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Applying semantic gravity wave profiles to develop undergraduate students' academic literacy

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This study draws on Legitimation Code Theory (LCT), particularly semantic gravity waving, as a strategy for academic literacies practitioners to conceptualise how knowledge in their field might be organised and presented. Students can be guided to notice meanings related to context-dependency at the discourse and lexico-grammatical levels through the presentation of semantic gravity waving profiles. For this study, semantic gravity waving profiles have been found useful for explaining the rationale of a genre pedagogy approach, the structure of an Introduction-Method-Results-Discussion (IMRD) genre, and teaching both lexical coherence for a theoretical framework section, and accurate use of determiners with non-count abstract nouns such as “research”. Therefore, semantic gravity profiling seems to provide explanatory power as a pedagogical tool in the classroom. Findings from a mixed method survey with sixty students as well as extracts from student texts before and after semantic gravity waving profile pedagogical interventions are provided.

Keywords: Legitimation Code Theory; semantic gravity; knowledge; Introduction-Method-Results-Discussion

1. Introduction

This paper explores a strategy for academic literacies practitioners to conceptualise how knowledge is valued and organised into hierarchies of meanings in a specific discipline. In line with Clarence and McKenna (2017), academic literacies practitioners in this context refers to those involved in developing the writing practices of their students in the disciplines. To do this, the paper draws on Legitimation Code Theory (LCT) (Maton, 2000, 2009, 2011, 2013, 2014a, 2014b, 2016). Semantics from Legitimation Code Theory (LCT), and specifically semantic gravity waving, provides explanatory power to make disciplinary knowledge the object of study. The paper begins with an overview of Legitimation Code Theory (LCT)-informed discussion on curriculum development and links this overview to some of the literature on Content and Language Integrated Learning (CLIL), the academic English language context for the study. It then proceeds to overview the theoretical framework, semantic gravity. After that, follows a depiction of the research context and methodology. As the course uses a genre pedagogical approach, this is described in the research context section. The paper then moves on to explore the design of the research. Finally, in the findings, a presentation of how semantic gravity waving profiles were applied in the undergraduate university classroom is provided.

2. Literature review

2.1. Legitimation Code Theory (LCT) and Content and Language Integrated Learning (CLIL)

Legitimation Code Theory (LCT) is a framework revealing the “rules of the game” (Maton, 2014a) or “legitimation codes” essential to achievement in educational environments. It seeks to uncover if the codes facilitate or restrict knowledge-building. The framework of Legitimation Code Theory (LCT) comprises five dimensions that apply organising principles. In this paper, only one of those dimensions is explored: Semantics. Semantics looks at semantic structures in social fields. It is divided into semantic gravity and semantic density. Semantic gravity was first introduced in Maton (2009, 2011) and more fully elaborated in Maton (2013, 2014a, 2014b, 2016). It is becoming more widespread in a variety of academic contexts (Clarence, 2016; Clarence & McKenna, 2017; Deng, 2018; Maton & Doran, 2017) and has been used to teach various subjects such as Journalism (Kilpert & Shay, 2013), Nursing (McNamara, 2010), English (Macken-Horarik, 2011), History (Macnaught, Maton, Martin, & Matruglio, 2013; Matruglio, Maton, & Martin, 2013), Physics (Georgiou et al., 2014), Biology (Macnaught et al., 2013) and Chemistry (Blackie, 2014). Semantic gravity is further elaborated in section 2.2.

In Legitimation Code Theory (LCT) terms, there appears to be an ongoing trend in language learning focusing on topics such as “study skills” or a “learner-centred” (Baeten, Kyndt, Struyven, & Dochy, 2010) or “inquiry-based” learning (Bozalek et al., 2015) approach. These tend to downplay knowledge as the primary object of study (Maton & Doran, 2017). They are “knower” rather than “knowledge-oriented” (Maton, 2013, 2014), and this is evident in much of the English for Academic Purposes (EAP) field. Thus, Macken-Horarik (2011) argues that there is an orientation in English for Academic Purposes (EAP) towards processes (the “how” of English) rather than towards content (the “what” of English). Similarly, Deng (2018) recently claimed that “the relative absence of attention to knowledge has something to do with the ‘learnification’ of educational discourse – the global shift towards talking about learning rather than education” (p. 335). These practices downplaying knowledge have been lamented in studies across faculties (Clarence, 2014, 2016; Clarence & McKenna, 2017; Georgiou, Maton, & Sharma, 2014; Szenes, Tilakaratna, & Maton, 2015; Yates & Collins, 2010) and criticised for their “knowledge blindness” (Maton, 2013, 2014). As Clarence and McKenna (2017, p. 40) point out, strategies developed to explain the knowledge that a curriculum values need to be clear so that students can be guided to use the knowledge successfully. For this research paper, knowledge-oriented explanations were key. These were facilitated using semantic gravity waving profiles.

The modules explored in this paper belong to a Content and Language Integrated Learning (CLIL) environment. Content and Language Integrated Learning (CLIL) is linked to courses promoting L2 competence as well as bilingualism and immersion programmes (Coyle, 2008). The teaching commonly has a dual knowledge focus. On one hand, English language is taught; on the other, subject matter is the object of instruction – for instance, Economics or Sociology. For this dual function, what is generally undertaken is the integration of both content obligatory language (“what-oriented”) and content complementary language (“how-oriented”) (Fortune & Tedick, 2008). Thus, the content complementary language is viewed as the content carrier. Content and Language Integrated Learning (CLIL) is commonly linked to disciplinarity; therefore, some researchers posit that it shares characteristics with English for Specific Purposes (ESP) (Ball, Thames, & Phelps, 2008; Ballinger & Lyster, 2011; Genesee & Lindholm-Leary, 2013; Morton, 2010). However, what seems to make it different to ESP is its dual objective of teaching English for general academic language purposes (EGAP). This dual focus has led to descriptions of Content and Language Integrated Learning (CLIL) classrooms as learning-rich environments (Marsh & Frigols, 2013; Marsh, Mehisto, Wolff, & Frigols, 2010). This is because students need to engage with the disciplinary content as well as think,

read, and write about it in sound academic language. Both are part of the teaching content of the Content and Language Integrated Learning (CLIL) classroom in this paper.

If Content and Language Integrated Learning is input-rich due to this dual approach (Ballinger & Lyster, 2011), it is essential to use a systematic strategy for presenting the content of instruction. Semantic gravity waving is one strategy that can be useful for the presentation of content obligatory language. Language can be conceptualised as content obligatory language (SG-) on a semantic wave profile and the lecturer can concentrate on how this is unpacked and exemplified using content complementary language (SG+). In this way, semantic gravity waving profiles can help to conceptualize and sequence knowledge structures, and to present the interrelationships between concepts. Semantic gravity is further explained in the next section.

2.2. Semantic gravity

Semantic gravity depicts levels of context dependency of knowledge. Maton (2011) defines semantic gravity as:

The degree to which meaning relates to its context, whether that is social or symbolic. Semantic gravity may be relatively stronger (+) or weaker (-) along a continuum of strengths. The stronger the semantic gravity (SG+), the more closely meaning is related to its context; the weaker the gravity (SG-), the less dependent meaning is on its context. (p. 65)

Thus, semantic gravity describes how closely meanings are linked to their context. It is viewed as stronger (SG+) or weaker (SG-) and is commonly analysed using profiles as ranges as shown below in Figure 1 (SD refers to semantic density but is not in the scope of this paper).

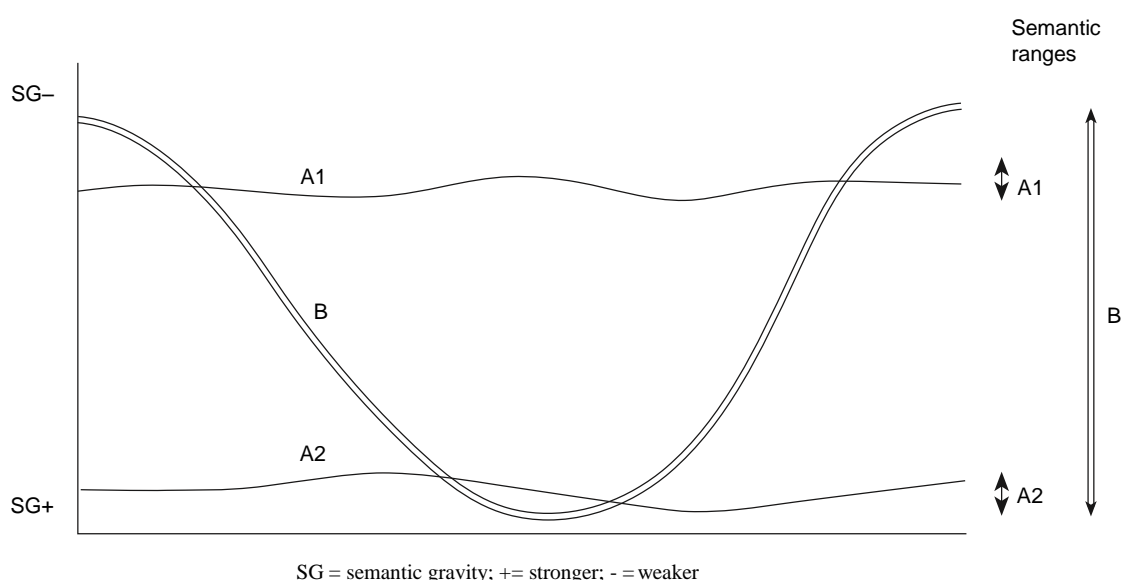


Figure 1. Illustrative profiles and semantic ranges. Reprinted from “Making semantic waves: A key to cumulative knowledge building” by K. Maton, 2013, *Linguistics and Education*, 24(1), p. 13. Copyright 2012 by Elsevier. Reprinted with permission from Elsevier

Using semantic gravity, it is possible to explicitly explore the relations that exist

between knowledge structures. Flatlines can be recorded as profiles with very limited range (refer to A and B in Figure 1). These appear when the meaning of a message remains either consistently context-independent (A=SG-) or consistently context-dependent (B=SG+). For example, referring to several abstract theoretical concepts such as “embodiment” without unpacking their meanings using examples produces a profile with “A” characteristics (SG-). In contrast, recounting a narrative, for example, going into the events of a football match, produces a profile with B characteristics (SG+). Shifts between these meanings construct waves, specifically, semantic gravity waves (C). In this study, the waves presented to students move from SG- to SG+ and back to SG-.

In “Exploring the Nature of Disciplinary Teaching and Learning using Legitimation Code Theory”, Clarence (2016) presents lecturer discourse in an undergraduate Political Science course. Monologues from three classroom lectures are analysed. There was a tendency to produce “high flatlines” (A in Figure 1) describing abstract terms such as “sovereignty” without unpacking them (SG-); or employing informal conversational English creating “low flatlines” (B in Figure 1). If concepts were defined or examples used to help student comprehension, these were not connected effectively. However, Clarence (2016) argues that using Semantics and making semantic waves (C in Figure 1) facilitates the teaching of concepts in the classroom. This study draws on Clarence’s (2016) work by exploring how this strategy can be used to explain several concepts in a Content and Language Integrated Learning classroom. Explanations at discourse and lexico-grammatical levels can be guided as shifting from SG- to SG+ and back again to SG-.

Similarly, Szenes et al. (2015) explore how critical thinking skills may be analysed using semantic gravity. The authors point out how the ability to reflect is viewed as a quality of mind and as sensory in source. By understanding critical thinking as a subjective state of consciousness, the ability to teach and learn it is constrained. The authors argue that this concept is also a part of the subjective doxa in educational practices today, in particular in areas such as “study skills” or “learner-centred” (Baeten et al., 2010) approaches, as noted above. However, through their research on a large number of highly achieving papers in Business and Social Work, the authors conclude that a knowledge of semantic gravity waving can help in equipping students with successful critical reflection writing in these two faculties. They report that a mastery of semantic gravity, and specifically “the capacity to create waves that weave together context-dependent and context-independent forms of knowledge” (p. 586) was viewed highly positively by lecturers. High achieving papers used empirical cases to explain abstract concepts from their courses. Thus, these cases became more generalizable practices for future contexts.

For this study, semantic gravity waving has been found useful for explaining the rationale of a genre pedagogy approach, the structure of an Introduction-Method-Results-Discussion (IMRD) genre, and teaching both lexical coherence for a theoretical framework section and accurate use of determiners with non-count abstract nouns such as “research”.

3. Method

3.1. Context

The research findings were produced over four academic semesters between 2016 and 2018. The studies occurred in two separate English for Academic Purposes (EAP) courses. Both courses pertain to Content and Language Integrated Learning (CLIL) pedagogy. The first sits within the field of the Sociology of Sport; the second looks at Healthy Lifestyles for

Undergraduate Students. Development of students' knowledge of the topics being studied links the courses to the Content element of Content and Language Integrated Learning (CLIL). This content instruction is provided by reading authentic IMRD articles from content-specific journals, such as *The International Review for the Sociology of Sport (IRSS)* and the *Harvard Medical Journal*. The tutor then deconstructs and analyzes these texts in class at discourse (macro) and lexico-grammatical (micro) levels, linking this process to the language element of Content and Language Integrated Learning (CLIL) and drawing on genre pedagogy. Both courses are informed by the genre-based pedagogical approach. This approach is based on the well-known cycle from Rothery and Stenglin (1994).

A genre is defined as a set of social practices developed to perform certain acts or achieve certain goals (Derewianka, 2003). The basic notion of the approach is that academic literacy can be scaffolded by initially deconstructing text models of a genre and reconstructing them with various levels of support; normally this support decreases as learners become more competent with the genre leading to an independent construction. Each stage is designed to achieve different purposes and thus associated with different activities; for example, stage 1 focuses on tasks to help students explore the context by analysing the purpose of the text: Why it was written? For whom? What is the relationship between the writer and audience? Another purpose at this stage is to build field-specific knowledge (vocabulary). Stage 2 involves the deconstruction of a text by exploring its stages and their functions; and analyzing the argumentation and the language features chosen by the writer to persuade the reader. Stage 3 focuses on students producing the genre with scaffolded support; this might start as a whole class writing task or group task. Stage 4 takes students from guided writing to independent production of the particular genre. Stages 3 and 4 normally involve peer evaluation, and a focus on process writing with drafts and revisions. The genre in the case of this research is the Introduction-Method-Results-Discussion structure. The genre-based pedagogical cycle (Rothery & Stenglin, 1994) was used ending in students' own "creative exploitation" (Derewianka, 2003, p. 146), which involved students producing their own Introduction-Method-Results-Discussion texts.

3.2. Design

Findings from the study were collected over two years. Four case studies, with fifteen to eighteen students in each were conducted. Two different courses with students of distinct English language ability were used for this, each course providing two case studies. The Sociology of Sport module comprised students with high proficiency; the Healthy Lifestyles for Undergraduate Students module was comprised of weak and mid-level proficiency students. Each course lasted over a semester and comprised forty-eight hours. The strategy for student feedback collection on the presentations was mixed method survey with closed and open-ended questions distributed using an online survey tool. Answers were anonymous. The following open-ended questions were asked to students from both courses: How useful were the semantic gravity wave presentations? The other open-ended question reported in this study was: Why was this useful/ not useful? After that, the students were asked: Would you like to see more tutors explaining course aims in this way? Did the use of the semantic gravity waving profile help you to better understand how to connect concepts for the theoretical framework section? Finally, the students were asked: Did the use of the semantic gravity waving profile help you to better understand how to use the (in)definite article with non-count nouns like "research"? In addition to this data, extracts from student texts before and after the pedagogical interventions at the lexico-grammatical level are provided and analysed in the findings section to evidence the effectiveness of these uses of semantic gravity wave profiling.

4. Findings

One of the first items of the survey was a 3-point Likert scale question about the usefulness of the strategy for four different explanations. Table 1 below demonstrates that students from the courses responded very positively.

Table 1. Findings from both courses on the use of semantic gravity waving profiling

Use of strategy and number of students				
	Genre pedagogy	Genre structure	Text cohesion	Use of article with non-count nouns
Very useful	55	54	56	54
Useful	3	5	3	4
Not useful	2	1	1	2

In the following sections, depictions of the explanations and the figures accompanying them are presented and discussed. Additionally, in 4.2., an extract from a student's own writing in the theoretical framework section is examined to evaluate the effectiveness of the strategy for connecting conceptual terms in a coherent way as part of the content obligatory language of the course.

4.1. Application of semantic gravity waving profiles to explain the logics of practice

The first two uses of semantic gravity profiling were for more macro elements of the course's disciplinary knowledge. As observed from the quantitative study, students positively evaluated these explanations and accompanying visualisations. From the qualitative data collected, reasons for this appreciation are that these helped develop students' awareness of course structure and how transfer beyond the module was valued. As Macken-Horarik (2011) has noted, transfer is an essential element of a sustainable knowledge-oriented curriculum.

4.1.1. *The genre-based pedagogical cycle*

The following explores the research question: Is applying semantic gravity waving an effective way to present the genre-based pedagogical cycle to students? A heuristic semantic gravity wave profile of the cycle is provided in Figure 2 below. Students were shown this visual and instructed that stage one of the course looks at the discourse level meaning of the sections of the Introduction-Method-Results-Discussion structure and focuses on tasks exploring their functions. This is at the context-independent (SG-) end of the continuum as this content can be generalized across disciplines. Stage two concentrates on analyzing Introduction-Method-Results-Discussion papers in the fields of the two modules taught, Sport Socialization and Healthy Lifestyles. This stage is positioned closer to SG+ as it is more context-dependent due to its focus on a specific subject-field. Students were then told that they would be guided to produce the genre themselves, which is the strongest SG+ as this is related to the single and unique context that each student chooses to explore for their research. They were also informed that the final stage of the course would involve engaging them to consider how they might transfer the knowledge from the sport sociology course to their own disciplines. The Introduction-Method-Results-Discussion is a prominent genre in academia. This focus shifts

back to SG- onto a more generic theme – for example, IMRD genres across disciplines. This is, however, less SG- than stage one, as the topic is partially contextualized by the students’ own disciplinary usage.

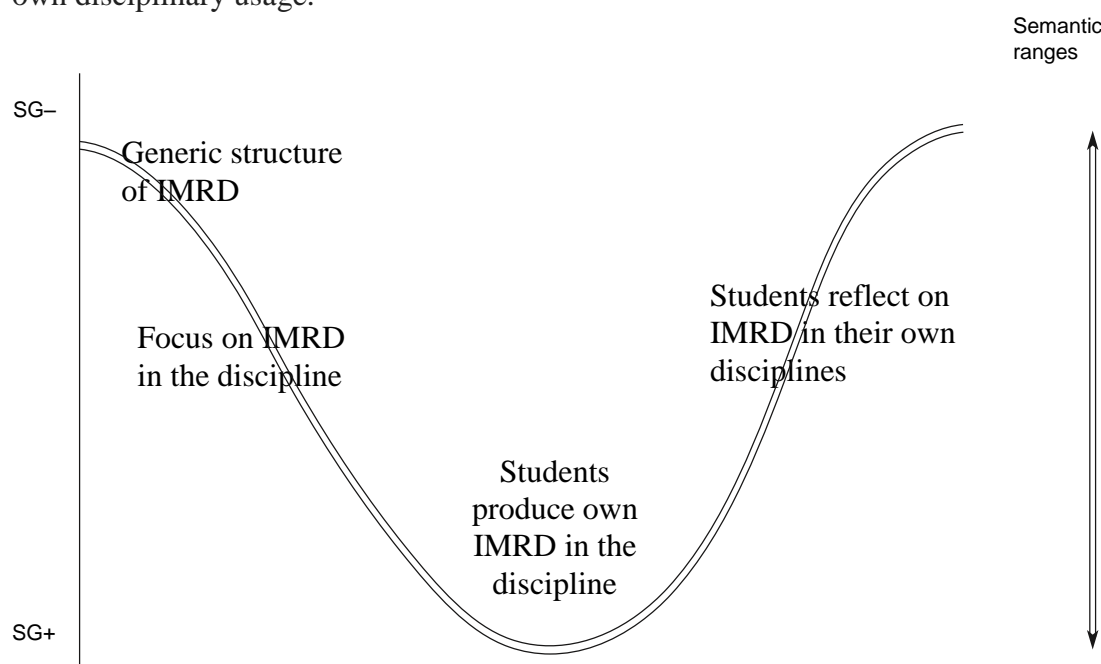


Figure 2. Heuristic semantic gravity wave profile of the genre-based pedagogical cycle

Several qualitative points were raised by students regarding this strategy for explaining the course design:

“The explanation gave me confidence in the tutor”.

“We do not normally have explanations about the course structure in such detail”.

“It helped me to understand the organisation of the course and what I can learn from it”.

“This IMRD structure is new for me but I see it exists in other faculties now, so it is useful to learn about it”.

“The course can teach us an important writing task that is useful in our own speciality”.

“It is very different to some tutors saying we must learn how to be good at writing”.

Having an explanation about how the main aims of the course were both near and far transfer was appreciated. Students positively responded to this explicit presentation of the course aims related to the genre pedagogical approach. This further confirms Macken-Horarik’s (2011) point that transfer should be the goal of a knowledge-oriented curriculum. The explanation enabled students to understand this and to be assured that the main goal, researching for and writing an IMRD is a concrete academic literacies development outcome. This also provided confidence in the tutor, as observed. The reason for this is that a “course outcomes” presentation of this nature enabled the students to see that the learning went beyond more opaque goals such as “improving writing” and developing “study skills”, which have been criticised by educationalists (Boughey, 2013; Boughey & McKenna, 2015; Clarence, 2014; Jacobs, 2013; Mitchell, 2010) in some university settings.

4.1.2. Structure of the IMRD genre

The following explores the research question: Is applying semantic gravity waving an effective

way to present the main structure of the IMRD? This was also interpreted using a semantic gravity waving profile. Students were told that the content shifts from general (SG-) to specific (SG+) and back to general (SG-). Using Figure 3, students were told that the starting point, or introduction of the genre, overviews the academic conversation related to the field of inquiry (SG-). This normally relates to the wider subject matter and then, in the literature review, the topic becomes increasingly context-dependent because there is a shift from the broader academic field to more specific findings from individual research papers related to the research question under investigation. The tutor continued to explain how the Method and the Results sections from the IMRD are then presented (and how this relates to content at the most SG+ level) as it involves specific contexts. Then as these results are discussed, they are reframed and analysed in relation to the broader field of investigation applying the literature review and theoretical framework. Thus, the content tends to shift back towards the SG- range. The conclusion often refers back to the subject matter of the introduction and may also look forward to future research in the field in a more generic way (SG-).

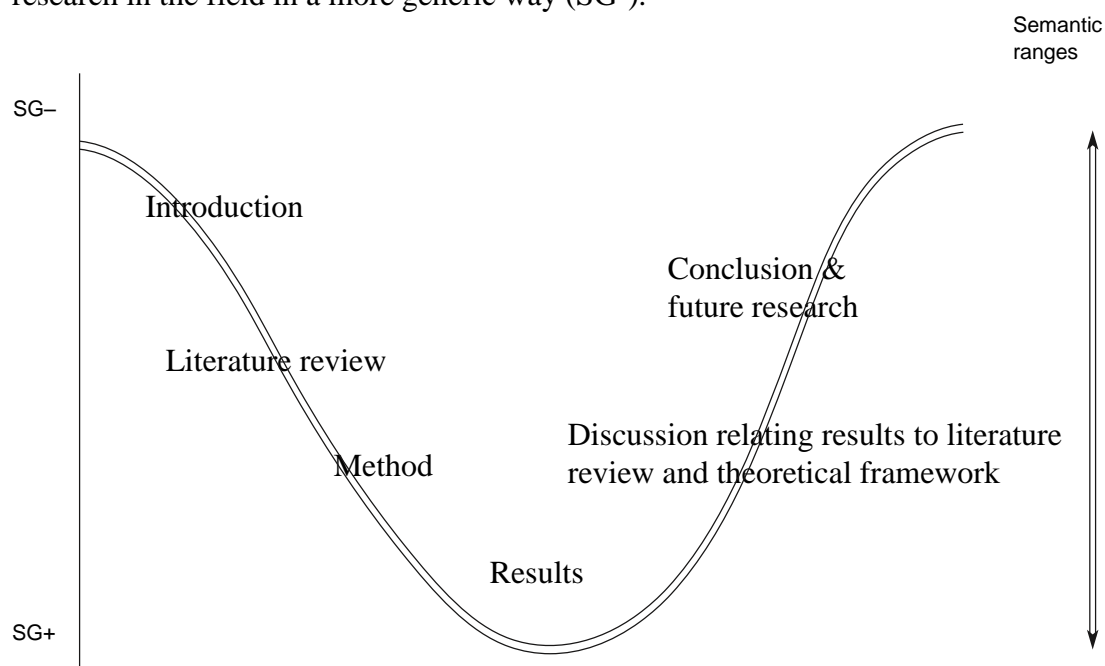


Figure 3. Heuristic semantic gravity wave profile of the IMRD genre structure

Students' responses to the open-ended questions of the survey are provided below:

"We read IMRD in ENG [Engineering] but we are not given explanations as such about what we need to do to research – this is very useful".

"I better understand the patterns in meanings across the areas of the research paper such as how we need to write about the theory in the literature review".

"It showed me how to plan and write a research paper".

"It is logical for explaining the structure of the research paper".

"Since this is new to me, it is very helpful to find out the organisation of the research paper".

From this feedback, it is clear that students were guided to develop an awareness of the structure of the genre stages by presenting these in relation to semantic gravity waving profiles. This awareness is an essential element of the genre pedagogical approach goals as the knowledge code is made visible (Coffin & Donohue, 2012; Derewianka, 2003; Martin & Rose,

2007). Additionally, from their feedback, students understood that the SG- stages required more engagement with conceptual underpinnings and abstract notions such as the content of a theoretical framework; and on the other hand, the Methods and Results required more practice-oriented content, emerging from the research, to achieve the outcome of producing the research paper. Therefore, this presentation acted as a succinct overview of the intended learning processes that students would follow with regard to producing the content of the sections. Interestingly, one student stated that, in other fields, these are not always shared explicitly. This again brings up the importance of Macken-Horarik's (2011) argument about having an orientation to the content (the "what" of English) in the curriculum and underscores the need to provide a more "visible pedagogy" (Bernstein, 1975). From feedback, the semantic gravity waving profiling strategy can help to facilitate this.

4.2. Micro level application of semantic gravity waving profiles

The following section looks at extracts from the text of a student from the Sociology of Sport course. In the survey, the student provided her name and consented to a follow up interview. She reported that the strategy of semantic gravity waving aided her in organising the discourse in the IMRD theoretical framework section. It better enabled her to think about the meanings in the framework and how key concepts should be presented and connected. The theoretical framework section tends to foreground theorizing. This means that conceptual key terms need to be presented and unpacked. The student noted how she had initially found writing this section difficult due to her unfamiliarity with the field of feminist theory.

4.2.1. *Individual sections in the IMRD*

Below is an extract from the student's first draft:

Boardley and Grix (2013) provide insight on male bodybuilders and show their socialization process through muscularity. Jones et al. (2013) and Curry (1993) explain how one's body affects self-identity, particularly regarding discipline of the self and the normalization of pain. Aitchison (2006) brings embodiment into a broader perspective as he illustrates how the media perpetuates the traditional notion of the female body. Connell and Messerschmidt (2005) present hegemonic masculinity and the set of practices that maintain male dominance.

Using semantic gravity waving, the extract represents a high flatline or weaker semantic gravity throughout, with context-independent knowledge structures (see Figure 1). Complex notions should be related between the fields of self-discipline, bodybuilding, and identity. However, the connections in this presentation were not made. Following a presentation of semantic gravity waving, the draft was reconsidered and rewritten to connect concepts logically:

Durkheim (1933) suggests that deviance exists because actions from those outside the norm "shock the collective conscience" (p. 38). In the case of female bodybuilders, pursuing their sport is seen as challenging the social distinction between masculinity and femininity, particularly the traditional notion of the female body (Aitchison, 2006). Unfortunately, female bodybuilders are often met with disapproval. From stares from fellow gym users to insensitive comments, female bodybuilders suffer from forms of opposition. Chare (2004) labels the resistance of female bodybuilders against this cultural norm as the

“radical politics of muscle”. The female bodybuilder’s physique strongly opposes the traditional female body dictated by hegemonic masculinity (Connell & Messerschmidt, 2005), a set of ideologies and practices that reinforce male dominance in society.

It can be seen that the subject matter of this text relates meanings more effectively together, creating better “textuality” (Halliday & Hasan, 1976) or textual cohesion. In this second extract, the key conceptual terms relate much more effectively together using waving to unpack their meanings and connect them. “Deviance” is a collective abstract noun with significant “technicality” (Martin, 2017) or condensed meaning. It is towards the weaker semantic gravity (SG-) end of the continuum. The way the student’s text unpacks this technicality is sound. Shifts from “outside the norm” and “shocking the collective conscience” to “challenging the traditional notion of the female body” are linked semantically. After this, gender-related terms “masculinity and femininity” are used; then, the “female body” helps to contextualise these. Femininity is a technical term and can relate to more than the physical body, for example, language and behaviour can also be depicted as gendered. The “female body” is therefore more context-dependent than “femininity”. Subsequently, the subject further becomes context-dependent with the reference to “female bodybuilders”. This is a particular type of “female body” and thus is less abstract in meaning; it is the strongest context-dependent element. After this, the text again reverts to weaker semantic gravity meanings as the content returns to relatively abstract terms such as “traditional female body” and “hegemonic masculinity”.

4.2.2. Individual language items

Moving further into the micro-level, linguistic items can also be analyzed and presented using semantic gravity waving profiles. Students demonstrated difficulty with non-count nouns commonly seen in academic writing, such as “literature” and “research”, especially those following the Healthy Lifestyles for Undergraduates module. “Literature” and “research” are known as non-count nouns because they cannot be counted. Thus, they have only a singular form and do not collocate with the indefinite article “a”. However, they can use “the” or “zero” article (no article). Additionally, if they are linked to another noun such as project, they may become countable – for example, “a research project”. In order to deal with this common academic language problem, the following anonymized text from a learner of a prior cohort was presented on a screen to the class of students studying Healthy Lifestyles for Undergraduates:

According to research from World Health Organization (2018), nowadays, many students all over the world have too much work for sport. This leads to a sedentary lifestyle. In a research project/ a study (Bister, 2016), sitting too long may do harm to our body. The research/ findings show(s) it may cause weight problems even increase the risk of heart disease. Therefore, the World Health Organization (2018) encourages research on regular exercise, even if it is done for just a short period.

This text demonstrates how the article is used for retrospection or referring back to nouns across the text. Students were told that the first nominal construction (research) is abstract and non-count and that it tends to be towards the SG- range of the continuum. It uses zero article for the first use because it is less context-dependent. If we add the indefinite article “a” by collocating

“research” with another noun, such as “project”, the meaning becomes more context-dependent (SG+); “a study” would also be appropriate at this stage as it has more specific focus and, therefore, context-dependence (SG+) than the generic term “research”. As applying the word “project” means that a piece of research has been identified, the next usage of “research” can collocate with definite article “the”. “The research findings” might also be used at this stage as the meanings become more context-dependent (SG+), that is, going into more depth about the empirical content of this particular study. The wave in Figure 4 below also demonstrates how the abstract, non-count noun “research on exercise” might also be connected and unpacked in a similar way producing a wave and helping to build “textuality” (Halliday & Hasan, 1976). This is more context-dependent (SG+) than the first generic abstract noun “research”.

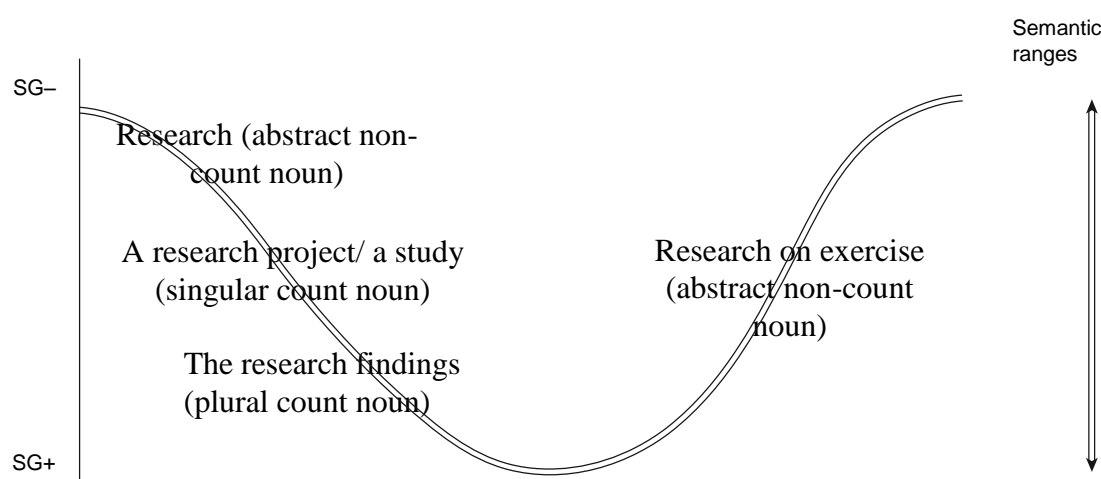


Figure 4. Heuristic semantic gravity wave profile of article usage

The joining and subsequent contextualizing of another related abstract concept such as “research on exercise” can facilitate the creation of another wave. This could be done by pinpointing particular studies in this area, thus producing a set of waves or a “constellation of meanings” (Maton, 2014b, pp. 148-170). It is potentially an indefinite process of abstract nouns and their collocations being added to the semantic gravity waving profile.

The following statements sum up the main gist of the comments on this usage from the open-ended survey with the students:

“I see how general and specific meanings with the article work in English”.

“This is very hard for Chinese students because we do not have the article. It showed us how to think about it”.

“My understanding of rules for the article has improved”.

“This is a good way to understand this grammar”.

This is a particularly difficult element of English grammar. Chuang and Nesi (2006), for example, found that “lexico-grammatical non-count noun error” with “determiner-article error” (p. 255) comprised 27% of the errors from their academic corpus. The explanation provided in Figure 4 focuses on how concepts collocate with the article in English in relation to context-dependency (SG-/+). To sum up, it can be seen from the quantitative data in Table 1 as well as extracts from the qualitative data that the strategy was found to be an effective one.

5. Conclusion

This study has presented how a curriculum can seek to demonstrate some of what it values as knowledge using semantic gravity waving. Knowledge is viewed as an object of study and a product of learning. The semantic gravity waving profiles in Figure 2 demonstrate to students the logic of the genre-based pedagogical approach. The Figure 3 wave explains the structure of the IMRD paper; and as demonstrated, the content of the theoretical framework section can also be partially explained in relation to context-dependency (SG-/±). Connections between important concepts can be constructed to produce a coherent structure. The student draft demonstrates that this coherence can be facilitated applying a semantic gravity waving profile. Finally, Figure 4 shows how semantic gravity waving can be used at the lexico-grammatical level to teach the use of non-count noun behaviour with articles.

The approach of using semantic gravity wave profiles lends less importance to knower-oriented concerns in educational research and practice. These concerns do not provide enough of a focus on how knowledge as a concrete phenomenon is construed in a given field and how it can be treated as an object of study (Maton & Doran, 2017). Maton (2014a) points out that research with semantic gravity waving of the kind presented in this paper is beginning to illustrate its capacity to reveal the contours of “powerful intellectual, curricular and pedagogic practices” (p. 193). Overall, semantic gravity waving seems to be a versatile code with effective explanatory power. Moreover, having had several instances of exploring meanings in this way using semantic gravity waving profiles as a pedagogical tool, students were noticing these patterns themselves and linking them to other contexts, pointing to an awareness raising that might lead to more independent cumulative knowledge building (Maton, 2013, 2014a). This is powerful knowledge if this is the case, and further longitudinal research might help to develop this line of inquiry. It is hoped that the findings from this study contribute to the movement of using Legitimation Code Theory (LCT) to inform educational practice. Both the educator and the student can learn to be more aware of relations within knowledge structures in multiple areas of pedagogy.

References

- Baeten, M., Kyndt, E., Struyven, K., & Dochy, F. (2010). Using student-centred learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review*, 5(3), 243-260.
- Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of teacher education*, 59(5), 389-407.
- Ballinger, S., & Lyster, R. (2011). Student and teacher oral language use in a two-way Spanish/English immersion school. *Language Teaching Research*, 15(3), 289-306.
- Bernstein, B. (1975). Class and pedagogies: Visible and invisible. *Educational studies*, 1(1), 23-41.
- Blackie, M. A. (2014). Creating semantic waves: Using Legitimation Code Theory as a tool to aid the teaching of chemistry. *Chemistry Education Research and Practice*, 15(4), 462-469.
- Bozalek, V., D. Ng'ambi, D. Wood, J. Herrington, J. Hardman, & A. Amory. (Eds). (2015). *Activity Theory, authentic learning and emerging technologies: Towards a transformative higher education pedagogy*. New York: Routledge.
- Chuang, F. Y., & Nesi, H. (2006). An analysis of formal errors in a corpus of L2 English

- produced by Chinese students. *Corpora*, 1(2), 251-271.
- Clarence, S. (2014). Enabling cumulative knowledge-building through teaching: A Legitimation Code Theory analysis of pedagogic practice in law and political science. Unpublished PhD thesis, Rhodes University, South Africa [available at <http://www.legitimationcodetheory.com>].
- Clarence, S. (2016). Exploring the nature of disciplinary teaching and learning using Legitimation Code Theory Semantics. *Teaching in Higher Education*, 21(2), 123-137.
- Clarence, S., & McKenna, S. (2017). Developing academic literacies through understanding the nature of disciplinary knowledge. *London Review of Education*, 15(1), 38-49.
- Coffin, C., & Donohue, J. P. (2012). Academic literacies and systemic functional linguistics: how do they relate? *Journal of English for Academic Purposes*, 11(1), 64-75.
- Deng, Z. (2018). Bringing knowledge back in: perspectives from liberal education. *Cambridge Journal of Education*, 48(3), 335-351.
- Derewianka, B. (2003). Trends and issues in genre-based approaches. *RELC journal*, 34(2), 133-154.
- Genesee, F., & Lindholm-Leary, K. (2013). Two case studies of content-based language education. *Journal of Immersion and Content-Based Language Education*, 1(1), 3-33.
- Georgiou, H., Maton, K., & Sharma, M. (2014). Recovering knowledge for science education research: Exploring the “Icarus Effect” in student work. *Canadian Journal of Science, Mathematics and Technology Education*, 14(3), 252-268.
- Halliday, M. A., & Hasan, R. (1976). *Cohesion in English*. London: Longman.
- Jacobs, C. (2013). Academic literacies and the question of knowledge. *Journal for Language Teaching*, 47(2), 127-40.
- Kilpert, L., & Shay, S., (2013). Kindling fires: examining the potential for cumulative learning in a Journalism curriculum. *Teaching in Higher Education*, 18(1), 40-52.
- Macken-Horarik, M. (2011). Building a knowledge structure for English: Reflections on the challenges of coherence, cumulative learning, portability and face validity. *Australian Journal of Education*, 55(3), 197-213.
- Macnaught, L., Maton, K., Martin, J. R., & Matruglio, E. (2013). Jointly constructing semantic waves: Implications for teacher training. *Linguistics and Education*, 24(1), 50-63.
- Marsh, D., & Frigols, M. J. (2013). Content and language integrated learning. In C. Chapelle (Ed.), *Blackwell Encyclopedia of Applied Linguistics* (pp. 911-20). Oxford: Blackwell.
- Marsh, D., Mehisto, P., Wolff, D., & Frigols, M. J. (2010). *The European Framework for CLIL Teacher Education*. Graz: European Centre for Modern Languages.
- Martin, J. R., & Rose, D. (2005). Designing literacy pedagogy: Scaffolding asymmetries. In R. Hasan, C. M. I. M. Matthiessen, & J. Webster (Eds.), *Continuing discourse on language* (pp. 251-280). London: Equinox.
- Maton, K. (2000). Languages of legitimation: The structuring significance for intellectual fields of strategic knowledge claims. *British Journal of Sociology of Education*, 21, 147-67.
- Maton, K. (2009). Cumulative and segmented learning: Exploring the role of curriculum structures in knowledge building. *British Journal of Sociology of Education*, 30(1), 43-57.
- Maton, K. (2011). Theories and things: The semantics of disciplinarity. In F. Christie & K. Maton (Eds.), *Disciplinarity: Functional linguistic and sociological perspectives* (pp. 62-84). London: Continuum.
- Maton, K. (2013). Making semantic waves: A key to cumulative knowledge-building. *Linguistics and Education*, 24(1), 8-22.
- Maton K. (2014a). Building powerful knowledge: The significance of semantic waves. In B.

- Barrett & E. Rata (Eds.), *Knowledge and the future of the curriculum* (pp. 181-197). London: Palgrave Macmillan.
- Maton, K. (2014b). *Knowledge and knowers: Towards a realist sociology of education*. London: Routledge.
- Maton, K. (2016). Legitimation Code Theory: Building knowledge about knowledge- building. In K. Maton, S. Hood, & S. Shay (Eds.), *Knowledge-building: Educational studies in Legitimation Code Theory* (pp. 1-24). London: Routledge.
- Maton, K., & Doran, Y. J. (2017). Semantic density: A translation device for revealing complexity of knowledge practices in discourse, part 1—wording. *Onomázein*, 46-76.
- Matruglio, E., Maton, K., & Martin, J. R. (2013). Time travel: The role of temporality in enabling semantic waves in secondary school teaching. *Linguistics and Education*, 24(1), 38-49.
- McNamara, M. S. (2010). What lies beneath? The underlying principles structuring the field of academic nursing in Ireland. *Journal of Professional Nursing*, (6), 377–384.
- Morton, T. (2010). Using a genre-based approach to integrating content and language in CLIL: The example of secondary history. In C. Dalton-Puffer, T. Nikula, & U. Smit (Eds.), *Language use and language learning in CLIL classrooms* (pp. 81–104). Amsterdam, the Netherlands: John Benjamins.
- Rothery, J., & Stenglin, M. (1994). *Exploring literacy in school English* (Write it right resources for literacy and learning). Sydney: Metropolitan East Disadvantaged Schools Program.
- Szenes, E., Tilakaratna, N., & Maton, K. (2015). The knowledge practices of critical thinking. In M. Davies & R. Barnett (Eds.), *The Palgrave handbook of critical thinking in higher education* (pp. 573-591). Palgrave Macmillan, New York.
- Yates, L., & Collins, C. (2010). The absence of knowledge in Australian curriculum reforms. *European Journal of Education*, 45, 89–102.