic*** on GCSF ***thing*** and other community energy initiatives ***activity*** that [[will benefit a wide range of groups ***source*** in Goulburn ***place*** including low income households ***source***]]. 16. (Condition:)[[Should the GCSF ***activity*** expand the operation ***activity*** to the land ***place*** adjacent to the Goulburn Correctional Centre ***place***]] that (Senser:) CE4G Inc. ***source*** and the Goulburn Solar Farm Ltd ***source*** (Process:Mental:) revisit (Phenomenon:) the feasibility (Cause:) to [[establish a community fund ***thing***]].	SG+

Appendix B: Kellogg

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or Projected clauses]]	Semantic Gravity
Introduction	**Background and project objectives** (Actor:) CSIRO ***source*** (Process: Material:) is undertaking (Range:) a project ***activity*** (Cause:) for the Australian Water Recycling Centre of Excellence (AWRCoE) ***source*** (Cause:) to [[support the reduction ***activity*** of fresh water use in the Agri-food sector ***activity*** by increasing the amount of water ***thing*** that is being recycled]]. (Carrier:) Kellogg ***source*** (Process: Relational: Attributive:) has (Attribute:) a water treatment plant ***thing*** (Location: Spatial:) at its ***source*** manufacturing facility ***thing*** in Botany, NSW ***place***. (Actor:) Kellogg ***source*** (Process: Material:) has identified (Range:) [[an opportunity ***semiotic*** to further treat its ***source*** waste water ***thing*** in Botany ***place*** to the required quality standards ***semiotic*** so that [[this water ***thing*** could be used in their wet scrubbers ***thing*** and potentially in other applications ***activity*** in non-food manufacturing areas ***place***]]. (Goal:) Kellogg ***source*** (Process: Material:) has been approached (Actor:) by local Council ***source*** (Matter:) about [[the possibility ***semiotic*** of providing **water *thing*** for irrigation ***activity*** of local parks ***place***]]. There (Process: Existential:) is (Existent:) interest ***semiotic*** in assessing [[what treatment ***activity*** would be required to do this]]. It (Process: Relational: Attributive:)is (Attribute:) not certain (Carrier:) [[what volume of water ***thing*** the Council ***source*** may be interested in]], and whether (Carrier:) demands ***semiotic*** (Process: Relational: Attributive:) would be (Attribute:) seasonal. (Actor:) This project ***activity*** aimed to: • (Process: Material:) Explore (Range:) different water recycling options ***semiotic*** and to (Process: Material:) identify (Range:) appropriate technologies ***activity*** to [[achieve target standards ***semiotic*** of water quality for non-food areas ***place*** of the plant ***place*** as well as for irrigation ***activity*** of local parklands]] • (Process: Material:) Review (Range:) existing regulations ***semiotic*** and compliance requirements ***semiotic*** (Matter:) for in-plant recycling ***activity*** of water and irrigation ***activity*** of local parklands • (Process: Material:) Evaluate (Range:) the commercial viability ***semiotic*** and value ***semiotic*** to Kellogg ***source*** (Manner:) by [[implementing the selected technology options ***semiotic***]].	SG+ SG↓ SG↑ SG↓ SG-

Methods	**Methodology** (Goal:) A team ***source*** from CSIRO ***source*** and Kellogg ***source*** (Process: Material:) was formed (Cause:) to [[undertake the project activities ***activity***]]. (Token:) The CSIRO team ***source*** (Process: Relational: Identifying:) consisted of (Value:) personnel ***source*** with expertise ***semiotic*** in selecting ***activity*** technologies ***activity*** for waste water treatment ***activity***, knowledge ***semiotic*** of regulatory requirements ***semiotic*** for water recycling ***activity*** and expertise ***semiotic*** in evaluating ***activity*** the value proposition ***semiotic*** for recycling options ***semiotic***. (Actor:) Kellogg ***source*** (Process: Material:) was responsible for providing (Range:) key information ***semiotic*** on current water treatment processes ***activity***, raw and treated waste water quality at various points ***place*** in the plant ***place***, an understanding ***semiotic*** of water quality variability ***activity***, proposed use ***activity*** of recycled water ***thing***, history ***semiotic*** of water treatment system development ***activity*** and site constraints ***semiotic***. (Range:) This information ***semiotic*** (Process: Material:) was (Location: Temporal:) then used (Actor:) by the CSIRO team ***source*** (Cause:) to [[provide guidance ***semiotic*** on 'fit for purpose' water quality requirements ***semiotic*** to conform to relevant regulatory requirements ***semiotic***]]. (Range:) Water treatment technology options ***semiotic*** to [[produce the required quality of water ***thing***]] (Process: Material:) were also identified and (Range:) a value proposition analysis ***activity*** (Process: Material:) was carried out (Cause:) for the selected technologies ***thing*** (Manner:) [[using a tool ***thing*** that the team ***source*** has developed in its current project ***activity*** for AWRCoE ***source***]].	SG+ SG- SG- SG+
Investigation /Results	**Main results** (Range:) Five technology options ***semiotic*** (Process: Material:) were identified (Cause:) to treat the waste water ***thing*** at the Botany plant ***place*** (Cause:) in order to [[achieve the required quality of water ***thing*** for recycling in non-food manufacturing areas ***place*** and for irrigating local parklands ***place***]]. (Token:) These (Process: Relational: Identifying:) are: (Range:) • Microfiltration ***activity*** using a 0.2 micron filter ***thing*** • Microfiltration ***activity*** and anaerobic digestion ***activity*** of sludge ***thing*** • Aerobic membrane bioreactor ***thing*** • Conversion ***activity*** of existing equalisation tank 1 ***thing*** into an aeration tank ***thing*** • Anaerobic membrane bioreactor ***thing***	SG+

	(Token:) All these options ***semiotic*** (Process: Relational: Identifying:) will require (Value:) an in-line disinfection system ***thing*** (e.g. using ultraviolet light ***thing***) (Location: Temporal:) prior to the final use ***activity***. (Range:) These options ***semiotic*** (Process: Material:) were presented to (Beneficiary:) Kellogg ***source*** and (Location: Temporal:) after [[considering the advantages ***semiotic*** and disadvantages ***semiotic*** of all these options]], (Actor:) Kellogg ***source*** (Process: Material:) identified (Range:) microfiltration ***activity*** as the most viable option ***semiotic***. (Range:) This selection (Process: Material:) was made (Location: Temporal:) after [[considering factors ***semiotic*** such as capital and operating costs ***semiotic***, space requirements ***semiotic***, energy recovery ***activity***, odour issues ***semiotic*** and installation constraints ***semiotic***]]. (Contingency:) Based on a budgetary quote ***semiotic*** for capital ***thing*** (including all associated equipment ***thing***) and estimated installation and operating costs ***semiotic*** for a microfiltration system ***thing***, (Range:) a value proposition analysis ***activity*** (Process: Material:) was carried out (Cause:) for two scenarios ***semiotic*** when [[microfiltration ***activity*** is used to treat waste water ***thing***]]. (Matter:) In the first scenario ***semiotic***, it (Process: Mental:) is assumed that (Phenomenon:) [[200 kL / day of treated waste water ***thing*** is made available to the local council ***source*** for irrigation ***activity***]]. (Matter:) In the second option ***semiotic*** it (Process: Mental:) is assumed that (Phenomenon:) [[the water ***thing*** available for irrigation ***activity*** is discharged as trade waste ***thing***]], although it (Process: Relational: Attributive:) is (Attribute:) unlikely that (Carrier:) [[Kellogg ***source*** would build capacity ***activity*** to treat waste water ***thing*** and then discharge to sewer ***thing*** unless this could be justified on the basis of reduced BOD ***semiotic*** and volumetric charges ***semiotic***]]. (Token:) The value proposition analysis ***activity*** (Process: Relational: Identifying:) showed that [[based on a 20-year period ***time***, the microfiltration option ***semiotic*** will yield a present value ***semiotic*** of around $5M with the irrigation option ***semiotic*** and $4M ***thing*** with no irrigation ***activity*** for a cost ***semiotic*** (capital and operating) of around $2M]]. (Token:) The main components of value ***semiotic*** (Process: Relational: Identifying:) were (Value:) the savings ***activity*** of water ***thing*** for scrubbers ***thing*** (73,000 kilolitres ***thing***/year ***time*** [kL/yr]) as well as the reduced charges ***semiotic*** for trade waste volume ***thing*** (146,000 kL ***thing***/yr ***time***) and BOD charges ***semiotic***.	SG- SG↓ SG↑ (waves)

	(Token:) An analysis ***activity*** of the microbiological quality of the effluent (Process: Relational: Identifying:) showed (Value:) acceptable levels of sodium ***thing***, specific chemicals ***thing*** and microorganisms ***thing*** (including pathogens). However, (Cause:) due to the high sugar content ***semiotic*** and elevated temperature ***semiotic*** in the effluent ***thing*** (Location: Temporal:) sometimes, (Goal:) the regrowth ***activity*** of common organisms (Process: Material:) may occur (Location: Temporal:) from time to time. (Actor:) The microfiltration / UV sterilisation option ***semiotic*** (Process: Material:) will reduce (Goal:) the health and environmental risks ***semiotic*** for internal and external use ***activity*** of treated waste water. (Token:) An assessment ***activity*** of the regulatory framework (Process: Relational: Identifying:) showed (Value:) no major concerns ***semiotic*** (Condition:) when [[treated waste water ***thing*** is used for internal use ***activity*** (in non-food manufacturing areas ***place***) and in irrigation ***activity*** of surrounding parklands]] and it (Process: Mental:) is believed that (Phenomenon:) [[the health and environmental regulations ***semiotic*** will be met]].	
Conclusion +Recommendations	**Conclusions** (Token:) Further treating ***activity*** of the waste water at the Botany plant ***place*** with microfiltration ***activity*** followed by UV / chlorination disinfection system ***thing*** (Process: Relational: Identifying:) could be considered (Value:) as an option ***semiotic***, but (Carrier:) the return ***semiotic*** on investment ***activity*** (Process: Relational: Attributive:) is (Attribute:) very low. (Actor:) The reuse ***activity*** of this water in non-food manufacturing areas ***place*** (e.g. scrubbers) and in irrigating surrounding parklands ***place*** by the local Council ***source*** (Process: Material:) would enable (Goal/Actor:) Kellogg ***source*** to: • (Process: Material:) Reduce (Goal:) the use ***activity*** of fresh water from the mains water supply ***thing*** in the use ***activity*** of scrubbers (Manner:) by around 73,000 kL ***thing*** /yr ***time*** • (Process: Material:) Reduce (Goal:) trade waste ***thing*** (Manner:) by **around** 146,000 kL ***thing*** /yr ***time***. (Carrier:) These Figures ***semiotic*** (Process: Relational: Attributive:) are calculated on (Attribute:) the basis ***semiotic*** that [[200 kilolitres ***thing*** per day ***time*** (kL/day) of fresh water ***thing*** is currently used in the scrubbers ***thing*** and 200 kL/day of treated water ***thing*** could be used in parkland irrigation ***activity***]]. (Carrier:) This Figure ***semiotic*** (Process: Relational: Attributive:) is based on (Attribute:) the assumption ***semiotic*** that [[the waste water ***thing*** is pumped through a piping	SG↑ SG+ SG↓ SG↑ (waves)

	system ***thing*** from the Kellogg site ***place***]]. (Condition:) [[If however, a tanking system ***thing*** is used]], (Carrier:) the volume of water ***thing*** that [[could be used in irrigation ***activity***]] would be (Attribute:) much smaller. (Token:) The demonstration ***activity*** of the value proposition tool (Process: Relational: Identifying:) shows (Value:) [[the sensitivity of the results ***semiotic*** can be explored for data ***semiotic*** and assumptions ***semiotic***]]. For example, (Condition:) given data ***semiotic*** and other assumptions ***semiotic***, (Token:) the initial results ***semiotic*** (Process: Relational: Identifying:) suggest (Value:) a benefit ***semiotic*** of $5million for a cost ***semiotic*** of $2million over a 20-year period ***time***. (Carrier:) These results ***semiotic*** (Process: Relational: Attributive:) appear to be (Value:) sensitive to future water prices ***semiotic*** and (Manner:) to a lesser degree ***semiotic*** (Value:) the use ***activity*** of water ***thing*** by council ***source*** for irrigation ***activity***. However, (Condition:) [[if it is assumed that there is no real change ***activity*** in water prices ***semiotic*** and no use ***activity*** of waste water for irrigation ***activity*** by council ***source*** over the next 20 years ***time***]] then there (Process: Existential:) appears to be (Existent:) no significant difference ***semiotic*** between costs ***semiotic*** and benefits ***semiotic***. (Actor:) Further testing ***activity*** of the results ***semiotic*** by Kellogg ***source*** (Process: Material:) could: • Refine (Goal:) the data ***semiotic*** and other assumptions ***semiotic*** • Define (Goal:) cost/benefit ratios ***semiotic*** for project viability ***semiotic***. It (Process: Mental:) should also be noted that [[a number of benefits ***semiotic*** were not included in the analysis ***activity***]]. (Carrier:) The actual value of the irrigation option ***semiotic*** (Process: Relational: Attributive:) is likely to be (Attribute:) higher than [[considered in the analysis ***activity*** because of the social value ***semiotic*** associated with Kellogg contribution ***activity*** to the local community ***source***]]. However, (Carrier:) this social value ***semiotic*** (Process: Relational: Attributive:) is (Attribute:) difficult [[to quantify]]. (Value:) The cost ***semiotic*** for pumping ***activity*** and storage ***activity*** of treated waste water to local parklands ***place*** (Process: Relational: Identifying:) is not included in (Token:) the estimated cost ***semiotic***. (Accompaniment:) With this option ***semiotic*** [[(microfiltration ***activity*** followed by UV/Chlorination disinfection ***activity***)]], it (Process: Mental:) is expected that (Phenomenon:) [[the health and environmental regulatory requirements ***semiotic***	SG- SG-

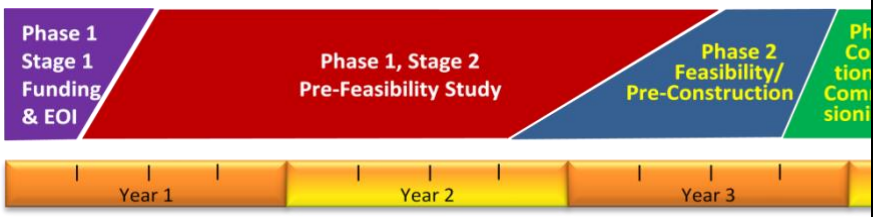
	will be met and the risk ***semiotic*** of non-compliance of water quality after treatment ***activity*** to the required standards ***semiotic*** will be very small]]. **Recommendations** • (Process: Mental:) Consider (Phenomenon:) [[microfiltration ***activity*** followed by an inline UV / chlorination disinfection system ***thing*** as a viable option ***semiotic*** to enable the recycling ***activity*** of treated wastewater to the scrubbers ***thing*** and parkland irrigation ***activity*** at Botany ***place***]]. (Phenomenon:) This option ***semiotic*** (Process: Mental:) should be further evaluated. • (Process: Mental:) Review and (Process: Material:) refine (Phenomenon/Goal:) the data ***semiotic*** and assumptions ***semiotic*** (Condition:)as appropriate and (Process: Material:) revise (Goal:) the value proposition ***semiotic***. • (Location: Temporal:) Before [[investment decisions ***activity*** are made]], (Process: Material:) work (Manner:) closely (Accompaniment:) with equipment suppliers ***source*** and (Process: Material:) carry out (Range:) plant trials ***activity*** (Cause:) to ensure that [[the required quality of water ***thing*** could be obtained from the chosen technology option ***semiotic***]]. (Actor:) Such work ***activity*** (Process: Material:) will also enable (Goal/Actor:) suppliers ***source*** (Process: Material:) to provide (Beneficiary:) Kellogg ***source*** with (Range:) accurate quotations ***semiotic*** for capital equipment ***thing*** and (Process: Material:) will enable (Goal/Actor:) Kellogg ***source*** (Process: Material:) to refine (Goal:) the cost/ benefit analysis ***activity***. It (Process: Mental:) is recognized that (Phenomonon:) [[the physical constraints ***semiotic*** at the Botany site ***place*** will be an important factor ***semiotic*** in making investment decisions ***activity***]]. • (Process: Material:) Engage with (Goal:) the relevant state health and environmental regulators ***source*** (Location: Temporal:) at the earliest stage possible ***time*** (Cause:) for any planned external uses ***activity*** of the recycled water. • (Process: Material:) Determine (Range:) sodium concentrations ***activity*** in the final wastewater ***thing***. (Carrier:) This (Process: Relational: Attributive:) will be (Attribute:) important (Cause:) for [[third party users ***source*** to determine if there are any Sodium Absorption Ratio issues ***semiotic*** at planned external irrigation sites ***place***]]. • (Process: Verbal:) Validate that [[the additional treatment ***activity*** does remove or reduce microorganisms ***thing***]].	SG↑ SG↓ SG↑ (waves)

	• (Process: Material:) Undertake (Range:) further microbiological testing ***activity*** of the wastewater (Cause:) to [[confirm the absence of specific pathogens ***thing***]]. • (Process: Material:) Develop (Goal:) a water recycling risk management plan ***semiotic*** that [[meets regulatory requirements ***semiotic*** for any planned external uses ***activity***]]. (Token:)The project scope ***semiotic*** (Manner:) explicitly (Process: Relational: Identifying:) excluded (Value:) [[using treated wastewater ***thing*** in food manufacturing and packing areas ***place***]].	SG-

Appendix C: SCG

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded and projected clauses]]	Semantic Gravity
Introduction	**Aim** 1. (Token:) The objective ***semiotic*** of the South Coast Community-Based Wind Power Concept Study ***activity*** (Process: Relational: Identifying:) was (Value:) [[to conduct a high-level preliminary investigation ***activity*** of a community–based wind-power generation ***activity*** on the South Coast ***place***]].	SG↑
Methods	**Approach** 2. (Token:) The approach ***semiotic*** to gathering the necessary input ***semiotic*** for the Concept Study ***activity*** (Process: Relational: Identifying:) was (Value:) [[to contact a range of government, scientific, industry and community interests ***semiotic*** in the area of community based and, to a lesser extent, commercial wind power ***thing*** and arrange interviews ***activity***]]. (Range:) A list ***semiotic*** of agencies ***source*** consulted and the nature of their input ***semiotic*** (Process: Material:) is provided (Location: Spatial:) at Annex A ***semiotic***.	SG-
Investigation /Results	**Analysis** ***Technical Feasibility*** 3. (Range:) Sufficient information ***semiotic*** (Process: Material:) has been acquired (Role:) as part of this Concept Study ***activity*** (Cause:) [[to establish a reasonable degree of confidence ***semiotic*** that there are sufficient high potential sites ***place*** in the Shellharbour ***place***, Kiama ***place***, Wingecarribee ***place*** and Shoalhaven ***place*** LGAs ***place***]]. (Carrier:) Grid capacity ***semiotic*** and location ***activity*** also (Process: Relational: Attributive:) seem to favour (Attribute:) small scale wind power developments ***activity*** of between 6-10 turbines ***thing*** (Cause:) to deliver 20Megawatts of power ***thing***. ***Environmental Issues*** 4. (Carrier:) The principal environmental considerations ***semiotic*** associated with wind power development ***activity*** (Process: Relational: Attributive:) are associated with (Attribute:) construction ***activity*** and operations ***activity***. (Goal:) Both (Process: Material:) are controlled by (Actor:) well established guidelines ***semiotic*** which [[will soon be developed into a set of national guidelines ***semiotic***]]. 5. (Carrier:) Much of the environmental argument ***semiotic*** against wind turbine operation ***activity*** (Process: Relational:	SG↓ SG-

	Attributive:) is founded on (Attribute:) misinformation ***semiotic***. (Carrier:) A concerted education effort ***activity*** and the local control ***activity*** implicit in community-based wind power ***thing*** (Process: Relational: Attributive:) have (Attribute:) proven potential ***semiotic*** [[to overcome much of the resistance ***activity*** to the concept ***semiotic*** of wind turbines ***thing***]].	SG↓
	The Cooperative Model 6. (Carrier:) The essential argument ***semiotic*** that favours the corporate management/ownership model ***semiotic*** over the cooperative model ***semiotic*** (Process: Relational: Attributive:) is based on (Attribute:) the alleged greater attractiveness ***semiotic*** of the corporate model to large investors ***source***. However, (Token:) the advantages ***semiotic*** of cooperative ownership (Process: Relational: Identifying:) are (Value:) many and (Process: Relational: Identifying) considered (Value:) vital [[to achieve community acceptance ***semiotic*** of a wind power project on the South Coast ***place*** or Wingecarribee ***place***]]. (Token:) It (Process: Relational: Identifying:) is therefore (Value:) the preferred option ***semiotic*** (Cause:) as [[it best achieves the aims ***semiotic*** of the project ***activity***]].	SG-
	The Business Case 7. (Token:) An outline business case ***semiotic*** (Process: Relational: Identifying:) suggests (Value:) [[there are many non-financial benefits ***semiotic*** from the proposed project ***activity***]]. (Carrier:) This assessment (Process: Relational: Attributive:) is based on (Value:) empirical evidence semiotic from overseas ***place*** and Australia ***place***. (Carrier:) The financial case ***semiotic*** for this project ***activity*** (Process: Relational: Attributive:) has (Attribute:) clear potential ***semiotic*** and (Token:) this (Process: Relational: Identifying:) is supported by (Value:) opinions ***semiotic*** from financial institutions ***source*** and experienced wind power developers ***source***. However, (Phenomenon:) the key factors ***semiotic*** that [[will determine the financial case ***semiotic***]] (Process: Mental:) need to be determined (Manner:) through evidence ***semiotic*** that [[can only be made available through the Pre-Feasibility Study ***activity***]]. 8. (Carrier:) Total project Costs ***semiotic*** (Process: Relational: Attributive:) are estimated to be (Attribute:) in the vicinity of $25M ***thing***. 9. (Token:) The preliminary risk assessment ***activity*** (Process: Relational: Identifying:) indicates (Value:) no major risks ***semiotic*** that [[are show stoppers ***semiotic***]], (Location: Temporal:) at this stage ***time***.	SG↓ SG↑ (waves)

	Project Progression 10. (Carrier:) Wind power project development ***activity*** (Process: Relational: Attributive:) is (Location: Temporal:) now (Attribute:) a well established and proven process ***activity***. (Process: Mental:) Discounting (Phenomenon:) the Concept Study ***activity***, (Token:) the three phases of actual development ***activity*** (Process: Relational: Identifying:) are commonly regarded to be, (Value:) Pre-Feasibility ***activity***, Feasibility/Pre-Construction ***activity*** and Construction ***activity***. (Carrier:) Figure 1 ***thing*** (Process: Relational: Attributive:) provides (Attribute:) an indicative development timeline ***semiotic***  **Figure 1 - Indicative Development Timeline** 11. (Carrier:) Phase 1 costs ***semiotic*** (Process: Relational: Attributive:) are estimated to be (Attribute:) between $0.75M ***thing***- $1M ***thing***. ***Management Arrangements*** 12. (Goal:) The management ***activity*** of the project (Process: Material:) needs to be undertaken by (Actor:) an incorporated business entity ***source***, (Location: Temporal:) by no later than the commencement ***activity*** of Phase 2 ***activity***. Preferably (Actor:) this entity ***source*** (Process: Material:) would also manage (Goal:) Stage 2 of Phase 1 ***activity***, but (Goal: this Stage ***activity*** (Process: Material:) could also be managed by (Actor:) a formally constituted Project Board ***source***. (Goal:) Such a board ***source*** (Process: Material:) should be formulated (Manner:) [[using best-practice project management principles ***semiotic***]] (Cause:) [[to ensure best management risk reduction ***activity***]]. There (Process: Existential:) are (Existent:) a number of options ***semiotic*** for [[managing Stage 1 ***activity*** of Phase 1]].	SG+ SG+ SG↓
Conclusion +Recommendations	**Conclusions** 13. (Senser:) The Working Group ***source*** (Process: Mental:) has concluded that (Phenomenon:) [[there are not only good prospects ***semiotic*** for the development ***activity*** of a community-based wind project by the Southern Councils Group ***source***, but that there is strong public support ***semiotic*** for such an initiative ***semiotic***]].	SG↓ SG↑ (waves)

	Recommendations 14. (Contingency:) [[Based on the preceding conclusions ***semiotic***]], (Sayer:) the Concept Study Working Group ***source*** (Process: Verbal:) recommends that (Verbiage:) [[the Southern Councils Group ***source***: a. proceeds with the development ***activity*** of a community based wind project; b. that funding ***thing*** up to $1M be sought from the NSW Government ***source*** to undertake the Pre-Feasibility Study ***activity***; c. develops and issues an expression of interest ***semiotic*** to undertake the Pre-Feasibility Study ***activity***; d. form a Project Board ***source*** and assign tasking ***activity*** for the development ***activity*** of Phase 1 Stage 1 work; e. note the benefits ***semiotic*** of cooperative ownership for the project ***activity*** and agree this model ***semiotic*** be examined further in the context ***semiotic*** of the Pre-Feasibility Study for its ***activity*** financial viability ***semiotic***; f. agree that the Bendigo Bank 10 step model ***semiotic*** be used to investigate the cooperative model ***semiotic*** and that the assistance ***activity*** of the Bank be sought in this regard ***semiotic***; and g. establish an incorporated body ***source*** to take ownership ***activity*** of and manage the project ***activity*** from Stage 2 Phase 1 ***activity*** onwards, or formally appoint a Project Board ***source*** to manage this Stage ***activity***.]]	SG+

Appendix D: Moonambel

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded and projected clauses]]	Semantic Gravity
Introduction	Executive Summary (Carrier:) Moonambel ***place*** (Process: Relational: Attributive:) is situated within (Attribute:) the Pyrenees region of Victoria ***place***, approximately 200 km north-west of Melbourne ***place*** and 90 km north-west of Ballarat ***place***. (Carrier:) The region ***place*** (Process: Relational: Attributive:) is home to (Attribute:) a number of successful vineyards ***thing*** that [[attracts tourists ***source*** for day visits ***activity*** or overnight stays ***activity***]]. (Carrier:) The township ***place*** (Process: Relational:) Attributive:) is not connected to (Attribute:) a reticulated water supply ***thing***, nor (Process: Relational: Attributive:) is (Carrier:) it (Attribute:) within a water district ***place***. (Actor:) The Moonambel Water Supply Feasibility Study ***activity*** (Process: Material:) seeks to complete (Goal:) a 'needs, options, risk and comparative' analysis ***activity*** of potential water supply enhancements that [[will enable economic development ***activity*** for the Moonambel area ***place*** and increased social amenity ***activity***]]. (Phenomenon:) The Moonambel Water Supply Feasibility Study ***activity*** (Process: Verbal:) was (Manner:) formally announced (Location: Temporal:) on the 14th November 2014 ***time*** (Sayer:) by the Victorian State Government ***source***. (Goal:) The study ***activity*** (Process: Material:) is (Manner:) jointly funded (Actor:) by Regional Development Victoria (RDV) ***source***, Pyrenees Shire Council (PSC) ***source*** and Central Highlands Water (CHW) ***source***. (Token:) CHW ***source***, [[combined with RDV ***source*** and PSC ***source***,]] (Process: Relational: Identifying:) forms (Value:) the Project Control Group (PCG) ***source*** (Cause:) [[to oversee the development ***activity*** of this study ***activity***]].	SG+
Methods	Study Area & Growth (Goal:) A 'potential supply zone' ***activity*** for the township ***place*** (Process: Material:) was established (Actor:)by the PCG ***source***, [[comprising 38 residential dwellings ***thing*** and non-residential properties ***thing*** (including wineries ***thing***, accommodation/cafés/restaurants ***thing***, general store/cafe ***thing***, hotel ***thing***, school ***thing***, recreation reserve ***thing***, churches ***thing***, hall ***thing*** and the CFA ***thing***)]]. (Carrier:) The zone ***place*** (Process: Relational: Attributive:) is based on (Attribute:) the low density residential zone ***place***, and a number of nearby customers ***source*** (Location: Spatial:) in the rural living area ***place***.	SG+

(Range:) Three growth scenarios ***semiotic*** and a 25 year projection ***semiotic*** (Process: Material:) were adopted (Cause:) for the study ***activity***. (Phenomenon:) The estimated water demand ***semiotic*** (Process: Verbal:) is summarized (Location: Spatial:) in the following table ***thing***. SG↓

Scenario No.	Scenario	Description	Total Estimated Annual Demand (ML)
1	Zero Growth ***activity***		17.2
2	Low Growth ***activity***	0.65% per annum growth ***activity*** (residential and commercial population)	20.0
3	High Growth ***activity***	1.25% per annum growth ***activity*** (residential and commercial population)	23.4

Community Engagement

(Range:) Extensive engagement ***activity*** with the community ***source*** (Process: Material:) was undertaken (Location: Temporal:) during the development ***activity*** of this feasibility study, (Matter:) including but not limited to: SG+

- A landowner survey ***activity*** on current water supply arrangements ***activity*** and a potential water supply network ***activity***,

[[which was sent to the Moonambel business and residential community ***source*** on 16th February 2015 ***time***]],

- A public information session ***activity*** on 19th March 2015 ***time***, and additional face to face or telephone discussions ***activity*** that occurred afterwards with those that could not attend, or where the PCG ***source*** required additional information ***semiotic*** and/or clarification ***activity*** on a number of issues ***semiotic***, and SG↓
- Local business interviews ***activity*** (inside and some outside of the study area ***place***) [[to determine the extent of current water issues ***semiotic*** and economic development opportunities ***semiotic***]]. SG-

(Carrier:) The Community's input ***semiotic*** (Process: Relational: Attributive:) was (Attribute:) important for [[identifying a number of water supply options ***semiotic***, and the criteria ***semiotic*** for evaluation ***activity*** and assessment ***activity*** of the options]].

(Token:) The Community's feedback ***semiotic*** (Process: Relational:

	Identifying:) identifies (Value:) that [[water supply upgrade investigations ***activity*** for Moonambel **place** should focus on: • Supplying good tasting, low salinity, highly reliable and affordable drinking water ***thing***, • Delivering good pressure ***activity*** throughout the network ***thing***, and • Supporting jobs ***activity*** and food production ***activity***.]] (Range:) Some reservations ***semiotic*** (Process: Material:) were identified (Matter:) in regards to potential costs ***semiotic*** and ongoing tariffs ***semiotic***. (Sayer:) Many in the community ***source*** (Accompaniment:) also (Process: Verbal:) advised that [[their current supply ***thing*** was sufficient]]. (Sayer:) The 2011 Census data ***semiotic*** (Process: Verbal:) states that [[median weekly household income ***thing*** in Moonambel ***place*** is $675 ***thing***, compared to $1,216 ***thing*** for the state of Victoria ***place*** (www.censusdata.abs.gov.au)]].	SG↑ SG↓ SG+
Investigation /Results	Options (Actor:) The study ***activity*** (Process: Material:) has identified (Range:) a shortlist ***semiotic*** of four options ***semiotic***. (Range:) The options ***semiotic*** (Process: Material:) were assessed (Matter:) with respect to criteria ***semiotic*** that [[were identified as important based on community feedback ***semiotic*** and agreed to by the Project Control Group ***source***.]] (Token:) The four shortlisted options ***semiotic*** (Process: Relational: Identifying:) are: (Value:) 1. Local groundwater (potable) supply ***activity***, Option 1 ***semiotic*** 2. Onsite improvements ***activity*** (non-potable rainwater tanks ***thing***, collection ***activity*** and efficiency ***activity***), Option 2 ***semiotic*** 3. A pipeline ***thing*** from another system ***thing*** (potable), Option 3 ***semiotic*** 4. Maintaining current supply arrangements ***activity***, Option 4 ***semiotic*** Capital Works and Operational Costs (Veribiage:) Capital and operational cost estimates ***semiotic*** for each option ***semiotic*** (Process: Verbal:) are summarised (Location: Spatial:) below.	SG- SG↑

Option No.	Option	Capital Cost Estimate	Annual Operational Cost Estimate

1	Local groundwater (potable) supply ***activity***	$7,430,000 ***thing***	$91,640 ***thing***
2	Onsite improvements ***activity*** (non-potable rainwater tanks ***thing***, collection ***activity*** and efficiency ***activity***)	$60,000 ***thing*** (plus program administration costs ***semiotic***)	-
3	Pipeline ***thing*** from another potable supply system ***thing***	$8,100,000 ***thing***	$53,700 ***thing***
4	Maintain current arrangements ***activity***	-	

(Carrier:) The capital cost estimates ***semiotic***, whilst comparable for the potable groundwater supply ***activity*** (Option 1 ***semiotic***) and pipeline ***thing*** from another potable supply ***thing*** (Option 3), (Process: Relational: Attributive:) are (Attribute:) very high for a scheme ***activity*** that [[would service a small number of connections ***activity*** with low demand ***activity***]]. It (Process: Mental:) should be noted that (Phenomenon:) [[the annual operating costs ***semiotic*** for Option 1 ***semiotic*** are more expensive than Option 3 ***semiotic***]]. (Value:) Detailed site assessments ***activity*** (Process: Relational: Identifying:) would be required (Cause:) to confirm the extent of boring ***activity*** (to avoid vegetation ***thing***), potential vegetation removal ***activity***, environmental offset requirements ***semiotic*** and estimated construction costs ***semiotic*** for Options 1 ***semiotic*** and 3 ***semiotic***. SG↓

Assessment of Options

Whilst (Token:) Option 1 ***semiotic*** and 3 ***semiotic*** (Manner:) largely (Process: Relational: Identifying:) satisfy (Value:) the identified community criteria ***semiotic*** [[(refer to Section 5.3 ***semiotic***)]], (Carrier:) they ***semiotic*** (Process: Relational: Attributive:) would require (Attribute:) significant new infrastructure works ***activity*** that [[pose a large number of planning, technical and/or construction risks ***semiotic***.]] Furthermore, (Token:) Option 1 ***semiotic*** (Process: Relational: Identifying:) presents (Attribute:) an unacceptable level of risk ***semiotic*** (as agreed by the PCG ***source***) (Cause:) due to a poor level of confidence ***activity*** in the local groundwater ***thing*** quality and yield ***activity*** based on [[the available information ***semiotic*** SG-

	used in this study ***activity***]]. (Attribute:) Further investigations ***activity*** (Process: Relational: Attributive:) would be required (Cause:) to confirm supply ***activity*** availability and reliability, which [[is beyond the scope ***semiotic*** of this study ***activity***]]. (Token:) Onsite improvements ***activity*** (Option 2 ***semiotic***) (Process: Relational: Identifying:) fails to (Manner:) adequately satisfy (Value:) the community assessment criteria ***semiotic***. (Actor:) A water efficient products rebate scheme ***activity*** (Process: Material:) may reduce (Goal:) landowners' reliance ***activity*** on tankered water ***thing*** and poorer quality groundwater ***thing***. However, (Token:) the option ***semiotic*** (Process: Relational: Identifying:) does not meet (Value:) the key project driver ***activity*** that [[is to provide a safe and reliable supply ***activity*** to support economic development opportunities ***semiotic***]]. Whilst (Process: Mental:) recognising (Phenomenon:) its ***semiotic*** shortfall as [[it ***semiotic*** relates to the community criteria ***semiotic***]], (Range:) Option 2 ***semiotic*** (Process: Material:) could be (Manner:) further investigated (Condition:) [[if a centralised water supply option ***semiotic*** is discarded from further consideration ***activity***.]] (Carrier:) These investigations (Process: Relational: Attributive:) are (Attribute:) beyond the scope ***semiotic*** of this study ***activity***. (Token:) Option 4 ***semiotic*** [[(maintaining the current supply arrangements ***activity***)]] (Process: Relational: Identifying:) does not satisfy (Value:) the community assessment criteria ***semiotic*** for an enhanced water supply solution ***semiotic***. Benefits (Range:) Marsden Jacob Associates (MJA) ***source*** (Process: Material:) was engaged (Cause:) [[to complete the economic and financial assessment ***activity***]] (Cause:) [[to determine key inputs ***semiotic*** into the Moonambel Water Supply Feasibility Study ***activity***]]. (Range:) A high level summary ***semiotic*** of MJA's ***source*** assessment ***activity*** (Process: Material:) is provided (Location: Spatial:) in this report ***semiotic*** only (Cause:) as [[the detailed assessment ***activity*** contains commercial in confidence information ***semiotic***]]. (Carrier:) The assessment ***activity*** [[completed by MJA ***source***]] (Process: Relational: Attributive:)is based on (Attribute:) the assumption ***semiotic*** that [[reticulated water ***thing*** would be extended to Moonambel ***place*** from the Avoca system ***thing*** (as per Option 3 ***semiotic***)]]. (Token:) The assessment ***activity*** (Process: Relational: Identifying:) identifies (Value:) the high importance of viticulture ***activity*** and tourism ***activity*** in the region ***place***. (Token:) It ***activity*** (Manner:) also (Process: Relational: Identifying:) identifies (Value:) the absence of a	SG↓ SG↑ (waves)

	reliable and high quality water supply ***activity*** (Role:) as a significant constraint ***semiotic*** on further development ***activity*** at Moonambel ***place***. (Phenomenon:) Two funding scenarios ***semiotic*** for providing a reticulated water supply ***activity*** (Process: Mental:) were assessed. (Token:) The annual cost ***semiotic*** to individual customers ***source*** (Process: Relational: Identifying:) would be (Value:) $1,075 ***thing*** per connection ***activity*** (Accompaniment:) with 100% external capital expenditure funding ***activity***. (Accompaniment:) Without capital funding ***activity***, (Token:) the annual cost ***semiotic*** to individual customers ***source*** (Process: Relational: Identifying:) would be (Value:) $9,300 ***thing*** per connection ***activity***. However, it (Process: Mental:) is noted that (Phenomenon:) [[these funding scenarios ***semiotic*** differ from CHW's ***source*** standard regulated charging arrangements ***semiotic***]] and [[the methodology ***semiotic*** for charging ***activity*** at Moonambel ***place*** has not been determined.]] (Actor:) The scheme ***activity***(Process: Material:) would need to generate (Goal:) a 20% increase in current annual turnover ***activity***, or avoid a 9% reduction ***activity***, (Cause:) to achieve economic breakeven ***activity*** (a benefit cost ratio ***semiotic*** of 1). (Manner:) From discussions ***activity*** with the business community ***source***, (Carrier:) the potential business expansion ***activity*** being considered that could realise this level of growth ***activity*** (Process: Relational: Attributive:) could include (Attribute:) up to 33 new full-time jobs ***activity***, an additional 50 rooms ***things*** of tourist accommodation ***activity*** and related tourism facilities ***thing***. While (Existent:) potential ***semiotic*** for such growth ***activity*** (Process: Existential:) exists, there (Process: Existential:) is (Existent:) significant reliance on speculative third-party private investment ***activity*** (Cause:) for much of the growth ***activity***. (Actor:) The timing ***activity*** of investment ***activity*** (Process: Material:) would (Manner:) also impact (Goal:) the cost–benefit assumptions ***semiotic***. Risks (Contingency:) [[Based on the assessment ***activity*** completed]], (Carrier:) the major risks ***semiotic*** and uncertainties ***semiotic*** associated with a potential potable water supply scheme ***activity*** (i.e. Option 3) ***semiotic*** (Process: Relational: Attributive:) include: (Attribute:) • [[Securing project funding ***activity*** via various levels of government ***source*** or others ***source***,]] the willingness/capacity ***activity*** for the community ***source*** to contribute to capital funding ***activity***, and affordability issues ***semiotic*** associated with ongoing	

	scheme costs ***semiotic*** (fixed and variable water supply charges) ***activity***, • Environmental issues ***semiotic*** and approvals ***semiotic*** such as native vegetation removal ***activity*** and increased energy usage/greenhouse gas emissions ***activity***, • Management/approval ***activity*** and consideration ***activity*** of areas ***place*** of high cultural and heritage sensitivity ***activity***, • Construction requirements ***semiotic***, such as traffic management ***activity*** and trenchless pipe installation ***activity***, due to environmental and cultural heritage considerations ***semiotic***, • Public and private land availability ***activity*** and possible compulsory acquisition ***activity*** to support the development of the major infrastructure needs ***semiotic*** (tanks ***thing***, pipelines ***thing***, pumps ***thing***, etc.), • The capacity of Avoca's water supply system ***activity*** to provide the required additional supply yield ***activity***, manage the additional brine ***thing*** for salt reduction water treatment technology ***activity*** and service the future growth ***activity*** in Avoca ***place*** in addition to Moonambel ***place***, and • The potential major economic benefits/growth ***activity*** identified in this study ***activity*** are based on a significant reliance on speculative third-party private investment ***activity*** (much of which to date has been based on interest ***activity*** generated by overseas investment ***activity***, as confirmed by the PSC ***source*** and interviews ***activity*** with several businesses ***source***).]] (Token/Carrier:) The level of contingency ***activity*** built into the engineering estimate ***semiotic*** (Process: Relational: Identifying:) reflects (Value:) the feasibility nature of the investigations ***activity*** and (Process: Relational: Attributive:) is (Attribute:) reflective of the identified risks ***semiotic***, but (Process: Material:) could be amended (Condition:) if [[further investigations ***activity*** are undertaken to support a better understanding ***activity*** of these risks ***semiotic*** and uncertainty ***semiotic***.]]	SG-
Conclusion +Recommendations	Conclusion (Sayer:) The economic assessment ***activity*** (Process: Verbal:) confirms that (Verbiage:) [[viticulture ***activity*** and tourism ***activity*** is of high importance to the Pyrenees Shire ***place***, and very high importance to the Moonambel region ***place***.]] (Token:) The assessment ***activity*** (Manner:) also (Process: Relational: Identifying:) identifies (Value:) the lack of a reliable and high quality water supply ***activity*** (Role:) as a likely significant	SG↓ SG↑ (waves)

	constraint ***semiotic*** on further development ***activity*** at Moonambel ***place***. [[Whilst acknowledging the requirements ***semiotic*** for a significant capital (approximately $8 million) outlay ***activity*** and funding ***activity*** of ongoing annual operating costs ***semiotic***,]] (Value:) [[a number of major outstanding risks ***semiotic*** that impact the feasibility of a future water supply enhancement scheme ***activity***]] (Process: Relational: Identifying:) have been identified (Location: Spatial:) in this study ***activity***. (Carrier:) This (Process: Relational: Identifying:) is based on (Attribute:) the pipeline connection ***activity*** from Avoca ***place*** to Moonambel ***place*** (Option 3 ***semiotic***) that [[was identified as the preferred options by the PCG ***source***.]] (Token:) Option 3 ***semiotic*** (Manner:) largely (Process: Relational: Identifying:) satisfies (Value:) the majority of the community criteria ***semiotic***, for a safe and reliable supply ***activity*** that [[would support potential future economic development opportunities ***activity*** and increase social amenity outcomes ***semiotic***.]] (Phenomenon:) Reservations ***semiotic*** regarding cost ***semiotic*** and ongoing tariffs ***semiotic*** (Process: Verbal:) were expressed (Sayer:) by the residential community ***source*** (Location: Temporal:) during the engagement process ***activity***. Therefore, (Token:) affordability/capacity ***activity*** to pay for the upfront and ongoing costs ***semiotic*** of the scheme ***activity***, [[which is a key criterion ***semiotic*** for this community ***source***]], (Process: Relational: Identifying:) remains (Value:) a major unresolved concern ***semiotic***.	

Appendix E: Student Text 1

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or Projected clauses]]	Semantic Gravity
Introduction (+Methods)	(Token:) The purpose ***semiotic*** of this document ***semiotic*** (Process: Relational: Identifying:) is (Value:) [[to evaluate the feasibility of the ADAT system ***activity*** by analysing the goals ***semiotic*** of the project ***activity***, the proposed functions ***semiotic*** of the ADAT ***activity***, the current market ***activity*** and the market trends ***activity***]]. (Contingency:) Based on the analysis ***activity***, (Range:) the findings ***semiotic*** and the recommendations ***semiotic*** (Process: Material:) are provided (Location: Spatial:) at the end of the document ***semiotic***. (Token:) The goals ***semiotic*** of the project ***activity*** (Process: Relational: Identifying:) are (Value:) [[to develop convenient, hands-free, comfortable and safe driving system ***activity*** in the short term ***time*** and to earn benefits ***semiotic*** for the company ***source*** in long term ***time***]]. (Cause:) [[To reach these goals ***semiotic***]], (Existent:) several objectives ***semiotic*** related to them ***semiotic*** (Process: Existential:) are arranged. (Matter:) For the first goal ***semiotic***, (Token:) the objectives ***semiotic*** (Process: Relational: identifying:) focus on (Value:) technology ***activity*** and (Matter:) for the second goal ***semiotic***, (Token:) the objectives ***semiotic*** (Process: Relational: Identifying:) focus on (Value:) the vehicle market ***activity***.	SG-
Investigation /Results	(Contingency:) Based on the approved user needs ***semiotic***, (Carrier:) the proposed system ***thing*** (Process: Relational: Attributive:) has (Attribute:) functions ***activity*** of [[detecting ***activity*** and avoiding ***activity*** pedestrians ***source*** and obstacles ***thing***]], assessment ***activity*** of road and traffic condition ***semiotic***, assisted parking ***activity***, automatic vehicle light control ***activity***, information sharing ***activity*** and exchanging ***activity*** map building ***activity*** and guiding ***activity***, recording ***activity*** and reporting of system running information ***activity*** and training mode ***activity***. (Cause:) [[To achieve the requirements ***semiotic*** of these functions ***semiotic***,]] (Carrier:) the system ***activity*** (Process: Relational: Attributive:) is divided into (Attribute:) several components ***thing***. (Carrier:) Each component ***thing*** (Process: Relational: Attributive:) has (Attribute:) dataflow ***activity*** to another component ***thing***. (Actor:) The proposed system ***activity*** (Process: Material:) is able to update (Range:) information ***semiotic*** from the cloud ***semiotic***, which (Process: Relational: Identifying:) will allow	SG-

	(Carrier:) it ***activity*** to keep (Attribute:) firm (Matter:) with regulations ***semiotic***. There (Process: Existential:) are (Existent:) issues ***semiotic*** and constraints ***semiotic*** in the process of developing the system ***thing***, such as the stability of the system ***activity***, identification effectiveness ***semiotic***, information accuracy ***semiotic*** and sensor installation ***activity***. (Carrier:) The current market ***activity*** of ADAT ***activity*** (Process: Relational: Attributive:) is (Attribute:) relatively small. (Token:) The main customers ***source*** (Location: Temporal:) at present ***time*** (Process: Relational: Identifying:) are (Value:) [[those ***source*** who are interested in luxury vehicles ***thing*** and some potential customers ***source*** have not been familiar with ADAT ***activity***]]. (Carrier:) The trend ***activity*** of ADAT ***activity*** (Process: Relational Attributive:) is growing and (Carrier:) the proposed system ***activity*** (Process: Relational: Attributive:) will be (Attribute:) popular with drivers ***source*** (Location: Temporal:) soon.	SG+
Conclusion +Recommendations	To conclude, (Actor:) the proposed system ***activity*** (Process: Material:) will establish (Goal:) convenient, hand-free, comfortable and safe environment ***semiotic***. Additionally, (Condition:) according to the market situation ***semiotic***, (Condition:) [[once the proposed system ***activity*** put into use ***activity***]], (Carrier:) it ***activity*** (Process: Relational: Attributive:) will become (Attribute:) acceptable and popular among drivers ***source*** (Extent:) during a long period ***time***. Thus, (Range:) the goals ***semiotic*** of the project ***activity*** (Process: Material:) can be reached. However, there (Process: Existential:) are (Location: Temporal:) still (Existent:) some recommendations ***semiotic*** that [[should be taken into consideration ***activity***]]. Firstly, (Phenomenon:) the accuracy of information ***semiotic*** and data ***semiotic*** (Process: Mental:) should be focused. Secondly, (Goal:) some customizable functions ***activity*** (Process: Material:) should be developed. Thirdly, (Value:) a new function ***activity*** of driver recognition ***activity*** (Process: Relational: Identifying:) is needed.	SG↓ SG-

Appendix F: Student Text 2

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or projected clauses]]	Semantic Gravity
Introduction (+Methods)	(Range:) This feasibility study ***activity*** (Process: Material:) was conducted (Cause:) [[to determine the viability of ADAT ***activity***]]. (Range:) The feasibility of the proposed system ***activity*** (Process: Material:) was evaluated (Manner:) in three major sections ***semiotic*** namely goals ***semiotic*** and objectives ***semiotic*** of the proposed system ***activity***, description ***semiotic*** of the proposed system ***activity***, market considerations ***semiotic***. Finally, (Actor:) this feasibility study ***semiotic*** (Process: Material:) concluded (Range:) the findings ***semiotic*** and recommendations ***semiotic*** (Condition:) [[based on the above three sections ***semiotic***]].	SG-
	(Token:) The goal ***semiotic*** of the proposed system ***activity*** (Process: Relational: Identifying) is (Value:) [[to develop an integrated driver assist system ***activity***]] [[as well as guarantee high applicability and generalizability of the products ***thing***]]. (Matter: In relation to the goal ***semiotic*** of the proposed system ***activity***, (Carrier:) the proposed system ***activity*** (Process: Relational: Attributive:) will incorporate (Attribute:) all available Driver Assist technologies ***activity*** (Accompaniment:) [[as well as adopt modular and expendable design ***semiotic***]].	SG↑ SG-
Investigation /Results	(Contingency:) [[Based on the current available Driver Assist technologies ***activity***]], (Carrier:) the proposed system ***activity*** (Process: Relational: Attributive:) will have (Attribute:) three major functions ***activity***, [[which includes input function ***activity***, output function ***activity*** and Maintenance & Training function ***activity***]]. (Range:) These functions ***activity*** (Process: Material:) will be implemented (Actor:) by its build-in software systems ***activity***. (Actor:) This feasibility study ***semiotic*** (Accompaniment:) also (Process: Material:) considered (Range:) the interconnections ***activity*** and data flows ***activity*** among these systems ***activity***. (Contingency:) [[Based on the description ***semiotic*** of the proposed system ***activity***]], (Range:) two major risk factors ***semiotic*** (Process: Material:) were identified, [[which contained the discontinuity ***activity*** in the process ***activity*** of resuming ***activity*** full manual control ***activity*** and the low calculation ***activity*** accuracy of the software systems ***activity***]]. (Cause:) As a result of a lack in the anti-hacker and anti-virus technologies ***activity*** of the current	SG-

	technical level ***semiotic***, (Actor:) this feasibility study ***semiotic*** (Process: Material:) made (Goal:) a number of assumptions ***semiotic*** (Matter:) regarding the network firewall ***activity*** and the anti-hacking subsystem ***activity*** feasibility of the proposed system ***activity***. (Contingency:) Based on the limited information ***semiotic*** (Process: Mental:) it was concluded that (Phenomenon:) [[the proposed system ***activity*** could resist all network attacks ***activity*** and hacker intrusions ***activity***]]. (Contingency:) Based on the existing demand ***activity*** for Automated Driving System ***activity***, (Carrier:) ADAT ***activity*** (Process: Relational: Attributive:) will have (Attribute:) a bright market perspective ***semiotic***. (Existent:) Competition ***activity*** in the Automated Driving System market ***activity*** (Manner:) mainly (Process: Existential:) exists (Location: Spatial:) among U.S. ***place***, Europe ***place***, and Japan ***place***. (Actor:) Several corporations ***source***(Process: Material:) will (Accompaniment:) also launch (Range:) their Automated Driving products ***thing*** (Location: Temporal:) in the near future ***time***. The Automated Driving System market size ***semiotic*** was predicted [[to increase slightly from 2018 ***time*** to 2023 ***time*** and then increase dramatically from 2024 ***time*** (3,200,000 unit shipment ***activity***) to 2028 ***time*** (6,200,000 unit shipment ***activity***)]]. In addition, (Carrier:) Automated Driving system ***activity*** (Process: Relational: Attributive:) will have (Attribute:) some new features ***semiotic*** and functions ***activity*** in the near future ***time***. (Carrier:) These positive outcomes ***semiotic*** of the market predictions ***semiotic*** (Process: Relational: Attributive:) was, however, (Attribute:) heavily dependent upon [[the assumptions ***semiotic*** made during the study ***activity*** and on conditions ***semiotic*** (political, environmental, economical etc.) remaining relatively stable within the business's ***source*** operating environment ***activity***]].	SG↑ SG-
Conclusion +Recommendations	(Contingency:) Taking the description ***semiotic*** of the proposed system ***activity*** and the current Automated Driving System market ***activity*** into consideration, (Process: Mental:) it can be concluded that (Phenomenon:) [[the proposed system ***activity*** is anticipated to achieve all the goals ***semiotic*** and objectives ***semiotic*** as well as have a bright market perspective ***semiotic***]]. In addition, (Carrier:) further market research ***activity***, solar power system ***activity***, advanced security protection system ***activity*** (Process: Relational: Attributive:) are (Attribute:) highly recommended (Cause:) for the proposed system ***activity***.	SG-

Appendix G: Student Text 3

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded clauses]]	Semantic Gravity
Introduction	(Actor:) This document ***semiotic*** (Process: Material:) analyses (Range:) the viability of the Advanced Driver Assist Technologies(ADAT) project ***activity***.	SG-
Methods	(Range:) Four main elements ***semiotic*** (Process: Material:) were examined (Cause:) to determine the feasibility of the proposed system ***activity***: goals ***semiotic*** and objectives ***semiotic*** of the system ***activity***, technology ***activity*** and function ***activity*** feasibility, market ***activity*** and market trend ***activity*** feasibility, and rational recommendations ***activity***.	SG-
Investigation /Results	(Token:) The analysis ***activity*** of goals ***semiotic*** (Process: Relational: Identifying:) was revealed (Value:) that [[the proposed system ***activity*** was developed to assist driver ***source*** with multiple function ***activity*** and make profits ***thing*** for company ***source***]]. (Phenomenon:) The objectives ***semiotic*** (Process: Mental:) were identified (Cause:) to achieve each goal ***semiotic*** respectively. (Token:) The proposed system ***activity*** (Process: Relational: Identifying:) reveals (Value:) that [[the system ***activity*** focuses on the aspects ***semiotic*** of safety, convenience ***activity*** and communication ***activity*** and the system ***activity*** will provide users ***source*** with multiple functions ***activity***, for instance, potential danger detection ***activity*** and avoidance ***activity***, communication ***activity*** with other drivers ***source***, cruise control ***activity***, autonomous parking ***activity***]]. In addition, (Range:) several issues and constrains of the system (Process: Material:) were analysed (Role:) such as the limitation of the operational life ***semiotic***, the security of the system ***activity*** and regular updates ***activity***. (Matter:) Taking the current market ***activity*** and market trend ***activity*** into consideration, it (Process: Mental:) can be concluded (Phenomenon:) that [[the market ***activity*** may show considerable interest ***activity*** towards the proposed system ***activity*** such that the demand ***activity*** for the proposed system ***activity*** is anticipated to increase rapidly in the next decade ***time***]]. Further, (Token:) the proposed system ***activity*** (Process: Relational: Identifying:) is feasible to meet (Value:) the needs ***semiotic*** and the requirements ***semiotic*** of the	SG↓ SG-

	market ***activity*** and (Contingency:) based on the limited information ***semiotic***, (Carrier:) the proposed system ***activity*** (Process: Relational: Attributive:) could be (Attribute:) financially feasible.	
Conclusion +Recommendations	(Token:) The overall findings ***semiotic*** (Process: Relational: Identifying:) focus on (Value:) the technological and marketing feasibility which [[were concluded in the study ***activity***]]. (Verbiage/Actor:) Recommendations ***semiotic*** (Process: Verbal:) are emphasised (Angle:) from aspects ***semiotic*** of market ***activity***, promotion campaign ***activity*** and effective system maintenance ***activity*** and (Process: Material:) can increase (Goal:) the feasibility of the proposed system ***activity***. (Contingency:) Based on the analysis ***activity*** of the feasibility study ***activity***, it (Process: Mental:) can be concluded that [[the ADAT ***activity*** is feasible]]. However, (Goal:) the results ***semiotic*** (Process: Material:) are made (Angle:) according to assumptions ***semiotic*** which [[the assumptions ***semiotic*** are depended upon the market ***activity*** and system operating environment ***semiotic***]]. (Contingency:) If the environment ***semiotic*** of operation ***activity*** and market ***activity*** were differing from the assumption ***semiotic***, (Carrier:) the feasibility of the proposed system ***activity*** (Process: Relational: Attributive:) could be (Attribute:) different from this study results ***semiotic***.	SG-

Appendix H: Student Text 4

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded and projected clauses]]	Semantic Gravity
Introduction	(Actor:) This report ***semiotic*** (Process: Material:) ascertains (Range:) the feasibility of Advanced Driver Assist Technologies (ADAT) ***activity*** (Cause:) for Electromotive Vehicle System Ltd (EVS) ***source***. In addition, (Token:) it ***semiotic*** (Process: Relational: Identifying:) focuses on (Value:) four sections ***semiotic***, such as goals ***semiotic*** and objectives ***semiotic*** of the proposed system ***activity***, multifunction ***activity*** in different type of situations ***semiotic***, market considerations ***semiotic***, and findings ***semiotic*** and recommendations ***semiotic***. (Token:) The long term and general goals ***semiotic*** of this proposal ***semiotic*** (Process: Relational: Identifying:) are (Value:) [[to offer a more convenient operational system ***activity*** which combines the different functions ***activity*** to assist drivers ***source*** to control their cars ***thing***]]. In addition, (Actor:) it ***semiotic*** (Process: Material:) will list (Range:) the feasible technologies ***activity*** which [[are most considered and concerned by drivers ***source***]]. (Cause:) As a result ***semiotic***, (Sensor:) EVS ***source*** (Process: Mental:) can concentrate on (Phenomenon:) the most important fields ***semiotic*** (Cause:) to do the research ***activity*** and development ***activity***. Furthermore, (Actor:) this whole section ***semiotic*** (Process: Material:) narrows (Goal:) the core technologies ***activity*** of this proposed system ***activity*** and (Process: Material: provide a precise relevant goals ***semiotic*** (Cause:) to achieve in the future ***time***.	SG- SG↑ SG- SG↑
Investigation /Results	(Location: Spatial:) In the description of proposed system section ***semiotic***, (Goal:) the most significant characteristics ***semiotic*** and relative issues ***semiotic*** of the system ***activity***, and requirements ***semiotic*** from drivers ***source*** (Process: Material:) will be taken (Cause:) into consideration. (Cause:) To illustrate, (Process: Existential:) is there operational environment ***semiotic*** for this system ***activity*** or what (Actor:) the system ***activity*** (Process: Material:) will do. Significantly, (Actor:) new system ***activity***'s functions ***activity*** (Process: Material:) should fix (Goal:) most of the problems ***semiotic*** and all main factors ***semiotic*** which [[may affect drivers ***source*** during driving ***activity***]]. (Verbiage:) Availability of these technologies ***activity*** (Process: Verbal:) will be described. (Location: Spatial:) In market considerations ***semiotic***, (Token:) the existing market ***activity*** (Process: Relational: Identifying:)	SG↑ SG-

	lacks (Value:) of this type of creative driver-friendly operating system ***activity***. (Token/Actor:) The analysis ***activity*** of this section ***semiotic*** (Process: Relational: Identifying:) points out (Value:) the targeted customers ***source*** and (Process Material:) list out (Goal:) the competitive advantages ***semiotic*** and disadvantages ***semiotic*** of this new technologies ***activity***. In addition, (Verbiage:) business pressures ***semiotic*** and competitive environment ***semiotic*** (Process: Verbal:) will be discussed. In conclusion, (Carrier:) this new technology ***activity*** (Process: Relational: Attributive:) has (Attribute:) vast commercial potential ***semiotic***. Finally, (Token:) this system ***activity*** (Process: Relational Identifying:) is (Value:) a multifunctional automotive system ***activity***. (Actor:) It ***activity*** (Process: Material:) will change (Goal:) the type of the driving habits ***activity*** of drivers ***source***. Significantly, (Actor:) drivers ***source*** (Process: Material:) can change (Goal:)their negative driving behaviours ***activity*** and (Process: Material:) eliminate (Goal:) their operation ***activity*** by ADAT system ***activity***'s advice ***semiotic*** or automatic operations ***activity***, such as lane departure warning ***activity***, avoiding pedestrians ***activity***, etc. Then, (Goal:) some imperfections ***semiotic*** (Process: Material:) need to be modified (Role:) such as the hardware ***thing*** and the software ***thing***.	SG↑
Conclusion +Recommendations	(Contingency:) Based on the program ***semiotic*** of this feasibility study ***activity*** it (Process: Mental:) can be concluded that [[developing advanced driver assist technology ***activity*** is practicable]].	SG-

Appendix I: Student Text 5

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or projected clauses]]	Semantic Gravity
Introduction	(Sayer:) This document ***semiotic*** (Process: Verbal:) explains (Verbiage:) the goals ***semiotic*** and objectives ***semiotic*** of the project ***activity*** developed by CSSL ***source***. (Token:) The main goals ***semiotic*** of the system ***activity*** (Process: Relational: Identifying:) are [[to drive the company ***source*** into a new growth phase ***activity*** and enhance the safety and efficiency of the current mining haulage system ***activity***]]. (Matter:) In relation to these goals ***semiotic***, (Actor:) CSSL ***source*** (Process: Material:) will develop (Goal:) an autonomous mining haulage fleet ***thing***, a mine-site monitoring station ***thing***, and an Operational Control Centre (OCC) ***thing***. (Goal:) These software and hardware subsystems ***activity*** (Process:) will be combined (Cause:) to create an autonomous mining system ***activity*** (Cause:) to bring financial benefits ***semiotic*** to the company ***source***.	SG↓ SG↑ (waves)
Investigation /Results	(Token:) The proposed system ***activity*** (Process: Relational: Identifying:) is comprised of (Value:) a wide range of technologies ***activity*** and functions ***activity*** . (Actor:) The mining haulage fleet ***thing*** (Process: Material:) is able to operate (Manner:) in a fully autonomous mode ***semiotic*** and (Verbiage:) the number of trucks ***thing*** per fleet ***thing*** and the haulage ***activity*** capacity per year ***time*** (Process: Verbal:) are (Extent:) all specified. (Carrier:) The mining fleet ***thing*** (Process: Relational: Attributive:) will be (Attribute:) under 24/7 monitoring ***activity*** (Manner:) from the mine-site monitoring centre ***thing*** and (Goal:) the operation ***activity*** (Process: Material:) can be intervened (Actor:) by authorised human operators ***source***. (Carrier:) The OCC ***thing*** (Process: Relational:) Attributive:) is (Attribute:) capable of providing the real time locations ***semiotic*** and maintenance status ***semiotic*** of the mining trucks ***thing***, therefore (Process: Material:) enhancing (Goal:) the communication ***activity*** between the fleet ***thing*** and the mine manager ***source***. In addition, (Goal:) a web-based training subsystem ***activity*** (Process: Material:) will (Accompaniment:) also be developed (Cause:) to train maintainers ***source*** and support personnel ***source***, (Process: Material:) offering (Beneficiary:) staff ***source*** (Goal:) hard and soft copies ***thing*** of the manuals ***thing*** (Cause:)for further reference ***activity***.	SG+ SG↓ SG+

Conclusion +Recommendations	(Actor:) The feasibility study ***activity*** of the proposed system ***activity*** (Process: Material:) reaches (Goal:)a conclusion ***semiotic*** that [[the autonomous haulage system ***activity*** will greatly enhance the mining haulage efficiency and safety situations ***semiotic***]]. It (Process: Material:) is feasible to develop (Goal:) such an autonomous mining haulage system ***activity*** and (Token:) it (Process: Relational: Identifying:) will lead to (Value:) huge financial and reputational benefits ***semiotic*** (Cause:) for the company ***source*** and stakeholders ***source***. However, (Carrier:) CSSL ***source*** (Process: Relational: Attributive:) has (Attribute:) little experience ***activity*** in managing ***activity*** and maintaining ***activity*** such a complex autonomous control system ***activity***. (Actor:) This lack of experience ***activity*** (Process: Material:) may cause (Goal;) potential damage ***activity*** and losses ***activity*** (Beneficiary:) to the company ***source***. Therefore, (Sayer:) the study ***activity*** (Process: Verbal:) recommends (Verbiage:) that [[the company ***source*** do some further research ***activity*** on autonomous haulage control ***activity*** before entering the autonomous control industry ***activity***]].	SG- SG+

Appendix J: Student Text 6

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or projected clauses]]	Semantic Gravity
Introduction (Including Methods)	(Actor:) This document ***semiotic*** (Process: Material:) evaluates (Phenomenon:) the feasibility of the Mining communication and Autonomous Service (MCAAS) project ***activity*** (Cause:) for Communication Systems and Services Limited ***source*** (Manner:) by [[explaining the goals ***semiotic*** and objectives ***semiotic*** of the study ***activity***, describing the proposed system ***activity***, discovering the findings ***semiotic***, and making recommendations ***semiotic*** for the system ***activity***]], while (Value:) the current system ***activity*** and process ***activity***, market consideration ***semiotic***, market strategy ***semiotic***, schedule ***semiotic***, and financial projections ***semiotic*** (Process: Relational: Identifying:) are excluded. (Carrier:) The MCAAS system ***activity*** (Process: Relational: Attributive:) has (Attribute:)three main goals ***semiotic*** (Cause:) to accomplish [[including fully autonomous and remote control ***activity***, productivity and consistency, and sustainable development ***activity*** and minimize the environment impact ***activity***]]. (Token:) The corresponding objectives ***semiotic*** (Process: Relational: Identifying:) include (Value:) [[achieving autonomous system ***activity***, achieving autonomous truck ***thing***, enhancing existing trucks ***thing***, improving efficiency, and enhancing safety]].	SG- SG↑
Investigation /Results	(Carrier:) The MCAAS system ***activity*** (Process: Relational: Attributive:) will have (Attribute:) two main components ***thing*** [[including the autonomous haulage system ***activity*** and communication system ***activity***]]. While (Existent:) the haulage system ***activity*** (Process: Existential:) is (Cause:) to [[control the trucks haulage ***activity***, load and unload the ore ***thing*** automatically]], (Existent:) the communication system ***activity*** (Process: Relational: Existent:) is (Cause:) to [[communicate between the mine site ***place*** and OCC ***thing*** to monitor the mining process ***activity***]]. (Goal:) The maintenance centre ***thing*** and training system ***activity*** (Accompaniment:) also (Process: Material:) will be designed (Cause:) to enhance the system ***activity***. (Goal:) The trucks ***thing*** in the mine haulage system ***activity*** (Process: Material:) will be driven (Location: Spatial:) to the maintenance centre ***place*** (Manner:) automatically and (Process: Material:) shut down (Role:) to safe mode ***activity*** (Location: Temporal:) before the commencement of	SG+

	maintenance ***activity***. (Value:) A Health and Usage Monitoring System ***activity***, and an Automatic Logistic and Reporting Management System ***activity*** (Process: Relational: Identifying:) will (Accompaniment:) also be included (Token:) in the haulage system ***activity*** (Cause:) to [[inform the manager ***source*** about the needs ***semiotic*** of maintenance ***activity***]].	SG↓
	(Cause:) [[To ensure the safety and security of the system ***activity***]], (Token:) the system ***activity*** (Process: Relational: Identifying:) should comply with (Value:) the requirements ***semiotic*** of Work Health and Safety regulations ***semiotic***, mine operational safety regulations ***semiotic***, and system safety regulations ***semiotic***. (Cause:) In order [[to meet the requirements ***semiotic***]], (Value:) a fault detection and location system ***activity*** (Process: Relational: Identifying:) will be included (Token:) in the MCAAS system ***activity*** (Cause:) to avoid any accidents ***activity***.	
	(Goal:) A web-based training system ***activity*** (Accompaniment:) also (Process: Material:) will be developed (Cause:) [[to meet the training needs ***semiotic*** of MCAAS ***activity***]]. (Beneficiary:) The training system ***activity*** (Process: Material:) will be provided with (Goal:) self-paced instruction ***activity***, duplicating system performance characteristics ***semiotic***, capabilities ***activity***, and limitations ***semiotic***. (Goal:) Training manuals ***thing*** (Process: Material:) will also be provided (Accompaniment:) with the system ***activity***.	
	(Goal:) The issues ***semiotic*** and assumptions ***semiotic*** about the proposed system ***activity*** (Accompaniment:) also (Process: Material:) need to be taken (Cause:) into account. While (Goal:) the system ***activity*** (Process: Material:) is connected (Accompaniment:) to the Internet ***activity*** (Cause:) for communication use ***activity*** instead of inner network ***activity*** only, (Goal:) the system ***activity*** (Process: Material:) should be (Manner:) extremely safe designed (Cause:) to be prepared for any possible attack ***activity***. (Carrier:) The result ***semiotic*** (Process: Relational: Attributive:) will be (Attribute:) catastrophic (Contingency:) if [[the system ***activtiy*** is invaded and controlled]] (Contingency:) [[considering the fact ***semiotic*** that the trucks ***thing*** are destructive]].	SG-
Conclusion +Recommendation	(Token:) The main recommendation ***semiotic*** of this study ***activity*** (Process: Relational: Identifying:) is (Value:) that [[the proposed the system ***activity*** is feasible if the system ***activity*** can be continually developed and improved]]. Also, it	SG-

	(Process: Verbal:) is recommended (Verbiage:) that [[the system ***activity*** should have prepared for any extreme situation ***semiotic***, and operation log ***semiotic*** should be recorded for future use ***activity***]].	

Appendix K: Student Text 7

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or projected clauses]]	Semantic Gravity
Introduction	(Actor:) This feasibility study ***activity*** (Process: Material:) evaluates (Range:) the viability of automating mine haulage trucks ***thing*** and associated communications ***activity*** of the proposed MCAAS project ***activity***. (Carrier:) This project ***activity*** (Process: Relational: Attributive:) is a joint venture ***activity*** of CSSL ***source***, BHP Billiton ***source*** and Komatsu ***source***, in which [[CSS ***source*** will develop an autonomous system ***activity*** for resources extraction ***activity*** and haulage ***activity***, with the support ***activity*** of Komatsu ***source*** that will tightly integrate with the current mining processes ***activity*** of BHP Billiton ***source***]]. (Actor:) This joint autonomous technology project ***activity*** (Process: Material:) will bring (Goal:) benefits ***semiotic*** (Beneficiary:) to all stakeholders ***source***. (Carrier:) The goals ***semiotic*** and objectives ***semiotic*** of the project ***activity*** (Process: Relational: Attributive:) are clear and well defined. (Token:) The main goals ***semiotic*** (Process: Relational: Identifying:) include (Value:) the enhancement of productivity, efficiency and safety. (Token:) It ***activity*** (Accompaniment:) also (Process: Relational: Identifying:) focusses on (Value:) the reduction of human errors ***activity***, business risks ***semiotic*** and the adverse impacts ***activity*** on the environment ***place***. (Token:) The objectives ***semiotic*** of the project ***activity*** (Process: Relational: Identifying:) are (Value:) [[to implement autonomous haulage system ***activity***, OCC ***activity*** and inter-vehicular as wells long distance communication system ***activity***]].	SG+ SG-
Investigation /Results	(Carrier:) The proposed system ***activity*** (Process: Relational: Attributive:) will be (Attribute:) well accordant (Accompaniment:) with the current mine infrastructure ***thing***, [[including existing mine management software ***thing***]]. (Actor:) The mine haul truck fleet ***thing*** (Process: Material:) will be able to perform (Goal:) completely autonomous operations ***activity*** and there (Process: Existential:) will be (Existent:) one to ten trucks ***thing*** in each fleet ***thing***. (Existent:) A single national operations centre ***thing*** (Process: Existential:) will be (Location: Spatial:) there ***place*** (Cause:) [[to monitor the operational state ***activity*** of the truck fleet ***thing*** remotely]]. (Carrier:) The communications links ***activity*** to fleet operators ***source*** (Process: Relational: Attributive:) will be (Attribute:) two way operational enquiries ***activity***. (Token:) The	SG+

	forecasted maximum haulage capacity ***activity*** of the mine ***thing*** (Process: Relational: Identifying:) is (Value:) 1,500,000 tonnes ***thing*** (Extent:) per year ***time*** (Manner:) from each mine ***thing***. (Goal:) The entire system ***activity*** (Process: Material:) will be installed (Accompaniment:) with ALARMS ***activity***. (Location: Temporal:) During initial system computer boot-up ***activity***, (Carrier:) the system equipment ***thing*** (Process: Material:) will possess (Attribute:) Fault Detection/Location ***activity***. (Contingency:) Whenever [[requests ***semiotic*** are made]], (Actor:) the system ***activity*** (Process: Material:) will allow (Goal:) authorised human operators ***source*** to manage them ***semiotic***, either remotely or in the trucks ***thing***, but it ***activity*** shall not allow interference ***activity*** and takeover ***activity*** by non-authorised entities ***thing?***. (Sayer:) The trucks ***thing*** (Process: Verbal:) will (Manner:) automatically inform (Recipient:) the maintenance manager ***source*** (Location: Temporal:) two days ***time*** in advance of scheduled maintenance requirements ***semiotic***, (Contingency:) [[based on their on-board system capabilities ***activity***]]. (Goal:) A report ***semiotic*** of haulage activities ***activity*** and maintenance downtime ***activity*** (Process: Material:) shall be provided (Extent:) on a daily basis ***semiotic***. (Carrier:) Daily fleet operations ***activity*** (Process: Relational: Attributive:) will be (Attribute:) in accordance (Accompaniment:) with a daily task plan ***semiotic***, [[developed in conjunction with the mine manager ***source***]]. (Token:) The system ***activity*** (Process: Relational: Identifying:) will follow (Value:) all the environmental standards ***semiotic***, WHS regulations ***semiotic***,, operational safety regulations ***semiotic***, and system safety regulations ***semiotic***, that [[are applicable to mining ***activity***]]. (Contingency:) For specific mine management purposes ***semiotic***, (Actor:) the system ***activity*** (Process: Material:) shall be able to accommodate (Goal:) special tasking ***activity*** of individual trucks ***thing***.	SG↓
Conclusion +Recommendations	(Token:) Major finding ***semiotic*** in this feasibility study ***activity*** (Process: Relational: Identifying:) is (Value:) that, [[it endorses the viability of this proposed project ***activity***]]. (Token:) The study ***activity*** (Process: Relational: Identifying:) finds (Value:) that, [[the proposed system ***activity*** brings improvement in productivity, efficiency and consistency in mining ***activity***]]. (Token:) Other findings ***semiotic*** (Process: Relational: Identifying:) include (Value:) more safety in the mine site ***place*** and reduction of health-related issues ***semiotic***. (Token: The major disadvantages ***semiotic*** (Process: Relational: Identifying:) are (Attribute:) high initial cost ***semiotic*** and	SG- SG↑

	unemployment ***activity*** among labourers ***source***. (Token:) Some recommendations ***semiotic*** for the enhancing the viability of the system ***activity*** (Process: Relational: Identifying:) are (Value:) [[to improve employability ***activity***, incorporate control tower ***thing***, include more backup generators ***thing*** and consider consultation firms ***source***]].	

Appendix L: Student Text 8

Genre Analysis	Transitivity Analysis :(brackets) + Entity Analysis: underline ***entity type*** [[Embedded or projected clauses]]	Semantic Gravity
Introduction (Including Methods)	(Actor:) This feasibility study ***activity*** (Process: Material:) assesses (Range:) the viability of Mining Communications and Autonomy Service (MCAAS) ***activity***. (Range:) The feasibility of the proposed system ***activity*** (Process: Material:) is assessed (Matter:) in three areas ***semiotic***: goals ***semiotic***, description ***semiotic*** of the proposed system ***activity*** and recommendations ***semiotic***. (Matter:) About goals ***semiotic***, (Actor:) CSSL ***source*** (Process: Material:) aims to develop (Goal:) an autonomous mining haulage development program ***activity*** (Accompaniment:) with the help ***activity*** of BHP Billiton ***source*** and Komatsu ***source***. (Sensor:) CSSL ***source*** and Komatsu ***source*** (Process: Mental:) will focus on (Phenomenon:) an autonomous haulage system ***activity***, and (Sensor:) CSSL ***source*** and BHP Billiton ***source*** (Process: Material:) will focus on (Phenomenon:) mining processes ***activity***. (Token:) The other main goals ***semiotic*** (Process: Relational: Identifying:) include (Value:) [[improving the efficiency and security of the system ***activity*** and making profits ***thing***]]. (Goal:) The goals ***semiotic*** (Process: Material:) should be achieved (Manner:) through a series of objectives ***semiotic***.	SG- SG↑ SG-
Investigation /Results	Then, (Token:) the feasibility study ***activity*** (Process: Relational Identifying:) describes (Value:) the proposed system ***activity***, [[including system description ***semiotic***, issues ***semiotic***, assumptions ***semiotic*** and constraints ***semiotic***]]. (Location: Spatial:) In the system description ***semiotic***, (Range:) the characteristics ***semiotic*** and functionality ***activity*** of system ***activity*** (Process: Material:) are presented. (Token:) The main characteristics ***semiotic*** (Process: Relational: Identifying:) include (Value:) major system components ***thing***, communication requirements ***semiotic***, conformity and compatibility, safety, security and privacy, deployment and operational risk factors ***semiotic*** and continuity of operations ***activity*** in emergencies ***activity***. (Contingency:) Although the proposed system ***activity*** is almost perfect, there (Process: Existential:) are (Location: Temporal:) still (Existent:) some issues ***semiotic***. (Token:) One of the biggest problems ***semiotic*** (Process: Relational: Identifying:) is (Value:) that [[system ***activity*** needs to be resistant to the impact ***activity*** of bad weather ***activity***]]. (Token:) Another issue ***semiotic*** (Process: Relational:)	SG-

	Identifying:) is (Value:) that [[in order to get high-quality mine ***thing***, optimization technology ***activity*** should be considered in the design ***activity*** of control and communication system ***activity***]]. Also, (Goal:) the scalability of the system ***activity*** (Process: Material:) needs to be optimized. (Contingency:) [[Considering the assumptions ***semiotic*** and constrains ***semiotic***]], (Actor:) engineers ***source*** and managers ***source*** (Process: Material:) need to guarantee (Goal:) the reliability of the communication system ***activity***, the stability of software ***thing*** and hardware ***thing***, safety and security of the whole system ***activity***. (Cause:) As a result ***semiotic***, (Accompaniment:) with the help of three companies ***source***, (Actor:) the project ***activity*** (Process: Material:) will succeed and (Process: Material:) be put into use. However, (Location: Temporal:) before that, (Carrier:) training ***activity*** and tests ***activity*** (Process: Relational: Attributive:) are (Attribute:) necessary (Cause:) in order to [[carry out bug detection service ***activity*** and avoid flaws ***semiotic***]].	SG↑
Conclusion +Recommendations	(Location: Temporal:) In the section ***semiotic*** of findings ***semiotic*** and recommendations ***semiotic***, (Verbiage:) hybrid excavators ***thing***, routers ***thing*** and trailers ***thing*** (Process: Verbal:) are recommended (Cause:)to improve the competitiveness of the project ***activity***.	SG↑