

Review research paper

A CLAUSE COMPLEX ANALYSIS OF PROBLEM STATEMENT SECTIONS IN MPhil THESES ACROSS THREE DISCIPLINES IN A GHANAIAN UNIVERSITY

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Abstract. *Academic writing is considered persuasive (Hyland 2008) and as post-graduate-students negotiate their entry into the research community, they are expected to build a formidable argument to create a research space for themselves in their research problem statements. As such, how they build logical connections of ideas in their problem statements is key, varying from one discipline to the other. This study explores the Problem Statement sections of MPhil theses, using Halliday and Matthiessen's (2004/2014) notion of clause complexing in Systemic Functional Linguistics (SFL). Specifically, the study focused on the tactic and the logico-semantic relations of the Problem Statements sections of three disciplines: Mathematics, Nursing, and English Language in the University of Cape Coast, Ghana. The findings reveal that regarding the basic clause complex structure of the three disciplines, English Language uses a lot of clause complexes compared to the other disciplines. Also, all three disciplines use considerable hypotactic relations and hypotactic projection of locution instead of idea since in the problem statements, writers report what others have said and not their own thoughts. In terms of relations of expansion, there are variations in the three disciplines, with English language favoring elaboration whilst Mathematics favor extension and enhancement. The use of expansion relations for Nursing is closer to that of English language. It is suggested that clause complexing is not only determined by genre and mode but also conventions of academic discipline. The findings have implication for theory and disciplinarity in academic writing.*

Key words: *Academic writing, SFL, Clause complex, Disciplinary variation, Problem statements*

INTRODUCTION

Academic writing has become an area of scholarly interest and a lot of literature have concentrated on its development (Hyland 2004; Janks 2012; Paltridge and Starfield 2007). Academic writing can be viewed as an analytical process of writing that focuses on different perspectives, theories and concepts. Hyland (2011) posits that academic writing is persuasive and makes use of arguments demonstrated through “absolute truth, empirical evidence or flawless logic” (p. 194). Graduate students, as part of their degree requirements, face different writing tasks as they work to earn their desired degrees (Swales and Feak 2004), and one of the requirements is for them to produce a thesis at

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the end of their studies. This requires them to identify an area of interest and to formulate a problem that must be researchable in order to fill a gap in the research space within the research community.

Every research begins with a problem. The problem statement of theses or research articles (RAs) is one of the key ways through which one negotiates entry into a research community (Ankomah and Afful 2019). In writing problem statements, researchers are expected to be persuasive and relate their independent beliefs to shared experience (Hyland 2008). They offer a solid justification for the research by presenting a convincing argument for the need to undertake the new research (Ankomah and Afful 2019). It is in the problem statements section that researchers establish a niche which they occupy to make their research relevant in their fields of study. Shoket (2014) posits that research problem statements encompass “areas of concern, a condition to be improved, a difficulty to be eliminated, or a troubling question that exists in scholarly literature, in theory, or in practice that points to the need for meaning understanding and deliberate investigation” (p.512). Research problem statements, therefore, give the focus or reason for undertaking any research or scholarly investigation and also situate researchers within the research space.

One viable framework for investigating how researchers carve a niche for themselves is Swales (1990) CARS (Create-A-Research-Space) model. Since the inception of Swales’s (1990) CARS model, various studies have used the model to investigate how researchers create and occupy a niche in research from various disciplines, looking at the rhetorical move structure and the lexico-grammatical features that typify those moves (e.g., Abdullah 2016; Adika 2014; Afful 2010; Ankomah and Afful 2019; Kanoksilapatham 2007). The disciplines explored include Engineering (Anthony 1999; Abdullah 2016), English and Applied Linguistics (Abdullah 2016; Ankomah and Afful 2019; Dabamona et al. 2022; Kawase 2021; Ozturk 2007), Mathematics (Graves et. al. 2014; Moghaddasi and Graves 2017; Moghaddasi et al. 2019). These studies reveal that establishing a niche is an important strategy for making argument for new research in various disciplines. However, there seems to be no generalized model for all disciplines since patterns of the writing styles of various disciplines differ. For instance, Graves et. al (2014) identified “establishing presumptions” as important for making arguments in Mathematics RA introductions. He observes that Mathematics uses their presumptions in addition to variations in the CARS model to create a research space, arguing that this is due to the hypothetical nature of mathematical concepts and the grounds that Mathematics is a “logic-driven, argumentation-mediated discipline. This affirms McGrath and Kuteeva (2012) who note that Mathematics does not share common grounds with the Hard Sciences; that is, it has epistemological uniqueness and is not easily classified as empirical, unlike Natural Sciences, and is not dependent on interpretation of data but usually limited to a binary true or false. This makes it important to further explore how writers within the discipline organize language coherently at the clausal level to make their argument for a new research - a gap this study seeks to fill by examining the clause complex relations of research problem statements in MPhil theses across three disciplines.

Moreover, the study of language variation in academic discourse has also received impetus following the interest in works such as Halliday’s register theory, Swales’s (1990) genre analysis and Hyland’s (2006) variation in academic discourse. Many studies have looked at disciplinary variation in various aspects of academic writing, including

citation (Afful and Janks 2013), statement of purpose (Chen 2017), marked theme in method sections (Ebrahimi, 2016) and rhetorical choices (Afful and Mwinlaaru 2012; Hardy and Romer 2013). Variation in logical connections between clauses in academic writing has not received much scholarly attention. It will, therefore, be interesting to look at how researchers in some selected disciplines link clauses in order to present their arguments as textually-related ideas in their problem statement sections where they persuasively make a case for their research.

Swales and Feak (2004) identify six important characteristics of academic writing which must be given important consideration: audience, purpose, organisation, style, flow and presentation. 'Flow', according to Swales and Feak (2004), is important for successful communication in academic writing and it involves the establishment of a clear connection of ideas to help readers comprehend the text. This connection encompasses linking words, phrases, clauses, sentences etc. to join ideas together. The present study considers the 'flow' between the clauses in the problem statements of MPhil dissertations across three disciplines.

Specifically, the study investigates the logical flow of meaning in the problem statements across the disciplines of Mathematics, Nursing, and English Language and this is achieved by answering the following research questions:

1. What is the basic clause complex structure of problem statements across the three disciplines in MPhil dissertations?
2. What is distribution of taxis relations in the problem statements across the three disciplines in MPhil dissertations?
3. How are the logico-semantic relations used to realise problem statements across the three disciplines in MPhil dissertations?

THEORETICAL FRAMEWORK

Systemic Functional Linguistics (SFL)

Systemic Functional Linguistics (SFL) is a linguistic theory that views language as a social practice. The central claim of systemic theory is that "language is a resource for making meaning" (Halliday and Matthiessen 2004: 23) and that meaning is inherent in the systemic patterns of choice. Referring to language as choice, systemic theorists like Halliday (1994), Eggins (2004) and Martin (2010), give priority to the paradigmatic uses of language since the linguistic choices made by writers and speakers within the context of other potential choices that the user could have made are of maximum importance. SFL also maintains that language performs three meta-functions (Eggins 2004; Halliday and Matthiessen 2004/2014) which are the ideational, interpersonal and textual. However, this study adopted the logical meaning under the ideational meta-function since it involves the logical structure of the clause complex to encode meaning.

Clause complex refers to the grammatical and semantic unit that is formed when clauses are linked systematically (see Eggins 2004; Downing and Locke 2006; Halliday and Matthiessen 1994; 2004; 2014; Thompson 2014, for detailed description). It occurs in both spoken and written discourse. It deals with "how the flow of events is construed in the development of text at the level of semantics" (Halliday and Matthiessen 2004: 365). Eggins (2004) refers to it as the "logical chaining of experientially related meanings" (p. 258). Thus, a clause complex deals with how two or more clauses are combined and

presented as a textually-related message with explicit signals, such as conjunctions, indicating their interdependence. A clause complex analysis, therefore, helps to capture “significant dimensions of *flow* or *packaging* in a grammatical unit” (Egins 2004, p. 256), provides resources for construing logical connections between events and for developing meaning in any grammatical unit. There are basically two sub-systems under the system of the clause complex: taxis and logico- semantics.

The system of taxis refers to the type of interdependency relations between the linked clauses in the clause complex (Egins 2004; Halliday and Matthiessen 2004, 2014). This relates to dependent and independent clauses in Traditional Grammar terms. This system is made up of two categories: parataxis and hypotaxis. In paratactic relations, the clauses relate as equal independent entities, whereas in hypotactic relations, there is a dependency relationship. Halliday and Matthiessen (2004) propose (1, 2, 3) and (α , β , γ) to represent paratactic and hypotactic relations respectively. Thus, a clause complex is made up of two or more interdependent clauses which may be either paratactic, hypotactic or both, and it is simplified in Table 1 below:

Table 1 The system of Taxis (Halliday & Matthiessen, 2004, p. 376).

	Primary	Secondary
Parataxis	1 Initiating	2 Continuing
Hypotaxis	α (dominant)	β (dependent)

Paratactic clauses are linked by simple punctuations such as *comma*, *semi colon*, *colon*; and paratactic conjunctions such as *and*, *so*, *but*, *yet*, *neither...nor*, *either ...or* etc., whilst hypotactic clause boundaries are marked by relative pronouns (eg., who, that), hypotactic or subordinating conjunctions (eg., while, although, because), and verbal conjunctions (eg., supposing that, provided that). All non-finite clauses are also hypotactic.

The system of *logico-semantic* relations refers to the type of semantic relations between the linked clauses in the clause complex, whether dependent or independent. This system is sub-categorised into *projection* and *expansion* (Egins 2004; Halliday and Matthiessen 2004/2014; Thompson 2014). The system of *projection* indicates the attribution of what someone said (locution) or what someone thought (idea). Projection cross-selects with taxis. *Locution* and *idea* are represented by the symbols (“) and (‘) respectively. The system of expansion develops the clause in three ways: *elaboration*, *extension* and *enhancement* (Halliday and Matthiessen 2004/2014; Egins 2004; Thompson 2014; Nguyen 2013). *Elaboration* describes the relationship of restatement, where one clause restates or elaborates the meaning of another by providing an exposition or clarification, and it is represented by (=). The system of extensions describes relations of addition, variation or alternation represented by (+). It is marked by additive ‘and’, negative addition ‘nor’, adversative ‘but’; conjunctions like *instead of*, *except for* and alternation ‘or’, *either or*, *if not*. The last system enhancement, which is the largest sub-category under logico-semantic, describes relations of time, space, cause, condition, manner, consequence, concession, etc., and is represented by (\times). Enhancement, according to Egins (2004), is parallel to the circumstantial elements in transitivity structure of the clause. The system of expansion also cross-selects with taxis, so we can have hypotactic expansion or paratactic expansion. In conclusion, Halliday and Matthiessen (2004) assert that clause complex patterns are determined by contextual dimensions of genre and mode. Also, written texts use less

intricate clause complexes compared to spoken texts and that complexing is associated with spoken discourse.

Many researchers have employed the clause complex model to analyse texts from different perspectives, such as media discourse (Adjei and Opoku, 2017; Eid, 2016; Nasution, 2019), or literary discourse (Huang, 2021; Kurnia and Hidayat, 2019; Mayasari, Lubis and Putri, 2021; Wulansari, 2017). From the perspective of academic discourse, Leong (2021) studied forty research articles from the humanities and the hard sciences, with the argument that the two disciplines constitute two distinct varieties. The findings show the same distribution of dependent and independent clauses in the writings of the two disciplines. Also, the sciences make considerable use of clause simplexes and paratactic extensions, whilst the articles in the humanities make substantial use of embedded clauses and projections in their writings. The study emphasises that writing in the sciences makes more use of simple clause structure than writing in the humanities. The study is significant, as it demonstrates disciplinary variation in the use of tactic and logico-semantic relations. Other studies within academic discourse have concentrated on biodata (Mwinlaaru 2017), abstracts (Raputri 2022), undergraduate students' writing (Yuniar 2018; Ngongo 2018), and citation (Jomaa and Biden 2019). All these studies reveal a substantial use of *expansion*.

DISCIPLINARITY IN ACADEMIC WRITING

Disciplinarity has received scholarly attention, following Becher's (1989) exposition on academic territories which emphasises the importance of academic 'tribes' and 'territories' and the uniqueness of each discipline in terms of the conventions that influence how they do things. An academic discipline "is a field or site of scholarly inquiry (often linked to a profession outside the academy) having a central object of study, set of questions, or activity that causes people with related projects to identify with the discipline" (Wardle and Downs 2018, p. 112). Similarly, Hyland (2006) views discipline as "institutional convenience, networks of communication, domains of values and modes of enquiry" (p.18) which are recognized in the academia by the existence of departments (Becher and Trowler 2001). Becher (1994) categorizes the disciplines based on the nature of knowledge in the discipline. For instance, he groups them into hard-pure (pure sciences, e.g., Physics), soft-pure (Humanities, Social Sciences, e.g., Anthropology), hard-applied (Technologies such as Mechanical Engineering), and soft applied (applied Social Sciences such as Education and Law). Wardle and Downs (2018) argue, "disciplinarity offers institutional standing crucial to the development of a field of study and to the ability of its participants to make meaningful change in the areas they study" (p.110). Thus, the behaviour and values of academics are strongly determined by knowledge structures of their disciplines.

Disciplines bring about the concept of discourse community and research affirms the distinctiveness of genres around the concept of discourse community. Genres and communities are mutually defining (Swales 1990; Hyland 2006), and the interests of researchers have been directed towards how genres are written, used, and the responses they generate from individual members of the social group. Becher (1989) describes the communities as tribes with its own set of conventions, mode of enquiries, etc., and they essentially draw on contexts to produce and interpret written and spoken discourses (Hyland 2006). Academic contexts and texts are, therefore, an embodiment of social

negotiations of disciplinary inquiry which reveal how knowledge is construed and negotiated (Hyland 2004). Communication is, therefore, key to the academic enterprise. As posited by Becher and Trowler (2001), “academic cultures and disciplinary epistemology are inseparably intertwined” (p. 23). Hyland (2004) argues that disciplines are defined by their writing, and writing creates disciplines by determining their members, how members relate to each other and what they count as knowledge. Hyland (2008) posits that writers make rhetorical choices to connect their texts to their disciplines. He observes that sciences accept new knowledge based on experimental proofs, while the humanities rely on narratives and case studies, with claims that are accepted and based on the strength of arguments. This presupposes that each discipline values different kinds of arguments and writing tasks. These variations in the discipline, according to Lampi and Reynolds (2018), differ from one context to another with the students’ contextualized learning environment shaping the conventions of the discipline. Samraj (2005) also observes that disciplinary variation in academic writing does not only manifest in rhetorical structures, but also in their relationship with other genres.

Various studies have demonstrated that there are disciplinary variations in various aspects of academic writing, such as statement of purpose (Chen 2017), citation (Afful and Janks 2013; Charles 2006), rhetorical choices (Afful 2010; Afful and Mwinlaaru 2012; Hardy and Romer 2013), readability and clarity of written texts (Hartley, Sotto and Fox 2004), and authorial identity and disciplinary constraints (Hyland 2009). Hartley, Sotto and Fox (2004), for instance, employed computer-based readability measures to study the clarity of texts in the Sciences, Social Sciences, Arts and Humanities. Findings revealed that scientific texts use shorter and simple sentences and were easier to read than their parallel texts in other disciplines. The common trend in disciplinary studies reveal that not much consideration has been given to how the disciplines of Mathematics, Nursing and English Language vary in terms of the systematic meaningful ways in which they combine two or more clauses to present their arguments in writing problem statements. This study fills this gap by looking at how three disciplines build logical connections between the clauses in their research problem statements for the overall coherence of their message.

DATA AND METHOD

The study adopted the qualitative research method, considering the exploratory nature of the study, to investigate the interdependence and the logical relations in the clauses of the problem statements of the three disciplines. Qualitative research focuses on making meaning of a particular phenomenon, and understanding a process by analysing words or pictures. According to Creswell (1994), this design is flexible in its application and appropriate for expanding and describing specific phenomenon. Specifically, we used the qualitative content analytic approach since it is most suitable for analysing documents such as texts. Hsei and Shannon (2005) define qualitative content analysis as “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (p.1278). We employed both the directed and summative content analytic approaches to the study. The directed content analysis helped us to employ the clause complex system of SFL to develop the coding frame of the data, whilst the summative content analysis allowed us to quantify the patterns and present the results statistically.

The institutional context for the study is University of Cape Coast, a top university in Ghana. The university is ranked by the 2021 Times Higher Education World University Ranking as the number one in Ghana and West Africa, top five in Africa, and number one globally, for research influence. The University strives to produce highly qualified and skilled manpower for both locally and globally, which is also the core mandate of all the departments within the University. In the university of Cape Coast, there are one hundred and sixteen (116) academic departments administratively organised into eighteen (18) faculties/ schools and five (5) colleges. The academic disciplines within the university are situated within various departments. For the purpose of this study, the Departments of Mathematics, Nursing and English Language were chosen.

The data for the study consist of the Problem Statement sections of thirty MPhil dissertations downloaded from the University of Cape Coast repository (<https://ir.ucc.edu.gh>). The thirty dissertations were made up of ten from each discipline. They were selected from 2018 to 2021. The data was conveniently sampled, starting with the most recent from 2021 till we got the required number. The data were assigned labels, EPS1, MPS1 and NPS1 for the first set of dissertations from English Language, Mathematics, and Nursing respectively, where PS represents problem statement and the initial alphabets E, M, and N represent the disciplines respectively.

With regard to the procedure of analysis, we employed Halliday and Matthiessen's (2004, 2014) notion of clause complex which deals with univariate structures. The problem statement sections of each of the dissertations were extracted and typed into an excel sheet for the clause complex analysis. We followed the coding frame of Eggins (2004) for the clauses and so for easy presentation, each clause was indicated on a separate line indented from left to right. Embedded clauses were shown in parentheses. The study presents two layers of analysis; that is, the clause is analysed for taxis and logico-semantic relations. We gave samples of the analysis to two post-graduate students to go through after giving them prior orientation on the coding system of the clause complex model. The results showed 90% and 91% agreement respectively. The points of disagreement were referred to a senior scholar in SFL who helped to resolve them.

ANALYSIS AND DISCUSSION

The analysis and discussion were centered on the distribution of taxis and logico-semantic relations used by the three disciplines in their problem statements analyzed. Simple descriptive statistics were used to present the occurrences of the various relations in percentages for easy understanding. The results of the analysis are presented as follows.

Basic Clause complex structure across the three disciplines

Table 2 shows the summary of the basic clause complex structure for all three disciplines including the distribution in percentages.

From Table 2, there is a similar ratio of text length in terms of the number of words and sentences used by Nursing and English language, which is 5553 and 5321 respectively. The discipline of Mathematics, however, has an equivalence of almost 40% lower in text length when compared to Nursing and English language. This suggests that writing Problem Statements in Mathematics uses relatively shorter text length compared to Nursing and English language; thus, affirming Afful (2016), Hartley, Sotto and Fox's (2004) observation

that writers in the sciences produce shorter sentences. However, Nursing which has a text length equivalent to that of English ignites the debate whether the Nursing discipline belongs to the hard or soft sciences. VanLandingham (2014) argues that the ‘hard’ and ‘soft’ science label is meaningless when it comes to public health. Generally, nursing does not only draw from the hard sciences, but also has relations to professional practice which incorporates elements from health and social sciences.

Table 2 Basic Clause Complex structure summary for all three disciplines.

	Mathematics	Nursing	English Language
No. of Words	2821	5553	5321
No. of Sentences	114	193	171
No. of Clause Simplex	55 (48%)	91 (47%)	47 (27%)
No. of Clause Complex	59 (52%)	102 (53%)	125 (73%)
No. of Embedded Clauses	-	16	14
No. of Clause Complex of 2 Clauses	39	65	45
No. of Clause Complex of 3 Clauses	14	24	44
No. of Clause Complex of 4 Clauses	1	8	21
No. of Clause Complex of 5 Clauses	4	3	7
No. of Clause Complex of 6 or More Clauses	-	1	7

In terms of the distribution of clause simplex and clause complex, it can be seen from the table that both Mathematics and Nursing display similar percentages for their use; that is, 48% and 47% for clause simplex, 52% and 53% for clause complex distribution between Mathematics and Nursing respectively. The difference in percentage of clause simplex and clause complex suggests that Mathematics and Nursing favour a seemingly equal distribution of clause complex and clause simplexes in their problem statements. There are almost as many clause complexes as clause simplexes. However, it can be observed from the Table 2 that English language tends to favour the use of more clause complexes in their problem statements, accounting for 73% use of clause complex as against 27% use of clause simplex. This corroborates Leong (2021) who also noted that the sciences use more clause simplexes than the humanities with a statistically significant difference.

The use of clause simplexes is associated with academic writing because of its frequent use of nominalisation, affirming Hyland’s (2006) observation that academic writing is characterized by nominalized style, and in terms of lexical density, it is also very dense. Compared to English Language, Mathematics and Nursing use more simplexes. Let us consider the examples below from the Mathematics discipline:

Extract 1

- Clause simplex 1 Finding *the roots of a system of nonlinear equations* is *one of the important problems in most numerical computations* especially in areas associated with engineering applications.
- Clause simplex 2 However, *the convergence and performance characteristics* is highly dependent on *the good initial guess of the solution*.

(MPS1)

From Examples 1 and 2, it can be seen that the sentences are full of noun phrases, the only verb phrases in Sentence 1 are ‘finding’ and ‘is’. The higher use of nominalisation shows that there is high lexical density in the writings of Mathematics. English language is, however, geared towards spoken style. For the dominant use of clause complex by the English language discipline, it can be argued that the writings of English language in the problem statements is closer to spoken style than the sciences. Let us consider the clause complex below:

Extract 2

α	3i	This is essential
x β	3ii	because one needs
xy	3iii	to consider the gradient nature of language
x δ	3iv	and understand
= ε 1	3v	that linguistics need not necessarily be a report on what is ideal
+2	3vi	but must first account for all possible options
+3	3vii	and thereafter determine the ideal categorial predictor
+4	3viii	or evaluate the strength of the predictors (Bresnan & Ford, 2010; Bresnan, 2007; Gries, 2003).

(EPS10)

From Clause Complex 3 above, the use of the coordinators ‘and’, ‘but’ ‘or’ and information density, the higher proportion of verbs used compared to that of Mathematics makes it more geared towards spoken style in their problem statements as Halliday and Matthiessen (2004) assert that clause complex is particularly associated with texts since it represents the ability to put together long and intricate patterns and simultaneously maintain the flow of discourse.

Moreover, this picture challenges Eggins (2004), Halliday and Matthiessen (2004; 2014) who argue that spoken language tends to favor dynamic patterns of clause complexing than written texts. They further argue that the difference between spoken and written language in terms of complexing is reinforced by the dramatic difference in the use of embedded clauses. Their argument here is that clause complexing is mostly used by spoken texts, whilst written texts make use of embedded clauses. From the table 2, it can be seen clearly that Mathematics does not favor the use of embedded clauses. The embedded clauses are only seen in the writings of Nursing and English language and their instances in the texts are 16 and 14 respectively. Leong (2021) also observes lower occurrence of embedded clauses in Science articles. This, therefore, affirms that academic writing in sciences is structurally simpler than that of the humanities.

Also from Table 2 it can be seen that in terms of distribution of the number of complexes, there is not much significant difference, as all the three disciplines use dynamic patterns of complexes with English Language using significant dynamic patterns of complexes of 7 clauses with more than ten instances. From the above discussion, it can be argued that the view by Eggins (2004) and Halliday and Matthiessen (2004/2014) that frequency and types of clause complex is related to genre and mode is not always the case; it can also be related to discipline.

Taxis relations

Table 3 below gives a summary of the taxis relations for all the three disciplines. It must be noted that taxis will exceed the clause complex numbers.

Table 3 Summary of Taxis for all Three Disciplines

TAXIS	Mathematics	Nursing	English Language
Parataxis	44 (29%)	67 (25%)	55 (14%)
Hypotaxis	107 (71%)	205 (75%)	351 (86%)
Total	151	272	406

From the Table 3 above, the tactic or dependency relations show that there is a greater difference in the use of paratactic relations. There is a quasi-equal proportion of the use of hypotactic relations between Mathematics and Nursing; that is, 71% and 75% respectively. English language on the other hand makes significant use of hypotactic relations, accounting for 86% usage in their problem statements. This means that for all the disciplines, they make considerable use of hypotactic relations, affirming Leong (2021) who also observed that in terms of the distribution of dependent and independent clauses in the articles of both the sciences and the humanities, both disciplines favor the use of independent clauses in establishing flow in their writings. The examples below illustrate the taxis relations from English language, Mathematics and Nursing respectively.

Extract 3

α 4i Such a consideration will help establish the strength of the many factors
 $=\beta$ 4ii that determine either singular or plural agreement. (EPS10)

α 5i The present study attempts
 $x \beta$ 5ii to explore other methodologies in characterizing the prices of these products. (MPS4)

α 6i It is therefore not known
 $x \beta$ 6ii if the nursing care provided for the older adults in the hospitals meet their peculiar healthcare needs as older adults. (NPS9)

From the examples above, it can be seen that all the three disciplines use the hypotactic relations either to elaborate or to clarify, and to provide enhancement.

Projection

This section discusses the results for logico-semantic relations of projection for all disciplines summarized in Table 4 below. In projection, one clause links the other clauses by telling us who said or thought something. The linked clauses then reports or quotes what was said or thought about.

Table 4 Summary of Projection for all Disciplines

Logico-Semantic		Mathematics	Nursing	English Language
Projection	Locution	4	34	37
	Idea	-	-	1
	Total	4 (5%)	34 (22%)	38 (14%)
Hypotaxis	Projection	4 (5%)	33 (22%)	38 (14%)
Parataxis	Projection	-	1 (1%)	-

According to Table 4, all disciplines make considerable use of projections of locution instead of *idea*. Locution is attribution to sources (Eggins, 2004) and it is evident that all the disciplines use scholarly sources to build logical arguments in their problem statements. Comparatively, Nursing and English make frequent use of projected locution as compared to Mathematics. There is only one use of projection of 'idea' and this can be attributed to the fact that in academic writing, writers report or integrate literature on what researchers say, observe, note, etc., rather than their thoughts. The clause complexes below illustrate hypotactic projection of locution from Nursing, English Language and Mathematics respectively.

Extract 4

α	7i	Opoku-Boateng (2016) revealed	
" β	7ii	that caregivers experience a low quality of life.	(NPS1)
α	8i	He argued	
" β	8ii	that native speakers can through intuition guess	
" γ	8iii	that active is preferred over passive structures; positive over negative forms, declarative over interrogatives; this over that;	
" δ	8iv	but will be uncertain about the relative frequencies of singular and plural forms.	(EPS10)
α	9i	Li et al. (2015) explained	
" β	9ii	that, these algorithms are too complicated	
" γ	9iii	or expensive to calculate	(MPS1)

The hypotactic projection of locution in the three disciplines also suggests that in problem statements of MPhil dissertations, writers do not construct themselves as authorities and, therefore, it becomes imperative for them to source comments to others. Also, writers use hypotactic locution to avoid direct quotations and by using hypotactic locution their 'voice' stands out in the argument.

Relations of Expansion

In the relations of expansion, elaboration relates to restatement or clarification, extension relates to addition, variation or alternation and enhancement relates to ways by which one clause develops on the meaning of another by dimensions of time, condition, purpose, concession etc. Table 5 below gives a summary of the relations of expansion for all three disciplines.

Table 5 Summary for Logico-semantics of all three Disciplines

Logico-semantic		Mathematics	Nursing	English Language
Expansion	Elaboration	21 (26%)	50 (42%)	103 (45%)
	Extension	23 (28%)	27 (23%)	40 (18%)
	Enhancement	37 (46%)	42 (35%)	84 (37%)
	Total	81 (95%)	119 (78%)	227 (86%)

From Table 5 above, it can be seen that with regards to the relations of elaboration, Nursing and English Language make significant use of elaboration as compared to Mathematics. It can be argued that, in Mathematics, there is nothing to elaborate; there are no 'in other words' for formulas as compared to the problem statements in English and Nursing. This affirms that Mathematics is logic-driven (Graves et al. 2014) and limited to a binary true or false (McGrath and Kuteeva 2012). English Language, on the other hand, makes use of arguments, meaning that writers explain more to make their arguments convincing. This confirms Hyland's (2008) observation that the scientists accept new knowledge based on experimental proofs, whilst the Humanities researchers base their claim on the strength of their arguments. The more elaboration, the more argumentative a text is; this accounts for more clause complexing in the English language data. The problem statements from Nursing also tend to follow this direction. Below are examples of elaboration from Nursing and English language respectively.

Extract 5

- | | | | |
|------------|-------|---|--------|
| α | 10i | The above explanation shows clearly | |
| = β | 10ii | that the health/nursing care of the aged has attracted little attention in Ghana. | (NPS9) |
| α | 11i | It becomes imperative | |
| = β | 11ii | then that we shift attention from the traditional approach of literary or thematic analysis | |
| = γ | 11iii | which previous studies on the novel employed. | (EPS7) |

In relation to extension, that is where writers add new information, it can be seen that Mathematics, surprisingly, use significant percentage of extension. From the data, although there is little argumentation in Mathematics, there is more addition of new information, with each of the clauses saying a different thing. The examples below illustrate relations of extension from the three disciplines, Mathematics, English and Nursing respectively.

Extract 6

- | | | | |
|-------------|-------|---|--------|
| 1 | 12i | Like previous works, we build hierarchical graph for the hemoglobin Protein domain | |
| +2 α | 12ii | and use graph invariants and graph centralities | (MPS8) |
| 1 | 13i | Increasingly, the perspective that new varieties are legitimate means of communication in their own right is gaining acceptance | |
| +2 | 13ii | but the other perspective [that new varieties are errors] still lingers on | |
| +3 α | 13iii | and the only way to put it to rest is | (EPS5) |
| 1 | 14i | Moreover, in developing countries, taking care of the sick is mostly informal (unpaid services) and | |
| +2 α | 14ii | this role is carried out frequently by IFCs | (NPS1) |

With regards to enhancement relations, it can be seen that Mathematics, (46%) uses more enhancement compared to the two, Nursing (35%) and English Language (37%). The kind of enhancement used here is more formulaic, meaning that Mathematics uses formulaic language for enhancement. Thus, the language itself mirrors the discipline. Let us consider the examples below from Mathematics.

Extract 7

- α 15i The results by Adivar & Raffoul (2012) and Funakubo et al. (2006) on stability of solutions of Volterra integro-differential equations (VIDEs) does not extend to linear Volterra integro-differential equations of the form ###
- $x\beta$ 15ii where $\tau_i > 0$ is a constant, $q_i : [0, \infty) \times [-\tau, \infty) \dots$ (MPS9)
- α 16i Raffoul (2006) obtained sufficient conditions for the zero solution of the difference equation ###
- $x\beta$ 16ii to be asymptotically stable.
- 1 17i This equation however is a scalar equation
- $+2\alpha$ 17ii and so the stability results do not apply to the system of difference equations ###,
- $x\beta$ 17iii where, # is an ### matrix. (MPS6)

From the examples 15ii, 17iii above, it can be seen that enhancement is used to give modification information on a formula, whilst enhancement in 16ii is used to indicate purpose.

In conclusion, it can be seen from the analysis of the tactic and logico-semantic relations of the clause complexes, that there are some similarities and variations in the logical meanings of problem statements from the three disciplines.

CONCLUSIONS AND IMPLICATIONS

This study set out to examine how logical connections are built in problem statements of MPhil theses in three disciplines at a Ghanaian University, with the help of Halliday and Matthiessen's (2004) notion of clause complex under the ideational meta-function of SFL. Specifically, the study sought to investigate the basic clause complex structure, the distribution of taxis and logico-semantic relations across three selected disciplines: Mathematics, Nursing and English Language.

The analysis of the data brought to light four key findings. Firstly, in terms of the basic clause complex structure of the three, English Language uses more clause complexes in their problem statements compared to the two disciplines. Secondly, all three disciplines favor the use of hypotaxis as against parataxis; however, English uses it more than the other two disciplines. Thirdly, all the three disciplines use hypotactic projection of locution instead of idea as they attribute source to what people say instead of think. Finally, there are significant variations in the use of logico-semantic relations as English tends to use more elaboration, whilst Mathematics favors enhancement in relation to the other categories. The findings discussed demonstrate that the conventions of the disciplines of the researchers shape how they link ideas in their problem statements.

The key findings (and conclusions) of this study have implications for theory and scholarship on disciplinary variation in academic writing. First, the study confirms SFL's notion that language users make systematic choices in order to convey appropriate and intended meanings to an event (Halliday and Matthiessen 2004). Eggins (2004) indicates that clause complexing patterns are mainly sensitive to contextual dimensions of genre and mode. This study advances the argument that patterns of clause complexing in academic writing can be influenced by disciplinary variation. The study has demonstrated the three disciplines differ in terms of certain linguistic choices they make to build arguments in the problem statements. Academic writing, therefore, must be handled in a discipline-specific manner, as writing is shaped by the conventions of each discipline. The study also contributes to literature on academic writing and disciplinarity.

Due to time and space, this study was limited to only ten dissertations from only three disciplines. It will be interesting in future studies to increase the data from the three disciplines in order to extend generalizations (and consideration be given) to other disciplines; thereby throwing more light on disciplinary writing.

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