

Peeling the Onion: A Textual CDA of Research Articles in Humanities and Basic Sciences¹

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Abstract

This study aimed to investigate the disciplinary and cross-disciplinary variations of research article Introduction sections in 2 disciplines (i.e., humanities and basic sciences). Ninety research article Introduction sections (i.e., 15 from each discipline of applied linguistics, sociology, psychology, biology, agriculture, and geology) were examined. The study was conducted with reference to the onion model of discourse analysis developed by Humphrey and Economou (2015), and the data were coded by MAXQDA10. Results pointed to a general underlying pattern that moved from descriptive and taxonomic reports to more challenging genres like persuasion and critique, regardless of the disciplines. Findings, however, indicated that individual disciplines manifested their own systematic regularities in terms of rhetorical conventions of writing. Besides, the process of knowledge-making was reflected and reinforced through lexicogrammatical and appraisal resources. The study has implications both for teaching and materials development.

Keywords: Critical Discourse Analysis (CDA); Research Article Introduction Sections; Onion Model

1. Introduction

Over the last decade, researchers have shown an increasing interest in the analysis of academic English texts written by students because the ability to produce

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such texts represents their degree of learning at the tertiary level, which is considered to be of prime importance both to students and their teachers. Given that texts play a crucial role in demonstrating students' knowledge and understanding at the tertiary level, researchers should take into consideration the importance of identifying written discourse patterns across disciplines, so as to scaffold tertiary students in the process of learning and knowledge-building.

Yet, Woodward-Kron (2002) argued that a considerable degree of importance was attached to the concept of critical analysis vs. description in Western tertiary contexts, so that students' description of concepts, theories, and issues was not considered to be important. Whereas previous studies have primarily concentrated on differentiating critical argumentative writing from descriptive analysis, there have recently been some studies in the literature, reporting that such dichotomies tend to ignore the important role of descriptive writing in disciplinary learning for tertiary students (Chanock, 2000; Hunston & Thompson, 2000; Lea & Street, 1998; Mauranen, 2003; Woodward-Kron, 2002).

Therefore, Humphrey and Economou (2015) employed the onion model of discourse analysis as an academic writing model and a linguistic model to identify the linguistic patterning in student academic writing thus, suggesting a way of deconstruction of academic texts based on recognizable types of academic purpose. Humphrey and Economou suggested that "the 'onion' is a symbolic shorthand for the copresence and interdependence of all four ways or functions of writing; say, description, analysis, persuasion, and critique in academic discourse" (p. 38).

Regarding description in the onion model, Martin and Rose (2008) held that "in educational contexts at school level, *description* has been identified as a fundamental genre in literary and factual apprenticing texts, distinguished by the absence of unfolding sequences of events and by a focus on specific entities" (p. 5). Analysis refers to the logical organization of information in expository writing. In other words, Humphrey and Economou (2015) pointed out that analysis deals with reorganizing information, comparing and contrasting, and finding relationships/patterns/categories/parts in the text.

As stressed by Humphrey and Economou (2015), critique refers to evaluation of others' work, developing a debate, and taking, at least, two alternative positions into account, including the writers'. With regard to persuasion, Humphrey and Economou suggested that persuasion typically involves a claim, followed by some grounds that convince the reader to accept it and establish the background for the second claim.

Furthermore, the onion model draws on the systemic functional linguistics (SFL) theory to investigate specific linguistic patterns and schematic structures of the

texts. Woodward-Kron (2005) mentioned that, in particular, genre and register theory (Christie, 1987; Martin, 1985, 1992; Martin, Christie, & Rothery, 1987; Martin & Rose, 2007, 2008; Rothery, 1985) provide a methodological framework to analyze the academic texts based on their linguistic patterns and schematic structures.

Moreover, the onion model rests on two of the discourse semantic systems that were developed by Martin and Rose (2003): ideation and appraisal. Ideation analysis, according to Humphrey (2013), is concerned with knowledge-making in a text through examining linguistic features. Similarly, appraisal analysis examines how interpersonal meaning within a text culminates in evaluative meaning (Hyland, 2002; Humphrey & Economou, 2015; Hunston & Thompson, 2000; Martin & White, 2005).

Humphrey and Economou (2015), following Martin and White (2005) proposed that the theory of appraisal involves systems of attitude, engagement, and graduation. Besides, the attitude system consists of three distinct categories: affect, judgement, and appreciation. Martin and Rose (2003) described affect in terms of “resources for expressing feelings,” whereas judgement refers to “resources for judging character” and appreciation to “resources for valuing the worth of things” (p. 24).

Martin and Rose (2003) indicated that the system of graduation consists of resources that are categorized into force (making evaluation stronger or weaker) and focus (the way the boundaries between categories in a text are sharpened or softened). In addition, Martin and White (2005) held that the engagement system included the choices of “monogloss (bare assertions) and heterogloss (recognition of dialogic alternatives)” (p. 100).

Altogether, the onion model of discourse analysis takes into account the need for the simultaneous employment of all of the four genres in academic writing: description, analysis, persuasion, and critique. Actually, this interdependency between the four functions of academic writing was quite a neglected aspect in previous studies because they mainly analyzed one of the abovementioned functions, leaving the others behind. Nonetheless, the onion model of discourse analysis emphasizes the importance of improving persuasive and critical writing abilities through building upon descriptive and analytic writing.

2. Significance and Objectives of the Study

Overall, whereas there have been attempts to identify genres in academic contexts from a number of disciplinary perspectives (Coffin, 2004, 2006; Hood, 2010; Melles & Lockheart, 2011), according to Humphrey and Economou (2015), “ambiguities appear in distinguishing their discourse patterns and in the description

of the relationships between them” (p. 37). Woodward-Kron (2005) held that “there has been little research on the role of genre and writing for tertiary students’ learning of disciplinary knowledge” (p. 24). Swales (1990) asserted that Introduction sections of research articles are the most difficult section for the writer (Atai & Habibi, 2012; Bhatia, 1997; Jogthong, 2001; Lähdesmäki, 2009; Swales, 1990).

Thus, there is a need for more inquiry into research articles Introduction sections. A variety of studies have been conducted to analyze discourse patterns in research articles based on different approaches within the onion model, that is, considering descriptive, analysis, argumentative, or critique genres in academic writing (Coffin, 2007; Hood, 2010; Humphrey, 1996; Humphrey & Economou, 2015; Iedema, White, & Feez, 1994; Martin & Rose, 2008; Martin & White, 2005; Unsworth, 2001; Veel, 1997).

Nevertheless, to date, almost no studies have focused on the analysis of research article Introduction sections in the disciplines of humanities and basic sciences with respect to the onion model. Therefore, the present study aimed at identifying disciplinary and cross-disciplinary variations in the Introduction sections of 90 research articles from the above perspective.

2.1. Research Questions

Therefore, the study set out to find answers to the following research questions:

1. To what extent do the research article Introduction sections in applied linguistics, sociology, and psychology conform to the onion model of discourse analysis?
2. To what extent are the research article Introduction sections from biology, agriculture, and geology in accordance with the onion model of discourse analysis?
3. Are there any differences between the research article Introduction sections in the discipline of humanities and those in the discipline of basic sciences with reference to the onion model? If yes, in what ways are they different?
4. Are there any similarities between the Introduction sections of research articles from humanities and basic sciences concerning the onion model? If yes, what do these similarities indicate?

3. Method

3.1. Materials

The materials consisted of a sample of 90 Introduction sections, that is, 15 Introduction sections representing each of the soft disciplines of applied linguistics,

sociology, and psychology, on the one hand, and 15 Introduction sections representing each of the hard disciplines of biology, agriculture, and geology, on the other, all in English and written by native speakers. In addition, the length of the texts ranged from 231 to 1,280 words, with a mean of 755.5 words and a standard deviation of 741.7. Bhatia (1993) maintained that “Introductions are important because they play a key role in showing the relevance of the research to previous work in the field and setting up the reader’s expectations” (p. 82).

In addition, expert texts were selected from *ScienceDirect* journals, which usually deploy a wider range of language resources and contribute to more efficient modeling of key resources involved in each of the functions and their relationship with others. Moreover, five high-impact factor journals from each discipline were used. Then, three articles published from 1985 until 2018 from each journal were selected, all of which were written in English.

The applied linguistics articles were chosen from the following journals, which are accessible online through the *ScienceDirect* website: *English for Specific Purposes*, *The ESP Journal*, *Journal of Pragmatics*, *Journal of Second Language Writing*, *Linguistics*, and *Education*. Furthermore, from the discipline of sociology the following journals were used: *The Journal of Social Studies Research*, *Research in Social Stratification and Mobility*, *The Social Science Journal*, *Social Science Research*, and *Race and Society*.

The psychology journals included *Clinical Psychology Review*, *Cognitive Psychology*, *European Journal of Education and Psychology*, *International Journal of Clinical and Health Psychology*, *Journal of the American Academy of Child and Adolescent Psychiatry*. From the discipline of biology, the articles were chosen from the following journals: *Advances in Biological Regulation*, *Current Opinion in Genetics and Development*, *Current Opinion in Plant Biology*, *Cell Biology International*, *Evolution*, and *Human Behavior*.

Additionally, the journals selected from the discipline of agriculture involved: *Agricultural Administration and Extension*, *Agricultural Water Management*, *Agriculture, Ecosystems and Environment*, *Crop Protection*, and *Journal of Agricultural Engineering Research*. From the discipline of geology, the articles were selected from the following journals: *International Journal of Coal Geology*, *Journal of African Earth Sciences*, *Journal of South American Earth Sciences*, *Marine and Petroleum Geology*, *Russian Geology*, and *Geophysics*.

3.2. Data Collection

First, the introductory sections of the research articles were taken from professional journals. Next, particular schematic features within the excerpts, which

appeared to realize the four genres discussed in the onion model, were extracted and coded by means of the MAXQDA10 software: All of the data were imported in MAXQDA10's document system and, in the code system's section, the codes were defined and assigned to different parts of the Introduction sections based on the onion model of analysis (Humphrey & Economou, 2015). Table 1 shows the categorization of the codes used in the study:

Table 1. *Categorization of the Codes Based on the Onion Model*

Codes	Description
Entity-Based Description	Concrete or abstract entities
Event-Focused Description	Events, recounts, and processes
Analysis	Relationships, comparison/contrast, addition, and classification
Persuasion	Claims and arguments
Critique	Criticisms, evaluations, and judgments

It can be seen from the data in Table 1 that the descriptive codes were divided into entity-based and event-focused descriptive phases. Whereas entity-based descriptive phases focus on describing objects and entities, event-focused phases highlight a recount in terms of a series of events. Analysis establishes relationships between the different phases of Introduction sections. Besides, persuasion deals with presenting claims and grounds to support them. Finally, critique concerns evaluative judgments and opinions.

3.3. Data Analysis

3.3.1. Analytical framework of the study

The analysis was done with reference to the onion model of discourse analysis proposed by Humphrey and Economou (2015). The framework emphasizes the importance of considering descriptive, analytic, persuasive, and critical modes of academic writing and their interactions in various parts of text: phase, stage, and all text.

The analysis was done with regard to the introductory sections and their particular lexicogrammatical patterns. What is more, lexicogrammatical features comprised the choice of grammatical metaphor (nominalization). Concerning the choices of grammatical metaphor (nominalization), the study adopted the SFL theory, which regards nominalization as a process whereby not only actions and processes turn into concepts, but also information is packaged into nominal groups at high density.

Additionally, the analysis was done with reference to genre and register theory (Martin, 1992; Martin & Rose, 2007, 2008) that provides us with a way of deconstructing research article Introduction sections based on their schematic structure. What is more, the onion model is also informed by two discourse semantic systems of appraisal and ideation. Martin and Rose (2003) suggested that ideation is concerned with the content of a text. That is, the activities involved and the way the participants are presented in these activities.

As for the appraisal system, the present study adopted Martin and Rose's (2003) framework of analysis. Martin and Rose proposed that "appraisal is concerned with evaluation—the kinds of attitudes that are negotiated in a text, and the ways in which values are sourced and readers aligned" (p. 22).

3.3.2. Procedure

The data were studied with respect to the linguistic choices which characterized descriptive, analytic, persuasive, and critical academic writing. First, the introductory sections in applied linguistics, sociology, and psychology were analyzed.

Moreover, a comparison was made to identify the degree of subdisciplinary variation in the humanities. Second, the biology, agriculture, and geology Introduction sections were studied. Then, they were compared to identify the extent of subdisciplinary variation in the basic sciences. Next, the two disciplines were examined to identify the similarities/differences across the disciplines. In addition, the MAXQDA10 software was used for coding and establishing the frequency of the codes assigned to the articles in the subdisciplines of humanities and basic sciences.

Finally, in order to ensure a high degree of interrater reliability, the researchers along with another rater coded the data independently. Next, only the codes that were agreed upon were selected for the purpose of the present study. The interrater agreement was also estimated using MAXQDA18. The degree of correlation was 80%, which indicates a high level of internal consistency for the sample.

4. Results and Discussion

4.1. Results and Discussion of Quantitative Analysis of the Data

Table 2 summarizes the frequency and percentage of the codes involved in the humanities and basic sciences research article Introduction sections:

Table 2. *Frequency and Percentage of Codes Across Articles of Humanities and Basic Sciences*

Codes	Humanities		Basic sciences		Humanities and Basic Sciences	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Entity-Based	64	28.4	50	21.1	114	30.8
Event-Focused	43	18.8	48	20.3	91	24.6
Analysis	47	20.5	45	19	92	24.9
Persuasion	51	22.3	63	26.6	114	30.8
Critique	42	18.3	31	13.1	73	19.7
Total	229	100	237	100	370	100

Table 2 shows that 64 out of the 229 codes were found for entity-based descriptive phases in the humanities (28.4%). However, more entity-based descriptive phases could be found in the humanities (50 [21.1%]). It seemed that in the humanities, the authors tended to provide theoretical views and ideas via concrete and abstract entities. In other words, soft disciplines aim at presenting theories and challenging cognitive conceptions (Becher & Trowler, 2001; Jiang, 2017, Jiang & Hyland 2015).

In addition, 43 codes were assigned to the event-focused descriptive phases in the humanities (18.8%). Yet, more event-focused phases were identified in the basic sciences (48 [20.3%]). The results might be explained by the fact that, in basic sciences, the authors present scientific facts, experimentations, and processes, rather than theoretical notions. The findings are in agreement with those of Jiang (2017), who held that the hard disciplines involved more event-focused nouns.

Table 2 indicates that the total number of codes assigned to the entity-based descriptive phases in both disciplines was 114 (30.8%). But 91 codes were used for event-focused descriptive phases (24.6%). So, the bulk of the articles was descriptive (entity-based and event-focused). Thus, it seems that descriptive writing is of paramount importance in disciplinary learning for students because mastery of this genre is a prerequisite to move toward establishing more demanding, arguing genres such as persuasion and critique. This is in accord with what Martin and Rothery (1987) found in the Australian context. That is, their study proposed that descriptive genre should not be neglected, as students are required to incorporate this genre into most of their school essays.

The next prominent feature of the articles in both disciplines was persuasion (114 [30.8%]), which reveals the importance of argumentation in humanities and basic sciences. Therefore, students should be able to present clear arguments to

support their claims and judgments in these disciplines (Davies, 2008). Besides, 51 codes were assigned to persuasive phases in the humanities (22.3%). However, more persuasive phases were found in the basic sciences (63 [26.6%]). The results are likely to be explained by the fact that, in science, writers are required to convince readers of more complex, subtle, and succinct relationships. The results corroborate what was previously claimed by Hunston (1989) who also pointed to the importance of convincing readers in scientific writing.

Analysis was the third distinguishing feature of the articles (92 [24.6%]). Analysis appeared not only in isolation, but also in other phases of the articles, including descriptive, persuasive, and critical ones. This points to the crucial role of analysis in establishing relationships between different phases of academic writing. Moreover, 45 codes were assigned to analytic phases in the basic sciences (19%), but the articles in the humanities were more analytic (47 [20.5%]). It seems possible that the results are related to the critical nature of humanities: presenting the author's affective and judgmental views through establishing relationships between theories (Biber & Finegan 1989).

About critique, the least amount of codes was assigned to the critical phases of the articles in both disciplines (73 [19.7%]). However, critical thinking and writing helps establishing a person's own academic stance within his or her own discipline. Thus, familiarity with different genres help learners improve their skills to critically involve in their disciplinary communities (Hyland, 2008).

Furthermore, more critical phases were found in the discipline of humanities (42 [18.3%]). Consequently, a high level of personality could be seen in the humanities research article Introduction sections. This is in line with what Hyland (1999), Kuhn (1970), and MacDonald (1994) highlighted. To put it simply, they argued that texts are shaped and influenced by authors' ideas, selecting, and foregrounding of certain kinds of information.

Nonetheless, fewer criticisms were found in the discipline of basic sciences (31 [13.1%]), due to the fact that the authors were supposed to adhere to the principles of objectivity and presenting objective data. This is in line with Holmes (1997) who found interdisciplinary variation in the Discussion sections of social science research articles, that is, between soft and hard disciplines.

4.1.1. Humanities

Table 3 shows the frequency of the codes assigned to the humanities research articles, including applied linguistics, psychology, and sociology:

Table 3. *Frequency of Codes in Subdisciplines of Humanities*

Codes	All Coded Segments	Applied Linguistics	Psychology	Sociology
Entity-Based Description	64	15	16	15
Event-Focused description	43	15	13	15
Analysis	47	15	16	16
Persuasion	51	17	18	16
Critique	42	11	17	14
Total	229	73	80	76

Table 3 shows that equal codes were assigned to the entity-based descriptive phases in applied linguistics and sociology, that is, 15 for each. On the other hand, 16 codes were assigned to the entity-based descriptive phases in the articles of psychology. Nonetheless, it seemed that the entity-based descriptive phases were almost evenly distributed in the humanities articles. It is probably due to the fact that the authors in the humanities aimed at providing generalized accounts of the theories presented via entity-based descriptive phases.

Regarding the event-focused descriptive phases, equal codes were assigned to the articles in applied linguistics and sociology, that is, 16. However, 15 codes were assigned to the event-focused descriptive phases in psychology. Hence, there was no significant difference in terms of the distribution of the event-focused codes in the humanities. It seems that authors in soft disciplines apply event-focused descriptive phases to build and represent theoretical conceptions (Jiang, 2017).

Concerning persuasion, 17 codes were assigned to applied linguistics, whereas 18 codes were found in psychology. In addition, 19 codes were assigned to sociology. As a result, no significant difference was found regarding the distribution of persuasive codes in the humanities. One possible explanation is that no clear-cut intellectual boundaries of knowledge in soft disciplines necessitates developing persuasive skills on the part of the authors as the only way of dealing with the discursive nature of humanities and justifying their claims and values (Becher & Trowler, 2001; Jiang, 2017).

About critique, 11 codes were assigned to the critical phases in applied linguistics. Nevertheless, 17 codes were assigned to the critical phases in psychology. Finally, 14 codes were assigned to the critical phases in sociology. It might be related to the fact that not only descriptive issues, but also the complexity of interpretation was taken into account in psychology.

4.1.2. Basic sciences

Table 4 below represents the frequency of codes assigned to research articles of basic sciences:

Table 4. *Frequency of Codes in Subdisciplines of Basic Sciences*

Codes	All Coded Segments	Biology	Agriculture	Geology
Entity-Based Description	50	17	16	17
Event-Focused Description	48	16	16	16
Analysis	45	15	16	14
Persuasion	63	22	20	21
Critique	31	11	11	9
Total	237	81	79	77

In terms of comparison of the subdisciplines of basic sciences, equal codes were assigned to the entity-based descriptive phases in biology and geology, that is, 17. Nevertheless, 16 codes were assigned to the entity-based descriptive phases in agriculture. Hence, the entity-based descriptive codes were almost evenly distributed in the basic sciences. Apparently, marking entities and establishing relationships among them is of importance, given that basic sciences are concerned with the description of practical experience.

In addition, there was no difference in terms of distribution of the event-focused descriptive phases in the subdisciplines of basic sciences (16 codes for each discipline). It may be that the event-focused descriptive phases were employed in the basic sciences so as to present objective views of the authors. Besides, the least amount of analytic codes was assigned to psychology, that is, 14. On the other hand, 15 analytic codes were assigned to biology and 16 to agriculture.

Therefore, analysis appeared more in agriculture than in biology and geology. This might indicate the need to establish more logical relations and taxonomies in the disciplines of agriculture and biology in comparison to geology, given the complexity of these subject matters. The findings corroborate the ideas of Hyland (1998) who mentioned that there seem to be more clear-cut knowledge boundaries in hard disciplines.

About persuasion, 22 codes were assigned to biology. But 21 codes were assigned to geology. However, the least amount of codes was assigned to agriculture, that is, 20. Thus, the persuasive codes were identified more in biology than in geology and agriculture. Consequently, biology articles may be more challenging, as they involve more persuasive phases and, thus, require much more interpretation on the

part of the authors. But geology and agriculture were less persuasive and, thus, required less persuasive skills on the part of the authors.

In terms of critique, the least amount of codes was assigned to geology articles, that is, 9. But equal codes were assigned to agriculture and biology, that is, 11. It might show the need for biology and agriculture authors to engage more critically with the material. This is in line with Holmes (1997) who found interdisciplinary variation in the Discussion sections of social science research articles and Samraj (2005) who found variations across the related subdisciplines of biology.

4.2. Results and Discussion of Qualitative Analysis of Data

4.2.1. Entity-based description

In all the articles, the entity-based descriptive phase featured an abundant number of nominalizations in terms of simple and complex entities, regardless of disciplines which also helped establish the background context for the study. These similarities in the use of nominalizations might be explained by the fact that metadiscourse markers were significantly important in academic texts.

What is more, the concrete entities in entity-based descriptive phases of basic sciences texts were highly specialized or technical. The findings corroborate those studies in the literature (Banks, 2008; Bazerman, 1985; Halliday, 2004) that proposed that scientific writing involves not only a technicalizing process, but also an abstracting process. Some instances of specialized and technical texts are presented below:

- (1) . . . on *the Scandinavian crystalline shield* in central Sweden, in the area of *Siljan impact crater* . . .

(Pikovsky, Glasko, & Kutcherov, 2017)

- (2) . . . *chromatin* is mobile using *live cell imaging of GFP-tagged loci*

(Seeber, & Gasser, 2017)

As shown in examples 1 and 2, concrete entities in descriptive phases of biology texts may be specialized (e.g., *Siljan impact crater*) or technical (e.g., *geodynamic and hydrothermal activity*). On the other hand, in the descriptive parts of the research articles in the humanities, there appeared some questions that aimed at challenging the students' ideas and student involvement via problematization of the interpretive process.

- (3) *Do EFL learners' overall writing quality ratings and/or lexicosyntactic features vary by genre? Which lexicosyntactic and discourse features predict overall writing quality ratings within each genre?*

(Qin & Uccelli, 2016)

Likewise, in studies carried out on research articles within the discipline of humanities (Hyland, 1998; Love, 1993; Mei & Allison, 2009; Rashidi & Shahab, 2014; Reason & Bradbury, 2001), the data aimed at challenging the students' ideas and involving them in further interpretation of the theories. In addition, the choice of graduation (i.e., both force and focus) permeated the entity-based descriptive phases of all the articles. Whereas example 4 shows an instance of force, example 5 indicates graduation, (i.e., focus):

- (4) We propose a *more* rhetorical function for them.

(Jiang & Hyland, 2017)

- (5) *Very* different cell division patterns may occur in embryogenesis of other plant species.

(Bayer, Slane, & Jürgens, 2017)

4.2.2. Event-focused description

More recount phases were identified in the discipline of sociology so as to establish the social and historical context for the study. Therefore, students are required to get acquainted with the regularities found in schematic patterns of specific disciplines concerning the recount genre. However, Humphrey and Ecnomou (2015) argued that teaching descriptive genre is rather neglected in academic settings because it is assumed that students have already become familiar with the conventions of such genres.

But various studies pointed to students' failure in writing successful expositions, which was dependent upon descriptive writing (Hood, 2010; Woodward-Kron, 2005). The event-focused part also included a variety of nominalizations. Nominalizations are employed to help information packaging. Without nominalizations, the recount will be much longer because it involves many stories and events:

- (7) . . . *mass college attendance*

(Ford & Thompson, 2016)

- (8) . . . *external observations of learning processes*

(Rumenapp, 2016)

Besides, the event-focused descriptive phase involved both monoglossic and heteroglossic propositions in almost all of the articles. The following excerpts represent some monoglossic propositions, which indicate some facts without attributing them to external voices. These were typically identified in the discipline of humanities:

- (9) The variable of race occupies *an awkward position* in the study of *urban politics*.

(Kraus, 2004)

- (10) . . . *This mental representation may be a distorted self-image based on prior experiences*

(Gregory & Peters, 2016)

Heteroglossic propositions were typically represented in footnotes or in-text citations. Besides, the choice of attribution from the engagement system occurred frequently in the event-focused descriptive phases of the research articles, where the writer aimed at retelling events by attributing them to alternative sources. The extracts below highlight heteroglossic attributions, which were found in the basic sciences:

- (11) Reallocation of Nile water is *a hot issue* (Cascão, 2009; Waterbury, 2002; Whittington et al., 2005)

(Cascão, 2009; Waterbury, 2002; Whittington et al., 2005)

- (12) *Unrealistic optimism* has attracted a great deal of academic interest.... (for a review, see Helweg-Larsen & Shepperd, 2001; but see also Chambers & Windschitl, 2004).

(Shah et. al, 2016)

In examples 11 and 12, heterogloss is used to build up an argumentative framework that provides an explanatory schema for new findings (Kolb, 1981; Kuhn, 1970). The findings corroborate what other studies of heterogloss (Gallardo, 2005; Russell, 2010; Swales, 1990) have indicated. That is, they indicate that authors in science employ citations to establish an intertextual framework for their new claims, which, in turn, helps them justify their arguments.

4.2.3. Analysis

The descriptive phase was usually followed by an analytic segment. The structure of this phase constituted the ordering of main ideas in relation to each other and evidence from a variety of sources.

- (13) Recently, new interest in studying *the relationship* between cancer and metabolism has arisen as a potential avenue to identify *novel biomarkers* and *therapeutic targets* effective across *multiple breast cancer subtypes*.

(Geck & Toker, 2016)

- (14) Selective methods, *in contrast*, are methods in which a subset of the original population is selected to produce a synchronized culture and the remaining cells are discarded.

(Cooper & Gonzalez-Hernandez, 2009)

Example 13 reveals relationships in analytic phases of the articles, but example 14 highlights contrastive relations. The findings were consistent with previous studies in the literature that concluded that the language of science involves analysis (Humphrey, 2013; Lemke, 1990; Schleppegrell, 2004).

So, students need to be familiar with regularities in the rhetorical conventions of analytic expositions, given these kinds of texts help them present their claims in persuasive genre. The findings are in agreement with the ideas of Woodward-Kron (2005) who proposed that “expositions are texts whose social purpose is to present a logically sequenced argument in favor of a judgment” (p. 28).

4.2.4. Persuasion

The persuasive phase in the articles began with a primary thesis at the beginning stage, followed by some grounds that typically provided the context for the second claim or a restatement of the original thesis. What follows is that students should direct their attention to the stages revealed in the analysis of persuasive phases in order to identify both the choices available to them and their impacts. The results are in line with what previous studies of persuasive writing in the literature (Anderson & Anderson, 1997; Coffin, 2006; Hyland, 1998; Martin & Rose, 2008; Samraj, 2005; White, 1998) indicated. That is, they have also suggested that persuasive writing is realized through three stages: a background, claim, and reinforcement of claim.

The results, furthermore, indicated that more explicit attitude values were applied in the basic sciences. The findings contradict those of Bondi and Hyland (2006) who claimed that more explicit interactive forms of persuasion are characteristics of humanities and social sciences. The most likely explanation is that they studied the whole articles, rather than the Introduction sections:

- (15) . . . a wide discrepancy
- (16) Nonessential amino acids are *especially promising metabolites* for starvation therapy

(Geck & Toker, 2016)

In examples 15 and 16 from the basic sciences, the writer's positions in relation to the source is explicitly stated through explicit attitude values. On the contrary, more implicit attitude values were found in the humanities (a soft knowledge discipline) because humanities often deal with the influence of human actions/attempts to keep readers' interests and engage them in the process of interpretation.

- (17) Indeed, Latinos' networks and their sense of bonds in urban communities *can be heavily influenced*

(Oh, 2004)

- (18) *Although grading may be the most immediate goal* for students and instructors, laboratory work and its associated writing are central in the overall design of tertiary science and engineering curricula.

(Parkinson, 2017)

In example 17, the author implicitly expresses his ideas; however, in example 18, the author also challenges the previous beliefs about *grading*. Besides, the attitude values were often accompanied by the choices of graduation and entertain in order to achieve persuasion. The findings were in agreement with studies that stress the importance of evaluative language in establishing written argumentation (e.g., Hunston, 1989; Hyland, 2002).

- (19) . . . *I suggest* that differences in audience and purpose between laboratory reports and RAs make *highly-graded* student laboratory report . . .

(Parkinson, 2017)

- (20) . . . critical customers whom it *might* have offended with open denial

(Ho, 2017)

In example 19, the writer's position is achieved implicitly via intensification (*highly-graded student laboratory reports*). The writer also employs the choice of entertain (*I suggest that*) to explicitly present his ideas. In examples 20, the writer uses the choice of entertain or epistemic modality to present his views in terms of a possible suggestion (*might*). Furthermore, with respect to graduation, there appeared more instances of force, rather than instances of focus in the persuasive phases. The findings are in line with the ideas of White (1998) who suggested that the density or amount of an attribute can be foregrounded by force resources.

- (21) Children of a parent with a selective degree are *significantly more* likely to themselves attend a selective college

(Ford & Thompson, 2016)

- (22) . . . this strategy allows processing with *extremely small* bin sizes...

(Klokov, Treviño, & Meckel, 2017)

In example 21, the authors used force to strengthen their propositions, whereas in example 22, the writers applied force to soften their claim. In addition, usually in dialogic expansion, the appraisal choices of attribution and entertainment were identified. On the one hand, the choice of attribution aimed at attributing the proposition to a nonauthorial voice mostly through acknowledgement, rather than distancing. Additionally, the choice of entertainment allowed for dialogic alternatives usually via epistemic modality. The results are in line with the ideas of Mei and Allison (2009) who mentioned that “the frequent use of attributions construes a sense of the writers’ awareness of the intertextual nature of discourse and indicates a level of negotiability in positions taken” (p. 124).

- (23) The paper is empirically driven, with less focus attributed to the theoretical positioning of SAD . . . (see Gregory *et al.*, 2016; Markus & Wurf, 1987).

(Gregory & Peters, 2016)

- (24) . . . selective belief updating potentially provides a long-missing, fully specified, process account of how unrealistic optimism *might* come to be ...

(Shah *et. al*, 2016)

As can be seen in example 23, the writer’s claim is justified with attributions in terms of citations. In example 24, the writer’s claim is supported with attributions (citations) and the choice of entertain (*might*).

4.2.5. Critique

In the critical phases, persuasion was intertwined with critique, and the writer’s claim was supported by analytic and descriptive evidence. Hence, the full onion structure was evident in the critical stage. What is more, the engagement choices of attribution and entertain were frequently applied in dialogic expansion, both of which allowed for dialogic alternatives. Graduation (i.e., force or intensification) was also employed in the critical phases of the articles. Moreover, the structure of the critical phases was designed in such a way that they moved from a critical, reflective model of writing (i.e., heteroglossic expansion) to a more direct, authorial style of writing (i.e., heteroglossic contraction).

The results might be explained by the fact that, in Introduction sections, the writer tries to represent the particular direction toward which the study is going to

move, rather than allowing for critical and reflective thinking. The findings seem to be consistent with the ideas of Gunnarsson (2017) who held that “heterogloss of the expansive type is related to a critical, reflective model reader while contractive types of heterogloss suggest a more directly action-oriented model reader” (p. 284).

- (25) *Although* each virus produces unique symptoms (concession), the early ones, such as reduced plant height and dark green leaves, are *very similar* (contraction).

(Yang et al., 2017)

Example 25 indicates that, first, the writer concedes a point and, then, limits it. What is more, the writer employs graduation, intensification, and quality (*in very similar*) so as to better provide support for his claim. Besides, criticism in the humanities made more implicit references to the gaps in previous research, whereas in the basic sciences the references to the gaps were more explicit. The results are in agreement with those of Bondi and Hyland (2006) who held that the criticism of previous research occurred more frequently in the humanities, rather than in natural sciences abstracts. The results of this part points to the value of instruction that aims at raising consciousness concerning critical writing features.

- (26) However, Guo et al. did not investigate a number of lexical features theorized to be important components of essay quality Such differences *may* provide a greater understanding of how the two task types differ

(Kyle & Crossley, 2016)

Example 26 highlights that writers in humanities implicitly challenge previous ideas and represent their own claim as one of possible propositions via epistemic modality (*may*).

5. Conclusion and Implications

The present study aimed at analyzing the patterns of language used in the Introduction sections of research articles in the disciplines of humanities and basic sciences in order to identify disciplinary and cross-disciplinary variations. The results indicated the presence of not only a disciplinary but also an interdisciplinary model of academic writing in each discipline. This model of academic writing points to the important role of the descriptive and analytic genres to serve as a basis for the development of more persuasive and critical genres (Humphrey & Economou, 2015).

Firstly, the onion model indicates that in spite of nuanced differences in the structure of research article Introduction sections in the disciplines of humanities and basic sciences, their structure mostly conformed to the onion model. That is, they

started from a descriptive phase, moving towards an analytic phase, culminating in persuasive and, then, critical phases.

In addition, the humanities and basic sciences research article Introduction sections were quite similar in their rhetorical organization, with differences mostly occurring in terms of the way they structured the descriptive phases and the types of appraisal resources they applied in different phases, particularly in persuasive ones. Therefore, the present study verifies the conformity of the disciplines of humanities and basic sciences to the onion model.

The appearance of some discrepancies between the rhetorical organization of the research article Introduction sections in the disciplines of humanities and basic sciences points to the importance of making students familiar with the specific rhetorical conventions of disciplinary, subdisciplinary, and cross-disciplinary research article Introduction sections, especially if they like to publish in international academic journals.

In terms of pedagogical implications, language support programs should be held in academic settings, with a focus on improving the command of lexicogrammar, involving appraisal resources in writing Introduction sections. Therefore, intervention in the form of language awareness activities, conscious awareness of the readily available schematic structures, and the discourse value of lexicogrammatical choices could promote students' academic writing (Martin, 1985; Swales, 1990).

Thus, more content-based courses are required for students to help them deconstruct different academic texts and become familiar with the discipline-specific conventions (Liu & Jiang, 2009). The findings of this study may also be important for materials developers who should provide materials that expose students to real, authentic language. So, a corpus comprised of various discipline-specific texts might be used to develop materials that accommodate students from different faculties.

Moreover, the findings may point to the importance of developing a spiral curriculum in which there is an iterative revisiting of texts from different disciplines throughout the course. The outcome of such a process could be mastery of the structure of a large body of knowledge (Bruner, 1960). Further research about the present topic can be pursued in the following areas: Other studies are needed to investigate humanities and basic sciences at tertiary levels. Research article Introduction sections from other disciplines could be investigated as to see whether these characteristics are idiosyncratic to them. The development of a successful model of academic writing could be investigated with reference to Results, Discussion, and Conclusion section.

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