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A CORPUS-BASED INVESTIGATION OF PHRASAL COMPLEXITY IN L1, L2 PHD STUDENTS, AND EXPERT WRITERS IN EDUCATION FIELD

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By

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DISSERTATION

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DEDICATION

It is my genuine gratitude and warmest regard that I dedicate this humble work to my first teachers, father and mother, who first taught me the importance of education to become the person I am at present moment….!

To my small family, Rana, Mafaz and Keenaz. You are very inspirational. I love you to the moon and back.

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A Corpus-Based Investigation of Phrasal Complexity in L1 English PhD students, L2 Arabic PhD Students, and Expert Writers in Education Field

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ABSTRACT

This study compared 11 noun modifiers, adopted from Biber et al.'s (2011) index, in the writing of English native speakers (NS) and non-native speakers (NNS) graduate students in Education field and compare them with the frequencies found in published writings. Also, it investigated how the language background influences NP complexity in academic writing. The findings showed compared to the expert writers, the student writers used different amounts of phrasal modifiers in their dissertations (e.g., premodifying nouns). Then, a Chi-square test and residual analysis were run to explore how language background influences the noun phrases. Four particular noun modifiers were influenced largely by language background factor on noun phrase complexity. NS PhD students utilized premodifying nouns more effectively to structure dense noun phrases in their dissertations. On the other hand, L2 PhD students used more diverse noun phrases based on prepositional phrases (other), prepositions followed by -ing clauses, and infinitive clauses.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

"Words can be like X-rays if you use them properly--they'll go through anything. You read and you're pierced."
Aldous Huxley, *Brave New World*

Chapter 1

INTRODUCTION

This study aimed to compare the frequencies of the 11 noun modifiers in academic writing across the three groups (NS[1] English doctoral students, NNS Arabic doctoral students, and expert writers) and investigated how the language background influenced NP complexity in academic writing. This introductory chapter provides the background of the study, the research questions, the statement of the problem, the purpose of the study, the impetus of the study, the significance of the study, the scope of the study, and theoretical orientations of the study.

Background of the Study

According to the National Center for Educational Statistics (NCES), the number of students attending colleges and universities in the United States rose from 15.3 million in 2000 to 19.9 million in 2018. In the last two decades, much of this increase in enrollment has been due to the influx of international students who speak English as a second or additional language (Devereux et al., 2006; Institute of International Education (IIE), 2014). As an example, more than 44,000 Saudi students were attending US universities during the academic year 2017-2018.

[1] I refer NS label to the corpus of native English-language doctoral students who speak English as their first language. In contrast, I refer NNS label to the corpus of non-native speakers of English who speak Arabic as their first language. In the realm of comparing NS and NNS speakers, the two labels of NS and NNS are ubiquitous in language studies, especially studies that compare linguistic variations between languages (e., Friginal et., 2014; Lu & Ai, 2015). The majority of these studies used these labels. Therefore, I used the same labels in the entire dissertation to be consistent with similar studies. I also switch to L1/L2 labels when I talk about the general concept of language itself or writing itself, not to the speakers of such languages or the two corpora speakers I used in my study.

Academic writing is an important key to successful university education in an English-speaking country; international students face several challenges in this regard impacting their acceptance rates by these universities (Hyland, 2008). That is, graduate students are required to gain miscellaneous skills relevant to the academic language, especially in the written register, to be successful in their studies and their future careers. One of the fundamental concerns in higher education is the development of academic writing skills (Staples et al., 2016). Hence, studies focusing on academic writing development have been at the heart of numerous research studies in Second Language Acquisition (SLA) and applied linguistics. With the growing number of students (especially international students) and the pressing need for the possession of good writing skills on the part of graduate students, Leki et al. (2008) called for the provision of increasing scholarly attention regarding second language writing, especially in the realm of graduate students at research-focused universities. Staples et al. (2016) contended that "advanced academic writing is widely recognized as an elaborated form of discourse that is grammatically complex" (p. 150). Thus, becoming well-versed in writing skills, including syntactic skills, is an essential measure of academic and professional ability, not only for NNS, but also for NS (Kellogg & Raulerson, 2007), particularly for those students who wish to secure a position in academic settings that require scholarly publications (e.g., books, book reviews, and journal articles).

When writing in a first and/or a second language, many graduates, including master's and doctoral degree students, struggle because of the complexity and the nature of the various components of writing, particularly in academic prose (Biber et al., 1999). What makes academic writing even harder is the extreme difficulty of pinning down the qualities of proficient writing. Well-structured texts, for instance, are critical to ensuring comprehensibility. Having a strong linguistic background and relevant knowledge can produce error-free writing with complex

sentence constructs, correct punctuation, and wide vocabulary usage. Moreover, Dobakhti (2011) argued that writers should be aware of their writing discourse community's norms and conventions to assert a distinctive writer's voice. More importantly, they should also be able to instantly access a wide range of language structures (e.g., vast number of words, phrases, and syntactic constructs), as well as be able to coherently merge all these linguistic features into a single text (Crossley & McNamara, 2014).

Research Questions

This study sought to answer the following research questions:

1. Based on the normalized frequencies per 1000 words, which of the Ph.D. level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?
2. How do the first language and the second language influence the utilization of NPs complexity?
3. Among the 11 noun modifiers, which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

In this study, I provided a rationale for these questions, highlighted the relevant literature, discussed the methodology, reported results, concluded with the discussion, and suggested pedagogical implications.

A survey by the Association of American Colleges and Universities (2008) showed that colleges and universities mostly address writing skills more than other skills (i.e., reading skills) in their studies. A plethora of L2 graduate students who study in English-speaking countries have limited academic writing skills when they write in academic genres, such as research papers, dissertations, and theses (Rose & McClafferty, 2001). Therefore, most higher education

programs encourage students to enroll in academic writing classes or related academic writing workshops to augment their skills in writing, i.e., structure, writing style, organization, voice). (Eyres et al., 2001). For instance, the National Center for Public Policy and Higher Education (2010) reported that, in general, 60% of college students in U.S. universities and 68% of students in California State Universities (CSU) are required to register in intensive writing English courses. Besides, Biber (2006) affirmed that college students encounter "…a bewildering range of obstacles and adjustments...many of these difficulties involve learning to use language in new ways" (p. 1). However, he also stipulated that all students—whether native speakers of English or non-native speakers— are in dire need of adaptation to a variety of tasks (as required at the college level) that must be accomplished through language.

Interestingly, "…many [graduate] students having high academic grade point averages, lacked confidence in their ability to sufficiently decode a scholarly writing assignment and respond in an effective manner" (Holmes, Waterbury, Baltrinic, & Davis, 2018, p. 68). What makes it even more challenging for ESL students is that some academics set higher standards for ESL/EFL graduate students, believing that graduate students should go beyond writing well-established term papers, theses, and dissertations. They are expected to make an effort to publish peer-reviewed articles and contribute to their respective domains (Kamler & Thomson, 2006; Lovitts, 2001).

In the same vein, some L2 graduate students are faced with twice the demand when writing in academic genres. First, they enter graduate programs with inadequate academic writing skills, such as a lack of familiarity with the academic writing structure (Lambie et al., 2008). Second, graduate students lack professional guidance, for instance, from writing consultants who can help them improve their writing skills (McDonald, 2011). Consequently, the ability to produce effective academic writing becomes stressful for these graduate students.

Critically, the lack of writing development is due to a large number of external and internal linguistic factors, including educational background and the amount of exposure to the academic language. All these reasons would, potentially, in one way or another, affect the development of both NS and NNS writers. Surprisingly, the deficiencies in terms of writing skills are not necessarily exclusive to education: it can also be found in industries where companies spend more than $3 billion yearly on training, including improving their employees' writing deficiencies. Thus, the lack of writing performance affects not only opportunities for graduate students but also the workforce, and ultimately, it constitutes a severe societal burden.

Research (Albelihi, 2021; Hayes, 1996; Saddler & Graham, 2005) proclaimed well-constructed writing requires writers to have both high-order skills (planning, revising, and editing) and lower-level skills (spelling, vocabulary, and sentence construction). On the other hand, Jagaiah (2017) argued that when writers make a deliberate effort and engage in extensive practice in producing, composing, and organizing ideas, high-quality writing still requires writers to produce formal and elegant sentence constructs. Sentence construction is a fundamental skill for writers when producing successfully written text involving higher-order skills. In other words, being able to know how to organize ideas is useless if the writer lacks the skills of forming correct and structurally complex sentences (Graham, 2006; Scardamalia & Bereiter, 1986; Strong, 1986). More concisely, Ph.D. students are expected to be familiar with the appropriate lexicogrammatical features to construct their sentences to help them articulate their ideas effectively and in a way that displays explicit written texts to the audience.

Similarly, Hayes and Flower (1980) underscored the view that lacking competence in producing complex-structured sentences constitutes an impediment for writers when it comes to putting ideas and thoughts into vigorous sentences. Writers with limited skills, as a result, compose clear yet simple sentences. However, this very simplicity prevents them from linking

and completing their ideas (Jagaiah, 2017). Students who lack writing complex sentences would confront some challenges when they read texts that are structurally written in a complex way. The best way to articulate the whole discussion is by considering the following concrete example of simple and compound sentence structures:

(1) Mafaz always eats healthy food. Mafaz ate unhealthy food for lunch. Mafaz got sick.

(2) Mafaz, who always eats healthy food, ate unhealthy food for lunch, and she got sick.

In example (1), the ideas are not connected. Instead, each idea is presented in a simple sentence, including the primary form of a sentence (subject + verb + object) without using connectors. In so doing, the reader can link each idea, which depends on the reader's previous knowledge of the intended person (Mafaz). Conversely, in example (2), the sentence has connective words such as 'who' (a pronoun) and 'because' (a conjunction). These two connectors play a part in making the sentence cohesive by joining the first two parts. As a result, the sentence structure's complexity helps the writer efficiently and effectively convey the meaning to the reader. Producing a simple sentence structure impedes students' progress in writing skills and, as a result, may affect their grades. For example, an essay that lacks cohesive devices and syntactic complexity would be rated as a poorly written work. Hence, it becomes essential for students, [especially *graduate students*, emphasis is mine] to learn syntactically complex structured sentences to both enhance the quality of their writing and achieve better grades (Freedman, 1979). It is worth mentioning here that academic writing is more complex than any other written registers because of its dependence on phrasal features that are usually acquired by students at advanced stages (Biber et al., 2011). An in-depth discussion about the importance of the inclusion of phrasal features that graduate students should be familiar with in the academic contexts will be provided in Chapter two with comprehensive examples.

Statement of the Problem

Syntactic complexity, also called grammatical complexity, is among the three essential constructs of L2 performance and L2 proficiency; these constructs can be captured by the notions of complexity, accuracy, and fluency (CAF) (Housen & Kuiken, 2009). The CAF constructs are the descriptors used for assessing academic language development and proficiency. In this dissertation, *complexity* construct is the main focus.

For the past 45 years, the notion of syntactic complexity in L2 writing has received scholarly attention in the field of second language acquisition (SLA), language testing, corpus linguistics, and English for Academic Purposes (EAP) and English for Specific Purposes (ESP) . In general, syntactic complexity, according to Ortega (2003), is viewed as "…the range of forms that surface in language production and the degree of sophistication of such forms" (p. 492). Syntactic complexity is a fundamental construct in second language studies because of its entailment of presumptions about language development (Ortega, 2003). However, in L2 writing research, researchers have predominantly operationalized syntactic complexity by employing large-grained and longitudinally based studies (Larsen-Freeman, 1978; Ortega, 2003; Wolfe-Quinteroet al., 1998).

Moreover, traditional measures of syntactic complexity (e.g., T-unit, mean length of t-units, and the average number of clauses per t-unit are considered as critical tools in all language-related fields (Ortega, 2003). Over the past four decades, most studies in L2 writing have emphasized the measure of traditional syntactic indexes such as subordinate clauses, embedded clauses in academic contexts, especially in L2 writing (Casal & Lee, 2019; Shadloo et al., 2019). These researchers, theoretically, pedagogically, and practically have contributed to the area of syntactic complexity in L2 writing. However, studies in the 2010s called for the inclusion of phrasal constructions into lexico-grammatical features to reach a comprehensive representation of students' academic writing development (Lan et al., 2019b). More specifically,

these studies found that the syntactic complexity of students' academic writing grows through embedded NPs as they progress in their academic environments (Biber et al., 2011; Biber et l., 2014; Lu, 2011; Parkinson & Musgrave, 2014). For this reason, students, both NS and NNS have to develop competence with specific linguistic patterns (i.e., nominal phrase modifications) in the style of their discourse to be successful members of that linguistic community.

It is often assumed that graduate students, both NS and NNS have already attained a high level of writing quality since they have been admitted to graduate schools. However, Snively et al. (2006) emphasized that graduate students often attend writing centers to seek additional support to boost their writing skills, both in terms of content and language. Phillips (2008) maintained that compared to undergraduate students, the number of graduate students at a university is fewer; however, the latter use student writing centers more than the former. This indicates that graduate students are more aware of their needs to develop their writing development to meet the high expectations of academic writing requiring them to produce sophisticated sentence structures, yet easy-to-read, well-organized prose.

In response to the difficulties of graduate academic writing, I argue that both native and non-native graduate students should be aware of the most common linguistic features of the academic prose, particularly in using nominal groups in their academic writing (e.g., appositive noun phrases, prepositional phrases as post-modifiers, and prepositions as noun post-modifiers) which produce well-established written texts that help them translate ideas efficiently. For graduate students, hence, it is crucial to pack their texts with complex NPs since academic language is condensed with nominal phrases.

By examining written samples of graduate students using two different corpora, we can better apprehend the variations in the use of phrasal complexity by NS and NNS graduate students in academic prose and compare their writings to professional writers. With such

understanding, of course, researchers, curriculum designers, and teachers in L2 writing would develop writing instructions in different academic contexts.

Purpose of the Study

Recall that I have two research questions:

1. Based on the normalized frequencies per 1000 words, which of the Ph.D. level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?
2. How do the first language and the second language influence the utilization of NPs complexity?
3. Among the 11 noun modifiers, which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

Impetus of the Study

My inquisitiveness in studying syntactic complexity is long-standing: it has been part of the three stages of my educational journey. The genesis of this dissertation can be traced back to the time when I was an ESL student. I realized the importance of syntactic complexity when I had to prepare to pass the IELTS (International English Language Testing System) exam to enroll in my master's degree program at Murray State University. While I was reading the rubric for writing tasks, I noticed the criterion with regard to 'using a variety of complex structures.' At that time, I was unaware of the importance of writing complex structures, and I sought help from my L2 teachers to improve my syntactic skills and score a high band in the exam. That is, I was not familiar with complex structures such as noun complement and appositive noun phrases. Unfortunately, my L2 teachers could not provide me with assistance to enhance my skills in writing syntactically complex sentence structures. Their feedback did not exceed the boundaries of simple structures, such as correcting verb agreements.

However, over the time, my MA supervisor offered me an opportunity to teach writing skills to English L2 Saudi students preparing for the English proficiency test. While teaching those classes, I found that teaching writing to L2 students was never an easy task, especially when teaching syntactically complex structures. Later, when I started my PhD studies, I recognized that it was high time to study syntactic complexity in written texts both for myself as a learner and researcher and as an L2 instructor to my prospective students. Finally, by reading literature on SCMs, I realized how little research work had been done on the academic writing of NS and NNS graduate students.

Significance of the Study

There is a general paucity of empirical studies focusing specifically on nominal modifications in NS and NNS graduate students' academic writing. This is, of course, because the majority of L2 studies in the field of syntactic complexity (Beers & Nagy, 2009; Casal & Lee, 2019; Ellis & Yuan, 2004; Hunt, 1965; Jiang, 2012; Stockwell & Harrington, 2003) tend to gauge the traditional measures, such as clausal embedding and subordinate clauses, assuming that the complexity of academic writing is based on constructing clauses (Biber & Gray, 2010; Gray & Ponpoon, 2011). Even so, few researchers have been able to draw on any syntactic complexity research into nominal phrases, even less so focusing on graduate students (Ansarifar et al. 2018; Musgrave & Parkinson, 2014; Mazgutova & Kormos, 2015; Staples et al., 2016). For that very reason, this study intended to respond to Biber et al.'s (2011) suggestion that their hypothesized development needs to be revised. Furthermore, the current study stems from the need to understand the development of graduate students' writing, not only L2 writers but also NS writers, by examining critical characteristics (11 noun modifiers) of academic prose to help them develop their language skills.

Over and above that, scant attention has been paid to evaluating Saudi graduate students' writing development, whereas this study concentrates on NS and NNS graduate writers. Alamri (2017) asserted that novice writers would encounter a different type of challenges when writing for publication since English writing requires mastering various techniques, including being familiar with the linguistic structures related to academic written prose. For this reason, Saudi graduate students would benefit from the current study by identifying the areas of strengths and weaknesses in understanding selections of the proper linguistic features in academic writing.

Such a neglect will not aid students after they graduate and conduct research for publication. To illustrate this point, RiazI et al. (2018) highlighted that during the last 25 years, the typical research contexts and participants focus on undergraduate students in American institutions or colleges (40%), while 10.7% of empirical published papers focus on graduate writers. There is a dearth of research focusing on Arabic writers, especially Saudis, compared to other languages such as Mandarin, Japanese, and Persian. Li and Lu (2013) summed up that to learn about the role of NS in the improvement of L2 syntactic complexity, we need to conduct more studies of students from distinct NS backgrounds. The current study hopes to contribute towards this much-needed research.

Another significant aspect of the current study is that it hopes that the findings will contribute to the teaching of advanced academic writing. Graduate students in academic fields must acquire and learn specific grammatical structures and the discourse styles that are specialized to the registers. However, many native English speakers lack familiarity with this kind of complexity in writing (Biber et al., 2011). Therefore, this study measures the syntactic complexity through a wide range of lenses in the nominal phrases of graduate students to determine the development progress of the target syntactic characteristics specialized in academic prose.

Teachers, professors, and journal editors might encounter some challenges describing or giving explicit feedback to their students or researchers to help them to be successful members of the academic community since the noun phrase modifications increase the level proficiency of academic writers. Thus, the outcomes of the study will help them tackle such issues by understanding the form and the proper use of noun modifiers in academic writing at the graduate level. Finally, the results of the study will also shed light on the material designers of EAP by tailoring curricula that fulfill such needs.

Scope of the Study

To conduct the current study, I garnered 100 introduction sections of dissertations: 50 written by PhD NS students and 50 by NNS PhD students from different universities in the United States. Then, I compared the frequencies of 11 noun modifiers in the writings of the three groups: NS, NNS, and expert writers. I also examined how the language background influenced NP complexity in academic writing. The dissertations in the two corpora covered a period of 14 years (from 2011-2019) from education field with different sub-fields (e.g., applied linguistics, and Teaching English as a Second Language) Based on a corpus investigation, the study focused on a subset of NPs (11 noun modifiers) in Biber et al.'s (2011) index of writing developmental progression. The two corpora were collected using two search engines: 1) Quest engine, and 2) Saudi Digital Library. The 11 noun modifiers were extracted using both manual and automated steps. They were analyzed by calculating the normalized frequency of each noun modifier in the two corpora. Finally, the association between NS and NNS language background and NPs complexity was based on a Chi-square analysis.

Theoretical Orientations

Hypothesized Developmental Stages for Complexity Features

The current study adopted Biber et al.'s (2011) hypothesized developmental stages for complexity features to explore the academic writing of two NNS and NS graduate groups. The hypothesis was based on a large-scale corpus in which they investigated 28 grammatical features in a wide range of studies from different sub-registers (e.g., social and natural sciences) to provide a full characterization of the development of high advanced academic writing. The major results revealed that subordinate clauses were more common in conversation than in academic writing. Further, they showed that academic language depends heavily on complex noun modifications.[2] Based on their findings, they hypothesized developmental stages for complexity features for students writing, which considered as a new approach for investigating complexity in student writing development.

Furthermore, Biber et al. (2011) argued that academic language is considered complex under the condition of using only syntactic elements such as noun modifiers. Thus, their developmental hypothesis was built on the assumption that good or excellent writers are expected to utilize phrasal features placed at later stages as they are mostly found in academic writing. Further, they contend that writers (both native and non-native alike) should be conscious of the characteristic grammatical features associated with academic writing: using NPs structures. Besides, they claimed that complex NPs would be more appropriate when investigating grammatical complexity than measuring embedded clauses[3]. Now, I will move on to provide a more detailed description of the hypothesized series of stages.

There are in-depth descriptions of the developmental index progression. Biber et al. (2011) suggested that the developmental stages are from finite contingent conditions acting as

[2] More explanations of Biber et al.'s study can be found in the literature review.
[3] More discussions about what syntactic measure is interpretable for investigating academic writing development in the next chapter.

components in other clauses, through intermediate stages of non-finite dependent clauses and sentences working in the context of components in other clauses, to the final stage involving the intensive usage of nonclausal (phrasal) based constructs that act as constituents in non-paragraphs.

As can been seen below in Table 1, it includes five developmental index stages. The finite complement clause (that and Wh) is considered as the beginning stage of students' writing development. In other words, in this stage, the limited complement clause is governed by using verbs such as *think*, *know*, and *say* (e.g., "I think they are from Brazil"). Notably, the first stage does not include any noun modifications indicating that such complex noun modifiers are acquired at later stages. The second stage begins with simple noun modifications over the attributive adjectives and participles as pre-modifiers. Then in the third stage, it progresses through the use of complex noun modifiers, such as pre-modifiers, prepositional phrases as noun post-modifiers with concrete meaning, and relative clauses. Then the development of noun modifier features progresses further to involve nonfinite limitations, including -ing clauses and -ed clauses along with prepositional phrases as postmodifiers. The last stage involves appositive noun phrases as noun modifiers and complement clauses as noun modifiers. Two grammatical patterns illustrated below can summarize the five developmental stages.

A- Structural type

finite dependent clauses + nonfinite dependent clauses + dependent phrases.

B- Syntactic function

Constituents in clauses + constituents in noun phrases.

Therefore, the current study aimed to compare NPs based on a subset of Biber et al.'s index (11 noun modifiers) in the academic writing of graduate students (NNS &NS) and

compare their use of the 11 noun modifiers with those of professional writers to see how different L1 backgrounds of advanced writers might affect the use of NPs.

Table 1

Biber et al.'s hypothesized developmental stages for complexity features

Stage	Grammatical structure(s)	Example(s)
Stage 1	Finite complement clauses (*that* and *WH*) controlled by extremely common verbs (e.g., *think, know, say*)	1a *We never quite* ***know*** *what to make of him* (conv) 1b *I* ***think*** *I found her on the eighth floor* (conv)
Stage 2	Finite complement clauses controlled by a wider set of verbs	2a *I'd* ***forgotten*** *that he had just testified on that one* (conv)
	Finite adverbial clauses	2b *There's some here if you want it* (conv) 2c *I'm assuming I gained weight because things are a little tighter than they used to be* (conv)
	Non-finite complement clauses, controlled by common verbs (especially *want*)	2d *I don't* ***want*** *to fight with them about it* (conv) 2e *I* ***hate*** *watching the people interact* (conv)
	Phrasal embedding in the clause: simple adverbs as adverbials	2f *We came here and then parked inside* (conv)
	Simple phrasal embedding in the noun phrase: common attributive adjectives	2g *It certainly has a nice flavor* (conv) 2h *It's one of those big brown trays* (conv)
Stage 3	Phrasal embedding in the clause: prepositional phrases as adverbials	3a *He seems to have been hit on the head* (fict)
	Finite complement clauses controlled by adjectives	3b *I was* ***sure*** *that I could smooth over our little misunderstanding* (fict)
	Non-finite complement clauses controlled by a wider set of verbs	3c *The snow began to fall again* (fict)
	that relative clauses, especially with animate head nouns	3d *the guy that made that call* (fict)
	Simple phrasal embedding in the noun phrase: nouns as pre-modifiers	3e *a really obscure cable channel* (fict)
	Possessive nouns as pre-modifiers *of* phrases as post-modifiers	3f *Tobie's voice* (fict) 3g *the editor of the food section* (fict)
	Simple PPs as NP post-modifiers, especially with prepositions other than *of* when they have concrete/ locative meanings	3h *a house in the suburbs* (fict)
Stage 4	Non-finite complement clauses controlled by adjectives	4a *These will not be* ***easy*** *to obtain* (acad)
	Extraposed complement clauses	4b ***It is clear*** *that much remains to be learned. . .* (acad) 4c *In that case* ***it is useful*** *to phrase sustatinability in terms of. . .* (acad)

Table 1(cont.)

Stage	Grammatical structure(s)	Example(s)
	Non-finite relative clauses	4d *the* ***method*** *used here* (acad)
		4e ***studies*** *employing electrophysiological measures* (acad)
	Multiple pre-modifiers in the noun phrase: attributive adjectives and nouns as pre-modifiers	4f *the prevalence of airway obstruction and self-reported disease status* (acad)
		4g *Positive propagule size effects have been demonstrated for both plant and animal systems* (acad)
	PPs as noun post-modifiers, especially with prepositions other than *of* when they have abstract meanings	4h *half of the subjects in each age/instructional condition* (acad)
		4i *the specific growth rate at small population sizes*
Stage 5	Preposition + non-finite complement clause	5a *the* ***idea of*** *using a Monte Carlo approach* (acad)
	Complement clauses controlled by nouns	5b *the* ***hypothesis*** *that female body weight was more variable* (acad)
		5c *a* ***plan*** *to upgrade the airport* (acad)
	Appositive noun phrases	5d *The* ***CTBS*** *(the fourth edition of the test) was administered in 1997–1998* (acad)
	Extensive phrasal embedding in the NP: multiple pre-nominal and post-nominal phrasal modifiers	5e *the [presence of layered [[structures] at the [[[borderline]] of cell territories]]]* (acad)

Adopted from Biber et al.'s (2011) (pp. 253-254).

Biber et al.'s (2011) proposed developmental progression has been subject to considerable criticism. Yang (2013) pointed out that Biber et al.'s study used a corpus-based approach to investigate the syntactic complexity in two distinct registers (spoken vs. written); consequently, their research was not capable of responding to development-related inquiries and was "mathematically questionable" (Yang, 2013, p. 190). Besides, she contended that Biber

et al. collected data from highly advanced NS, but not NNS. Yang claimed that Biber et al.'s study lacked evidence and/or support from SLA studies. Methodologically speaking, Yang questioned some of the mathematical calculations used by the authors (Wang, et al., 2006; Wei et al., 2011; Yang & Li, 2004). Specifically, she argued that the estimate of subordination was based on normalized frequency (1000) words, which was not comparable to other studies that used conventional measures, such as the T-unit and CT/U.

Conversely, Biber, et al. (2013) refuted Yang's (2013) claims by demonstrating that Yang missed the goal of the article and emphasized minor points without considering the implications of their empirical study. They justified this by saying that the key objective of their research was to depict the grammatical features found in advanced academic writing, that were characterized by intensive complex phrase modifications. They also added that these complex phrases might be a challenge not only for learners, regardless of their L1 backgrounds, but also for professionals. Supporting the Biber et al.'s argument, Casal and Lee (2019) believed that Biber et al.'s index is a useful representation means of measuring the development of maturing academic writers.

Summary of the Chapter

This section attempted to provide the background of syntactic complexity in L2 writing. This was followed by a brief discussion of the purpose of the study and the statement of the problem. Then, the chapter stated the impetus of the study. After that, the debate moved to present the significance, scope, and the limitation of the current study. The branch closed by introducing Biber et al.'s hypothesis used in the current study. The next section presents the literature review for the research.

Chapter 2

LITERATURE REVIEW

This section presents a review of the relevant nominal phrasal complexity studies. The chapter begins by introducing the conceptualization and definition of the term, complexity, in linguistics, followed by an overview of syntactic complexity in L2 writing studies. After that, a summary of noun modification and its role in complexity is provided. This is followed by describing the empirical studies on noun phrase complexity. Then, a rationale for comparing NS and NNS writers will be provided. The last section introduces the aim of the current study.

Conceptualizing Complexity in Linguistics

From a theoretical construct, complexity has received increased attention across several academic disciplines (e.g., social sciences and natural sciences). In second language acquisition (SLA), a considerable body of literature has grown around the construct of complexity (Bulté & Housen, 2012). The complexity construct is one of the three critical dimensions (complexity, accuracy, and fluency [CAF]) in L2 writing studies that are used to benchmark language development, performance, and proficiency (Housen et al., 2012; Norris & Ortega, 2009; Skehan, 1998). Over the last two decades, these constructs (CAF) have become the leading primary research variables in the domain of SLA (Bulté & Housen, 2014). It is worth noting that the three constructs emerged from the L1 studies of Skehan (1998), who suggested an L2 model relying on the three constructs (Housen & Kuiken, 2009). In the following paragraphs, I will focus on complexity in L2 studies as the primary construct in the current study.

The construct of complexity in L2 writing studies plays a vital role in two full strands: first, being investigated as an independent variable when the researcher utilizes complexity to investigate the performance, proficiency, and development of L2 language learners based on

some linguistic aspects of the target language—for instance, looking into measuring the complexity of language used by L2 learners to probe for better and effective teaching approaches and instructions (DeKeyser, 1998; Doughty & Williams, 1998; Housen et al., 2005; Spada & Tomita, 2010). Second, it is also explored as a dependent variable in L2 studies, conjointly with accuracy, and fluency constructs. In the current study, I predominantly attended to the first strand by using the complexity as an independent variable to investigate the writing development of L1 and L2 in academic writing prose based on Biber et al.'s (2011) index. After giving a brief discussion about the conceptualization of complexity in linguistics, I move on to provide an extensive discussion of the definition of L2 complexity.

Definition of L2 Complexity

L2 complexity is "the most complex, ambiguous, and least understood dimension of the CAF triad" (Housen & Kuiken, 2009, p. 463). In line with Housen et al. (2009) asserted that "[complexity] certainly [is] the most problematic construct [...] because of its polysemous nature" (p. 592). Hence, Bulté and Housen (2012) maintained that "there is no commonly accepted definition of complexity" (p. 22) despite its essential position in modern sciences. However, complexity in SLA and applied linguistics, at the most basic level, is frequently viewed in two ways: [first] as a quality (or property) of a phenomenon; [second] as a structure in terms of [first]the number and the nature of the discrete components that the entity consists of, and [second] the name and the quality of the relationship between the constituent elements" (Bulté & Housen, 2012, p.22); for example, "using a wide range of structures and vocabulary" (Lennon, 1990, p.390) or "[t]he extent to which the language produced in performing a task is elaborate and varied" (Ellis, 2003, p.340). Another definition by Skehan (2003) pointed out that, "complexity refers to the complexity of the underlying interlanguage system developed" (p. 8).

In a literal definition, according to the Merriam-Webster Dictionary, complexity refers to the "state or status of being intricate or complicated; hard to separate, analyze or solve." Its origins are derived from a conjugation of the Latin word 'com', which means "together," plus the Latin word *plectere*, which means "to braid" (Bulté & Housen, 2012).

From the above definitions of L2 complexity, there are divergent opinions in defining complexity. Such interpretations, indeed, are influenced by the way scholars view their substantive justifications when explaining complexity. Not merely this, other factors such as the cultural and social backgrounds of the scholars significantly affect the way they conceptualize complexity, i.e., their interests in linguistics. Moreover, variations in time between the definitions is another guiding influence on the varied interpretations among the authors; for example, there are 13 years between the meanings of Lennon in 1990 and Ellis in 2003. Even with the undisguised variations, there are still outlines shaping the general frame of complexity in SLA:

1. Changes of the linguistic features in a text.
2. The proper use of structure in a sentence, in which it helps speakers/writers to provide meaningful linguistic production.
3. The use of sophisticated compositions.

In the main, the interpretation of L2 complexity divides into two approaches: relative (or cognitive complexity or difficulty) and absolute. Bulté and Housen (2012) articulated the differences between the two concepts in their taxonomy (see Figure 1). According to the authors, both the relative and absolute regard to the features of language properties such as structure, sub-systems, items, patterns, morphology, and phonology.

The *relative approach* refers to the specific linguistic elements that require language learners to make extensive mental efforts to learn or acquire language skills (Hulstijn & De Graa, 1994). For instance, it was revealed in psycholinguistic research that specific embedded structures (e.g., relative clauses) are more challenging to operate or acquire than other language constructs (Byrnes & Sinicrope, 2008; Diessel, 2004). However, Bulté and Housen (2012) contended that the difficulty of the language is, to a certain degree, influenced by a learner-dependence; that is, the degree of difficulty of some linguistic features may vary from one learner or language-user to another, relying on distinct external and internal factors such as language aptitude, L1 background, motivation, and so forth.

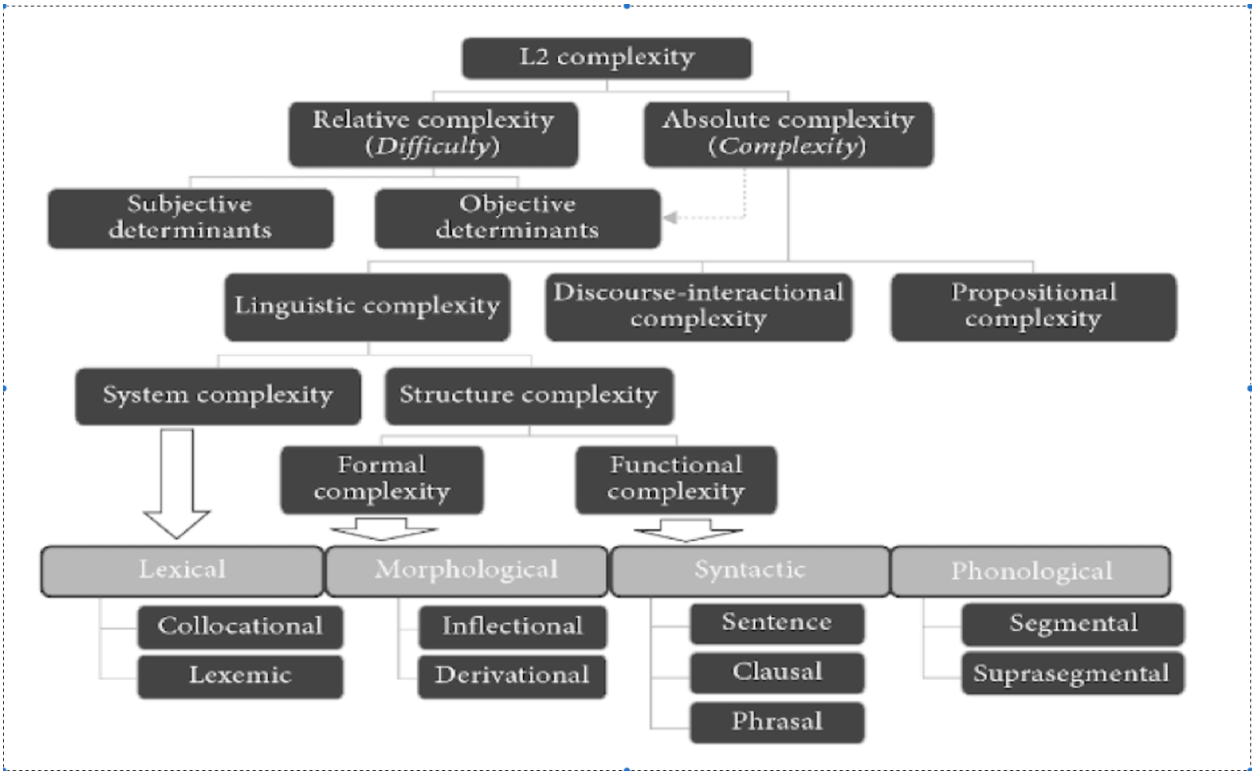
The *absolute approach,* on the other hand, considers that the more linguistic systems a language has, the more complicated it is (Miestam, 2008). To provide a more detailed definition, referring to the language user linguistic features, Bulté and Housen (2012) defined the absolute approach as "the number of discrete components that a language feature or a language system consists of, and as the number of connections between the different components" (p. 24). Bulté and Housen (2012) argued that researchers often employ a broad and ambiguous term when operationalizing complexity in L2 studies because it is naturally considered a multifarious nature. Therefore, they proposed a taxonomic model to conceptualize the meaning of complexity in SLA using various levels to characterize the components of *complexity* (see Figure 1). Figure 1 shows the two veins of L2 complexity: *absolute and relative approaches*. It is worth noting that the authors distinguished between difficulty and complexity in the taxonomy to classify complexity. In a widespread notion, discourse-interactional complexity, prepositional complexity, and linguistic complexity are primarily the main characteristics of L2 complexity.

Propositional complexity refers to the quantity of input (information or ideas) that a speaker/writer needs to be encoded to understand the meaning of specific messages (Ellis & Barkhuizen, 2005; Zaki & Ellis, 1999). For example, encoding 55 idea units in storytelling would likely be propositionally more intricate than verbally encoding 25 idea units (Bulté & Housen, 2012). *Discourse-interactional complexity*, which is still an ill-defined notion, refers to, "the discourse-interactional complexity of learners' L2 performance has been characterized in terms of the number and type of turn changes that learners initiate and the interactional moves and participation roles that they engage in" (p. 25) (Du 1986; Gilabert, et al., 2009; Pallotti 2008, as cited in Bulté & Housen, 2012). Both *prepositional complexity* and *discourse complexity* are still not considered novel concepts as they receive little attention in L2 studies, compared with linguistic complexity.

Lastly, L2 literature considers linguistic complexity to fall into two distinct categories: *system complexity* and *structural complexity*. *System complexity* (or global complexity) refers to the quantity of the linguistic system stored in the L2 learner's repertoire. To put it another way, the variety or range of language structures and elements they know or implement. on the contrary, *structural complexity* (or local complexity), refers to the production of deep or sophisticated L2 learners' structures, whether informal or functional complexity. For instance, using—whether in spoken or written registers— a wide range of different grammatical structures such as embedding and various nominal phrase modifications in an academic text.

Figure 1

A taxonomy of complexity constructs



Adoption of L2 complexity from Bulté and Housen (2012, p. 23).

An Overview of Syntactic Complexity

In the past forty years, research on syntactic complexity has seen increasingly rapid advances in the field of L2 second language writing. The current study concentrates on writing syntactic complexity through the lens of a subset of lexico-grammatical features based on Biber et al.'s (2011) developmental index progression. The following paragraphs present the definition of syntactic complexity via three dimensions: theoretical, observational and operational aspects, following Lan et al.'s (2019a) recent comprehensive review of L2 writing classrooms.

Theoretical Definition

Despite its extensive use in linguistic research, Bulté and Housen (2012) stated that "there is no consensus in the literature on the definition of complexity, and no consistency as to how it has been operationalized across studies" (p. 43). Since the definition of syntactic

complexity varies among researchers, it is essential to discuss some of the popular definitions in L2 writing literature to get a candid picture of the theoretical aspect of syntactic complexity.

Foster and Shehan (1996) defined syntactic complexity as "progressively more elaborate language…[and] a greater variety of syntactic patterning" (p. 303). A further definition was given by Wolfe-Quintero et al. (1998), who described syntactic complexity as "a wide variety of both basic and sophisticated structures [that] are available and [that] can be accessed quickly" (p. 69). Similarly, Nunberg et al. (2002) defined it as "the way words are combined to form sentences" (p. 1728). Similarly, Ortega (2003) defined syntactic complexity as "the range of forms that surface in language production and the degree of sophistication of such forms" (p. 492). In the same manner, Lu (2017) referred to complexity as "the variety and degree of sophistication of the syntactic structures deployed in written production" (p. 494). A widely accepted definition in L2 studies comes from Crossley and McNamara (2014), who asserted that grammatical complexity should contain "the sophistication of syntactic forms produced by a speaker or writer and the range or variety of syntactic forms produced" (p. 68). Bulté and Housen offered a taxonomy that includes three dimensions of operationalizing syntactic complexity (see Figure 2). In the theoretical level of the taxonomy, they stated that there are two fundamental types of grammatical complexity: systemic and structural complexity. The systemic complexity is related to the 'breadth' of grammatical features that would be used by an L2 learner (i.e., grammatical size, range, and variation). In contrast, the structural complexity refers to the 'depth' an L2 learner can produce (i.e., grammatical sophistication).

Nonetheless, researchers in register studies have argued that grammatical complexity has an impact on language use (i.e., register) (Lan et al., 2019a). Based on Biber et al.'s (2011) index (see the conceptual framework section), grammatical complexity is viewed as a grammatical

form, referring to lexico-grammatical elements, and grammatical function, referring to the specific syntactic features associated with a register. To illustrate this, the academic written prose (e.g., dissertations) is dense with nominal phrases (noun modifiers) as specific grammatical functions to this register. However, Bulté and Housen's (2012) definition of grammatical complexity did not explicitly consider the functionality of some grammatical features. Thereby, Lan et al. (2019a) maintained that the central difference between the two theoretical frameworks (Biber et al., 2011; Bulté & Housen, 2012) is that "Bulté and Housen (2012) considered grammatical complexity as an independent construct, which can be measured in a static way across contexts, whereas Biber et al. (2011) regarded grammatical complexity as, "a dependent construct which should be measured in response to specific registers" (p. 2). In a recent paper, Biber et al. (2020) comprehensibly defined syntactic complexity as, "the addition of structural elements to 'simple' phrases and clauses" (p. 6). That is, a 'simple' phrase or clause includes only obligatory elements (e.g., the headword in a phrase, or the subject, verb, and object in a clause). Structural additions to these patterns result in increasingly 'complex' grammar" (p. 6). While a variety of definitions of the term syntactic complexity have been suggested, this dissertation adopts Biber et al.'s (2020) stance of theoretical grammatical definition, since the current study investigates academic writing via dissertation genre, targeting lexicon-grammatical functioning as noun modifiers. After reviewing the theoretical aspect of grammatical complexity, the following section presents the observational definition.

Observational Definition

In a less abstract sense, the observational dimension of linguistic complexity refers to the actual language performance level. According to the Bulté and Housen (2012), this can be demonstrated in "language behavior in various ways and on several different levels" (p. 27); for

instance, the employment of diverse strategies for joining and including clauses. They bring to attention the paramount importance of differentiating between observable grammatical features and the choice of grammatical features that can be observed. This, technically, according to Lan et al. (2019a), is based on various levels of language performance such as sentences, clauses, T-unit, etc.

However, in a distinct amount of time, grammatical complexity has been observed at another level of language performance by L2 researchers. Accordingly, during the last two decades in L2 studies, there have been differences in defining the observational level when studying grammatical complexity. T-units, clauses, and sentences are the linguistic units frequently observed in L2 studies (detailed information about these units are provided in the following sections). In response to this, Lan et al. (2019a) argued that considering Bulté and Housen's (2012) definition of observational level means that the observation of grammatical complexity can be measured only through clausal levels, especially to subordinate clauses. Based on a comprehensive review of grammatical complexity measures in L2 studies, Wolfe-Quintero et al. (1998) revealed that grammatical complexity was associated with some specific syntactic features such as adverbial clauses and "the presence of specific grammatical structures in relation to clauses, T-units, or sentences [e.g., mean length of sentences]" (p. 69). It is worth mentioning here, despite the variations of opinions, some evidence showed that these traditional measures (e.g., T-unit and clausal) were a valid metrics of L2 writing in some certain levels of language proficiency (i.e., low and intermediate), but not for advanced ones (Ortega, 2003; Wolfe-Quintero, Inagaki, & Kim, 1998). For multidimensional grammatical complexity measures, including the structure of coordination, subordination, and phrases, Norris and Ortega (2009) and Lu (2010) recommended not focusing on only one area of the constructs mentioned

above. Moreover, they called for the inclusion of phrasal measures when targeting highly proficient English language students.

Even with the long history of the traditional measure of syntactic complexity in the L2 field, some scholars encountered the conventional standards and called for the inclusion of clausal and phrasal complexity when investigating academic writing (Biber et al., 2011; Biber, Gray, & Poonpon, 2013; Staples et al., 2016; Yang, Lu, & Weigle, 2015). For instance, Biber et al. (2013) claimed that academic writing is featured by "on phrasal structures, especially complex phrases with phrasal modifiers" (p. 192). Based on corpus-based findings, Biber et al. (2011) argued that the development for NS and NNS writing progress from a reliance finite and nonfinite clauses to dependent phrases. From then on, many scholars have mentioned that phrasal structures should be integrated into the analysis of grammatical complexity to make grammatical complexity more comprehensively represented (Lan at al., 2019a). In L2 writing, two of the important theoretical frameworks mirror the expansion of grammatical complexity: (1) Biber et al. (2011) included dependent phrases that function as modifiers of NPs in their matrix of grammatical form and function; (2) Bulté and Housen (2012) proposed the Taxonomy of L2 complexity which integrated phrase complexity (e.g., NPs) as part of the linguistic complexity. These theoretical frameworks generate a number of empirical studies in L2 writing with an emphasis on phrasal structures in the 2010s (Lan et al., 2019a).

In consonance with the suggestion of the above theoretical frameworks, I used in the current study NPs complexity, including clausal and phrasal modifiers (e.g., nouns as premodifiers and prepositional phrases), where Biber et al. (2011) considered them to be a robust example in representing phrasal complexity.

To end this, the observational definition of grammatical complexity has undergone considerable changes: from just using clauses to employing both clauses and phrases to grammatical metrics. Not only this, but it also includes morphological complexity. This is why the current study has a manifested observation level following the recent trend that supports measuring phrasal features (e.g., noun modifiers, including pre and postmodifiers) based on numerous corpus-based studies (Biber & Gray, 2011; Parkinson & Musgrave, 2014; Staples et al., 2016), mainly when targeting high-advanced students as I do in the current study (investigating dissertations of graduate students).

Operational Definition

This section will succinctly review how the syntactic complexity was operationalized in L2 writing based on the comprehensive review of Lan et al. (2019a). The operational dimension of syntactic complexity refers to, "the analytical measures and instruments that have been designed to give a quantitative indication of the degree of complexity of a given language sample" (Bulté & Housen, 2012 p. 27). As shown in Figure 2, the statistical construct includes length, ratio, index, and frequency. These primary parameters have been operationalized, from 1998 to 2018, to investigate grammatical complexity in L2 writing (Norris & Ortega, 2009; Wolfe-Quintero et al., 1998). A focus will be on the frequency construct because I employed it as a primary measure of the current study.

Length

Originating from L1 studies, length became the most prevalent grammatical measure employed in L2 writing studies. To be more specific, according to Orgeta (2003), the most common syntactic metrics are the mean length of sentence (MLS), the mean length of T-unit (MLTU), and the mean length of clause (MLC). Based on Lan et al.'s recent comprehensive

review from 1998 to 2018 (2019a), 44 studies used the mean length of T-unit. Even with the widespread use of the length parameter in the L2 grammatical studies, it is not immune from criticism. For instance, Wolfe-Quintero et al. (1998) defined the length parameter as a measure of fluency, not grammatical complexity.

Moreover, Biber et al. (2011) challenged the appropriateness of employing MLTU and clause per T-unit (C/TU) when examining writing development in L2 studies. This is because MLTU and C/TU measures do not represent linguistic features in the academic writing register. This was not the case for Norris and Ortega (2009) and Ortega (2003), who deemed length to be a valid parameter measure in grammatical complexity. Lan et al. (2019a) stated that even with the inconsistency, scholars overwhelmingly used length measure in L2 studies related to complexity from 2000 to 2010 (Crossley & McNamara, 2014; Lu, 2011; Norris & Ortega, 2009).

Ratio

Wolfe-Quintero et al. (1998) defined ratio as the number of one type of measure divided by the gross number of another measure. Various ratios measure the connection between clauses, sentences, and T-units in grammatical complexity (Wolfe-Quintero et al., 1998). In Lan et al.'s (2019a) comprehensive review of the operational definition of grammatical complexity, clauses per T-unit complex, T-units per T-unit, dependent clause per clause, dependent clause per T-unit, coordinate phrases per clause, coordinate phrases per T-unit, and T-unit per sentence are the most widespread grammatical complexity measures in L2 writing. Reverting to Norris and Ortega's (2009) assertion that grammatical complexity ought to be measured via a multi-dimensional construct, Lan et al. (2019a) proposed that, "future L2 writing complexity research should be conducted with measures that go beyond subordination" (p. 4).

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Index

Index refers to calculating numeric scores by applying a specific formula to produce holistic scores to show complexity (Wolfe-Quintero et al., 1998). For instance, the example below depicts the meticulous way of calculating the Complexity Index Score (Flahive & Snow, 1980, as cited in Lan et al., 2019a).

The complexity index score

Calculation: the sum of T-unit scores/number of T-units. The coding scheme for the T-unit score:

1 = derivational morphemes and adjectives

2 = relatives, embedded clauses, possessives and comparatives

3 = adverbial and noun clauses (Wolfe-Quintero et al., 1998)

Lan et al. (2019a) stated that few L2 writing studies have applied index as a primary parameter in the last two decades due to the complexity of holistically calculating its scores. They also asserted that, till this moment, only one study of writing applied index-based measures using a computational tool, Coh-Metrix (Crossley & McNamara, 2014).

Frequency

The frequency is calculated by counting the occurrences of a particular grammatical structure (Wolfe-Quintero et al., 1998); for instance, counting the frequency of attributive adjectives and prepositional phrases in a specific written text. Researchers in L2 writing studies use length, ratio, and index as one term: a holistic approach (Biber et al., 2016). According to Biber et al., "provides a few holistic measures designed to capture the entire system of grammatical complexity" (p. 649). However, this approach, according to Lan. et al. (2019a), is parsimonious, which poses the analysis of other grammatical features with different functions and distributions (Biber et al., 2016). The holistic approach's baseline value is that they allow only one measure of grammatical complexity instead of providing numerous grammatical features; conversely, the holistic approach cannot present the singularity of each grammatical feature (Lan et al., 2019a). Moreover, some of the holistic approaches might not be a reliable measure for certain proficiency levels of language and registers. In other words, counting the T-unit in the writing of graduate students might not be applicable since graduate students, especially Ph.D. students, have reached a high level of writing development.

Frequency, hence, enables L2 researchers to investigate certain grammatical features. For instance, in the literature, some certain grammatical features have been investigated in L2 writing complexity research, such as prepositional phrases, adverbial clauses, and complement clauses (Wolfe-Quintero et al., 1998). Further, in the 2000s and 2010s, scholars have used a myriad of grammatical features by relying on computational techniques, which has provided more wide-ranging grammatical analysis (Lan et al., 2019a). An example of this is investigating the frequency of 28 grammatical features by Biber et al. (2011) and the 23 features analyzed by Staples et al. (2016). Now, I will move to discuss the changes in measuring frequency over time.

The frequency measure has changed over time. From the beginning of its usage in L2 studies, until the start of the 1990s, the focus was only on the raw frequency. (Wolfe-Quintero et al., 1998). Wolfe-Quintero et al. doubted the validity of natural frequency measures due to "the lack of a fixed delimiter" (p.75). Lan et al. (2019) argued that raw frequency measures could be easily influenced by the context of writing (i.e., time limit or several words). Nonetheless, at the beginning of the 1980s, "normed frequency, which refers to the frequency of a grammatical feature in a standardized text length, has been a common practice in corpus linguistics since the 1980s." (Lan et al., 2019a, p. 5). Recently, a wide range of grammatical complexity studies in L2 writing has utilized the normalized frequency based on 1000 words (Biber et al., 2016; Ansarifar et al., 2018; Lan & Sun, 2019). An illustration of the calculation of normalized frequency is provided in the methodology section.

Finally, the use of frequency-based measures has undergone a few changes in line with selecting grammatical features. In the 1990s, some researchers used fine-grained frequency measures to examine grammatical complexity. Ferrise (1998), as an example, based on 160 ESL written texts, explored 62 lexical and syntactic features, obtaining only 28 of them to compare the ESL proficiency levels. Not long ago, the tendency to grammatical complexity in L2 writing shifted to choosing a specific set of grammatical features that represent a particular register due to certain grammatical features' functions on specific language situations (Biber & Conrad, 2009). Based on a register perspective, Lan et al. (2019) claimed that with some individual functions of some grammatical features, it is essential to consider the register when selecting grammatical features to study L2 writing complexity. They mentioned that since advanced academic language writing is dense with phrasal complexity (Biber et al., 2011; Norris & Ortega, 2009), numerous researchers incorporate NPs and phrasal modifiers, such as pre-modifying

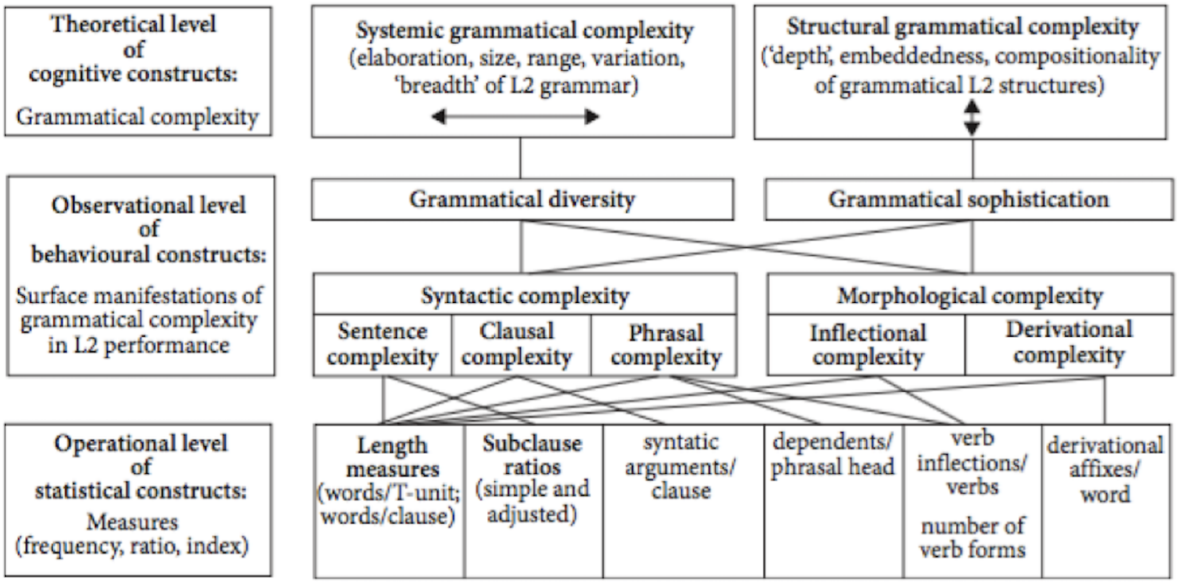
nouns, and appositive phrases in their studies on academic language because of a register-based approach (Biber et al., 2016; Lan & Sun, 2019; Parkinson & Musgrave, 2014). For this purpose, I adopted the frequency as the operationalized definition of grammatical complexity used in the current study for several reasons:

1. It is often based on a set of grammatical features in counting the 11 noun modifiers' frequency in the two corpora of the study.
2. It coincides with the academic register, as mentioned above.
3. The frequency would be an excellent approach for instructors to comprehend and apply grammatical complexity (Lan et al., 2019a).

In conclusion, the four parameters have been utilized to operationalize grammatical complexity for the last 20 years. During the framework of this period, a few changes are worth mentioning. Firstly, the length was the most remarkable measure used to gauge fluency; however, lately, it has been operationalized as a complexity measure in the field of L2 writing studies. Secondly, the ratio was mostly illustrated by a few sets of measures relying on subordination. Lan et al. (2019a) suggested that researchers use other constructions such as complex nominals. Thirdly, in L2 studies, many studies did not favor the index due to its calculation complexity. Finally, normed frequencies are the new type of frequency parameterized in most recent studies based on some specific grammatical features (e.g., register-based reviews).

Figure 2

Taxonomy of grammatical complexity



Note. Adapted from Bulté and Housen (2012, p. 26).

Noun Phrases

It is necessary here to clarify the definitions of NPs. Literman and Sproat (1992) defined the term NP as, "the head of noun [being] preceded by a sequence of modifiers" (p.131). This definition is close to that of Ni (2003), who defined NPs as, "strings of words with an internal structure centered around an obligatory head, which may be supplemented by determiners, premodifiers and post-modifiers" (p. 159-160 Biber et al. (1999) classified NPs into two scopes: a broad scope and a strict scope. NP in a board scope can grammatically function as a subject, subjective predictive, or a direct object consisting of three crucial constructions: noun-headed phrases, pronoun-headed phrases, and nominal clauses Biber et al., 1999; Hunston & Francis, 2000). While NP in a strict scope restricts NP to "a noun as head, either alone or accompanied by determiners, and modifiers" (p. 97). However, this study examines NPs based on Biber et al.'s (1999) strict scope (noun-headed phrases). There are two reasons for choosing the strict scope definition: Firstly, most pronouns associated with the broad scope, according to Biber et al.

(1999), infrequently utilized both modifiers and complements. However, there are a few exceptions, such as, 'those,' and 'one.' Second, nominal clauses, in most cases, "cannot be analyzed for modifying patterns in NPs" (Lan et al., 2019, p.3). For instance, 'what Smith stated would not be appropriate.' This sentence does not modify a head noun, so it cannot function as a modifier. For this reason, I excluded pronoun-headed phrases and nominal clauses from the current study. What is appealing about the above definitions is the emphasis on a noun as a head and the proceeding noun modifiers. So, the basic NP structure, according to Biber et al. (1999), can be summarized as follow

> Determiner +(pre-modification) + head noun + (post-modification and complementation.
>
> Example: the proper definitions of complexity in the studies would provide an obvious pircture of the present study.

As shown in the above example, it includes a determiner (the), attributive adjective as a premodifier (proper), a head noun (definitions), and ends the sentence with a prepositional phrase as a post-modifier (of complexity in the studies). Again, in this study, I adopted Biber et al.'s (1999) hypothesis of NP form to investigate the relationship between head nouns and grammatical features in relation to noun modification, including pre-/post-premodification.

Role of Noun Modification

During the last three centuries (i.e., 18th, 19th, 20th centuries,) the English style has changed. Biber and Gray (2013) claimed, based on language-corpus research studies, that this change in grammatical features is unique as the current academic language depends heavily on complex NPs (i.e., head nouns usually surrounded with noun modifications).

As an example, it was found by Biber and Gray (2011) that the proportion of NPs in academic prose constitutes is considered high: 60% written in the structure of pre-noun modifiers and/or

post-noun modifiers. In other words, they showed that the relative clauses and prepositional phrases (of) were relevant in all types of written registers in the 19th century. Furthermore, different studies also supported Biber and Gray's (2011) findings (Banks, 2008; Halliday,1979; Halliday & Martin, 1993), showing that the modern scientific pores are dense with the utilization of nominalizations, which includes the transformation of active processes. For instance, transforming adjectives and/or verbs into nouns (i.e., from *judicial* and/or *judge* to *judgment)*.

Crucially, the reliance on nominalizations is not tied to individual sections of research papers, where they can be found in introductions, methods, and discussion sections. They also occur in varied fields, e.g., education, medicine, and psychology (Biber & Conrad, 2009; Biber & Gray, 2013a, 2013b). Investigating the nature of academic language by studying linguistics change would provoke commonly held perspectives (i.e., subordinate clauses) on academic writing (Biber & Gray, 2016). After explaining the reliance on nouns as pre-modifiers and post-modifiers in present-day academic writing, it is vital to discuss their functions in written academic prose.

A plethora of scholars contended that meaning expansion is a crucial function of noun modifications allowing writers to extend the meaning in a sentence by composing the sentence structure (Biber et al., 1999; Biber & Gray, 2011; Cullip, 2000). To illustrate this, a noun functioning as a pre-modifier (e.g., vocabulary knowledge) would give extensive information about the head noun (knowledge). In line with this point, Cullip (2000) affirmed that NPs plays a vital role in syntactically stretching and semantically packing meaning (see Example 1):

"The absence of an authority to monitor the movement of ships carrying waste" (p.85).

As can be seen from Example 1, the densities of utilizing different modifiers (prepositional phrase post-modifier (*of an authority*), to-clause post-modifier (*to monitor the*

movement), and an -ing-clause (*carrying waste*) played a crucial role in elucidating the meaning of the head noun (the absence).

Furthermore, according to Eggins (2004), NPs allow the writer to provide descriptive, counted, classical and quantitative information (see example 2).

Example 2: "the smallest of the three shiny red-back spiders spinning their webs in the corner" (p. 96)

Based on the above example, Eggins argued that the nouns in the above example would not be transferred to other parts of speech as adjectives or verbs; therefore, the significant role of simple sentences in showing more in-depth meaning. That is, undoubtedly, would generate faster reading by experienced scholarly readers. Such an advantage of nominal phrases would help graduate students to package enormous amounts of information without embedding large quantities of clauses. Finally, for future publishing, some journal articles require that authors do not exceed a specific quantity of words; in this manner, graduate students should compress their writing to minimize the word limit. Again, condensing theoretical constructs offers a distinct superior advantage in acidic writing prose.

Empirical Studies on Noun Phrase Complexity

It is of great importance at this stage to present studies used in NPs in line with writing proficiency, genre and L1 influence, and writing development.

Noun Phrases and Writing Proficiency

Several L2 studies have recently revealed a correlation between NPs and writing proficiency (Casal & Lee, 2019; Lan, 2019; Lan & Sun, 2019). It is of utmost importance to mention that some researchers stated that writing development (e.g., academic levels) and writing proficiency (e.g., TOFEL scores) should be studied independently since they are not

considered to be identical constructs (Wolfe-Quintero et al., 1998). Biber et al. (2020) also asserted that writing development and writing proficiency require different analysis methods. Hence, each construct will be discussed separately. Now, I will review some studies in support of NPs as discriminators to levels of writing proficiency.

To start with the first study, Yoon (2017) looked at some variations in the use of different syntactic phrase-levels in the writing of university EFL Chinese argumentative essays across different proficiency levels. A MANOVA test revealed significant differences in the utilization of complex nominals within the different proficiency groups: highly proficient groups used more NPs than the other groups. Similarly, Casal and Lee (2019), by using a different context (ESL), investigated global measures (e.g., T-unit, clausal and subordinate sentences) and phrasal syntactic complexity measures (e.g., complex nominal per clause and a few noun modifiers such as attributive adjectives, prepositional phrases, relative clauses, possessive nouns, and participial clauses). Regarding noun modifiers, they found that essays with high-rated scores used significantly more noun modifiers (i.e., attributive adjective and prepositional phrases) than the essays with low and mid scoring grades. Overall, a high number of complex nominals were found in the high-rated essays.

By investigating groups from the same academic level, Lan and Sun (2019) examined the correlation of writing scores in TOEFL with the frequency of the 11 noun modifiers (outlined in Biber et al.'s index [2011]) in the writing of first-year Chinese L2 students. They originated their data from 79 argumentative papers based on Corpus and Repository of Writing at Purdue University. By doing a frequency analysis, they also compared the frequencies of the 11 noun modifiers used by L2 writers with expert writers in academic journal articles. By applying a new method of extracting noun modifiers, the authors tagged the corpus utilizing Biber Tagger. Then,

via manual and automatic steps, they extracted the 11 noun modifiers. In the automatic step, they used a Python program[4] to extract the noun modifiers based on the input of the tagged corpus. The results showed that L2 students used fewer noun modifiers than expert writers. The two groups' differences were found in phrasal nouns such as adjectives, nouns as modifiers, prepositional phrases, and appositive NPs.

Further, the study provided empirical evidence that the noun modifiers discriminate the language proficiency in which the higher-proficient students tended to use more modifiers in their written texts. Similarly, Lan et al. (2019b) examined the association between the 11 noun modifiers and L2 writing proficiency based on Biber et al.'s (2011) index. The authors collected 100 argumentative papers written by L2 first-year Chinses students: 50 argumentative papers for highly-proficient students, 50 argumentative paper for low-proficient students. By using Chi-square test, they found an association between the noun modifiers and the writing proficiency (the high and low proficiency groups). They then applied another statistical analysis (residual analysis) to assign the most contributing noun modifiers. The findings revealed that noun modifiers significantly contributed to the association between NPs and writing proficiency: attributive adjective, relative clauses, noun modifiers, and prepositional phrases (of).

Finally, Xu (2019) examined the correlation between NPs' complexity and the assigned scores by trained assessors in the writing of highly-proficient Chinese EFL students. The author then compared the use of NPs produced by Chinese students with native speakers of English students at the same level (university level). The findings showed a moderately positive correlation between the utilization of NPs and the writing scores. It also reveals that speakers NNS and NS significantly vary throughout most NPs measures.

[4] It is designed by Dr. Ge Lan

However, according to Lan et al. (2019b), not all research demonstrated a relationship between standardized test scores (i.e., TOFEL and IELTS) and NP complexity. For instance, Crossely and McNamara (2014) did not reveal an association between NP complexity and ratings in the writing of L2 students by longitudinally tracking down the complexity of clausal and phrasal features in TOFEL. They concluded that "the syntactic features that develop in L2 learners are not the same syntactic features that will assist them in receiving higher evaluations for essay quality" (p. 75)—moving now to consider studies about noun phrases, genre, and L1 influence—moving now to consider studies in relation to noun phrases, genre, and L1 influence.

Noun Phrases, Genre and L1 Influence

To date, studies that approached genre and L1 influence concerning NP complexity are scarce: the majority of L2 studies tended to investigate other linguistics features (i.e., the use of vocabulary across different L1s). For instance, based on lexico-grammatical features, the first study to undertake genre and L1 influence and NPs complexity in L2 writing was conducted by Staplers and Reppen (2016). To examine the impact of genre (argumentative and narrative essays), and language backgrounds of distinct L1s (Chinese, Arabic, and English), they observed statistical differences across the three groups in the use of noun modifiers. Significant differences were revealed concerning noun modifiers. For example, the three L1 groups differed significantly in the use of pre-modifying nouns and noun complement. Furthermore, by using holistic measures, Yoon and Polio (2017) analyzed the effect of topic on syntactic, lexical, and morphological complexity in university-level ESL Chinese students' writing. The results in terms of NPs showed that students used more complex NPs in argumentative essays than in narrative essays. The importance of the introductory sections in academic prose prompted me to examine

the use of NPs complexity in the writing of NS and NNS doctoral students as introductory of sections of dissertations provide the grounds for their dissertations (i.e., what they want to investigate and the importance of their investigations). All these would be written succinctly to give the expert and non-expert readers to understand the topics of their dissertations compressively; therefore, the roles of NPs (see the section of NPs role) would help them to address the meaning of their dissertations' topics in a compressed way. Further, according to Hylan and Jiang (2017), NPs create a sense of writing formality; therefore, the genre of introductory sections of a dissertation is formal in which doctoral students need to be familiar with such complex lexicogrammatical features.

Noun Phrases and Writing Development

The framework of NPs outlined in Biber et al.'s (2011) index generated numerous recent empirical studies with a focus on NP complexity in different academic writing contexts (Ansarifar et al., 2018; Lan et al., 2019b; Parkinson & Musgrave, 2014 Wang & Beckett, 2017). However, other studies generally investigated grammatical features with the inclusion of noun modifiers from Biber et al.'s index (e.g., Staples et al., 2016; Taguchi, Wetzel, & Zawodny, 2013). Findings from the previous studies have provided empirical evidence for Biber et al.'s (2011) hypothesis that the utilization of phrasal forms (e.g., NPs) increase in conjunction with writing development in distinct contexts. For example, various written genres, different academic levels, and written texts from writers with different L1 backgrounds. Since the current study is concentrating on NPs as a noun-headed phrase, I will discuss only empirical studies that used NPs complexity through noun modifiers (e.g., premodyfiing nouns, prepositional phrases as modifiers) rather than including studies featuring traditional measures of nominal forms (e.g., complex nominal per sentence) in academic written texts.

For example, Parkinson and Musgrave's (2014) study is the first research that tested Biber et al.'s (2011) developmental progression hypothesis. They manually observed a subset of Biber et al.'s developmental stages by comparing the frequency of the noun modifiers across TESOL MA and EAP students. The authors then compared the frequency of each noun modifier per 1000 words in the two groups (MA and EPA) with the frequencies in academic journal articles, as reported in two different studies (Biber et al., 1999; Biber & Gray, 2011). To analyze the NP modifiers, the MA students were asked to respond to a myriad of open questions related to the field of TESOL/Applied Linguistics, while the EPA group were asked to write argumentative essays. The data was extracted manually by two of the researchers. To analyze the data, they used Fisher's extract test. The findings revealed that the more proficient group (MA group) generally used noun modifiers in advanced stages from Biber et al.'s developmental index. For instance, a statistical difference was found in the use of attributive adjectives between the EAP and MA, in which the EAP group used a more significant proportion of attributive adjectives than the MA group. Another difference worth mentioning was found in the use of nouns as premodifiers between the two groups: the MA writers employed 484 words as nouns as a premodifier per 1000 words, while the EAP writers used 204 words per 1000 words. Moreover, the relative clauses, prepositional phrases, -ed clauses, were used more in the writing of the MA group. Comparing the frequencies of the two sets of data with the published frequencies, the MA group's frequencies of noun modifiers were much closer to the expert writers than the EPA group.

Another critical study was conducted by Staples et al. (2016). Based on the British Academic Written English corpus, they examined a wide range of grammatical features based on four different academic levels, where they included students from the first-year undergraduate,

second-year undergraduate, last year undergraduate, and graduate students. The sample is taken from different written genres (e.g., essays and literature) from various disciplines (e.g., physical sciences and social sciences). The results showed a positive association between the students' academic level and the use of phrasal noun modifiers (e.g., premodifying nouns, prepositional phrases).

Recently, Ansarifar et al. (2018) also tested Biber et al.'s developmental index of complexity in a different genre: abstracts. To carry out their study, they compared the frequency and distribution of 16 noun modifiers in 99 MA and 64 Ph.D. abstracts produced by L1 Persian students of applied linguistics; they compared them with 149 abstracts written by expert writers (writers from peer-reviewed articles) from the same field (applied linguistics). They manually extracted the noun modifiers and compared them across the three groups using a one-way ANOVA. The results showed that the MA group significantly utilized fewer noun modifiers than the expert writers in four distinct types of noun modifiers (i.e., pre-modifying nouns and prepositional phrases as noun post-modifiers). However, the Ph.D. group showed no statistical difference in producing noun modifiers from the expert writers.

In a recent critical review of the above studies, which tested Biber et al.'s (2011) index, Biber et al. (2020) stated the following:

> These studies demonstrate the feasibility of studying grammatical complexity in student writing based directly on the structural/syntactic distinctions found in English. The variables used in these studies are neither redundant nor lack distinctiveness. Rather, they attempt to directly represent the full range of structural/syntactic distinctions. In addition to showing that such an approach is feasible, the studies show that these distinctions truly matter. When considered from this perspective, the grammatical complexities of speech

> and writing are fundamentally different, as are the complexities of written discourse produced by students at different developmental stages. And finally, the studies have provided consistent support for the specific hypotheses proposed in Biber et al (2011). We fully recognize that those hypotheses will need to be revised and extended as we collect empirical data from more studies. But the cumulative evidence from this body of research clearly showed that developmental investigations of L2 student writing based directly on structural/syntactic distinctions are readily interpretable from a register perspective (p 17).

As stated above, even with the effectiveness of studying grammatical features that can differentiate the development of NS and NNS students based on Biber et al.'s (2011) hypotheses, there is still a need for revisions by conducting more tests from other studies. Therefore, the current study conducted a new test with a novel approach and context.

Comparing Graduate NS and NNS Writers

Research into understanding various textual writing categories (i.e., organization, planning, grammatical choices, and lexical choices) between NS and NNS writers has a long history. One of the most prominent seminal studies conducted by Hinkel (2013) who compared NS and NNS academic college writing and found that NNS writers tended to use significantly more simplistic grammatical features than NS writers. For instance, NNS writers heavily depended on sentences with copula verbs, such as '*There are many different writing genre types.'* In addition, Ai and Lu (2013), by investigating undergraduate academic writing between NS and NNS students, they found differences in syntactic complexity. To be more specific, it was revealed that NNS students used fewer complex phrasal structures (i.e., complex nominal per clause and complex nominal per T-unit) than NS students. Further, Staples and Reppen

(2016) compared written texts from students with distinct L1 backgrounds. They analyzed the impacts of L1 backgrounds ((i.e., Arabic, Chinese, English) and different written genres on a subset of grammatical features. The findings showed variations in the use of noun modifiers (e.g., premodifying nouns, noun complement clauses) in the writing of the three groups. For instance, they found repetitive patterns of some noun modifiers in the writing of Arabic students, such as premodifying nouns (e.g., video games).

Lu and Ai (2015) indicated that the development of students' syntactic complexity from different L1 backgrounds might not necessarily follow the same grammatical linguistic patterns, even if they were at the same levels of language proficiency. They also postulated for more research to investigate students' writing from different L1 backgrounds to determine if there are any possible L1 interferences with syntactic complexity development. Thus, scholars called for researchers to examine the development of NPs complexity in the writing of students from distinct L1 backgrounds (Lu & Ai, 2015; Staples & Reppen, 2016), which includes NP complexity (Ansarifar et al., 2018).

Last but not least, taking Silva's stance, I do not see native speakers as it is often referred to as a language model in language studies, especially in the domain of second language writing. As mentioned earlier, the goal of investigating native speakers' writing with non-natives' writing took for patterns of reliance on the 11 noun modifiers to provide a new contribution to the field. That is, I do not create any unequal power between NS and NNS as I did not depict NNS in negative terms. Such a comparison would reveal differences that can be acknowledged and addressed by university professors, who teach NS and NNS, to fairly treat, effectively teach, and equally help L2 writers with their academic strives (Silva, 1993). The higher education in the

U.S universities is mixed with NS/NNS students, which makes understanding the differences between L1 and L2 linguistic differences as primary importance.

Introduction to the Present Study

Based on the studies above, few research gaps can be summarized. The current study followed a recent trend of comparing the use of NPs complexity in doctoral dissertations, focusing on NS and NNS writers, where a few studies compared the use of NPs between writers from different language backgrounds in academic contexts and distinct variables (e.g., writing proficiency, academic levels). However, it worth noting that a few studies, to a certain extent, are related to NPs. As an example, Lu and Ai (2015), based on 14 syntactic measures, examined two NP measures: complex nominal per clause and complex nominals per T-unit. Another study was conducted by Escktein and Ferris (2018), who utilized the same 14 syntactic measures and included two NP measures. Nevertheless, it is vital to articulate here that the NP measures utilized in the two research studies as part of nominals, with the inclusion of both noun-headed phrases and pronoun-headed phrases and nominal clauses.

Hence, to the best of my knowledge, little research has been conducted to compare NPs (including only noun-headed phrases) with a comprehensive base of a particular set of modifiers between NS and NNS academic writing. To fill this gap, I explored the distinction of NPs complexity in the introduction section of dissertations between NS and NNS PhD students, based on the 11 noun modifiers hypothesized by Biber et al.'s (2011) and compare them with expert writers from published data. Taking into consideration the high academic level of both groups and considering them to be academicians in the future, understanding the use of NP in their academic writing is essential for them to have better writing skills. Thus, the current study sought to answer the following questions:

1. Based on the normalized frequencies per 1000 words, which of the Ph.D. level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?
2. How do the first language and the second language influence the utilization of NPs complexity?
3. Among the 11 noun modifiers, which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

Summary of the Chapter

This section has attempted to provide a summary of the literature relating to the background of complexity in the L2 context. This is followed by a brief discussion of its grammatical complexity and how it has been operationalized in L2 studies. Then, the chapter reviewed NP in academic language. After that, the conversation moves to present empirical studies on NP complexity. The chapter is closed by providing a rationale for comparing NS and NNS writers and ended with an introduction to the current study. The next section presents the methodology for the research.

Chapter 3

METHODOLOGY

The primary goal of this chapter is to describe the methods used to execute the current research. It begins with a brief explanation of the objectives of the study. Next, it explains the rationale for choosing the research design. After that, a brief examination is provided of the grammatical features of interest extracted from the two corpora. The final part highlights the followed by a detailed description of the data analysis.

Research Objectives

As mentioned earlier in Chapters, this study aimed to compare the frequencies of the 11 noun modifiers in academic writing across the three groups (NS English doctoral students, NNS Arabic doctoral students, and expert writers) and investigated how the language background influenced NP complexity in academic writing. The three questions are:

1- Based on the normalized frequencies per 1000 words, which of the PhD level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?

2- How do the first language and the second language influence the utilization of NPs complexity?

3- Among the 11 noun modifiers, which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

Research Design

The specialized corpora are defined comprehensively by Hunston (2002) as "a corpus of texts of a particular type, such as research articles in a particular subject" (p. 14). In this study, I utilized a specialized corpora approach (e.g., Parkinson & Musgrave, 2014; Mazgutova &

Kormos, 2015) to investigate the NPs complexity in the academic writing of two different graduate groups. Specifically, I collected 100 dissertations (50 dissertations for each corpus) from which I examined the first 1000 words in each dissertation's introductory section. The two corpora were tagged via Biber Tagger and the 11 noun modifiers were extracted through a Python program.

The rationale for adaptations

Recently, specialized corpora have gained popularity in language learning, especially when carrying out studies on particular registers and genres of academic and professional language (Flowerdew, 2002). Ma (1993) and Flowerdew (1998) advocated the adaptation of specialized corpora to investigate a particular text-linguistic level of the language. Specialized corpora, conversely, has a limited scope as it cannot be used to investigate any language aspects. Flowerdew (2004, 2005) stated that specialized corpora might not be appropriate for research investigating, for instance, vocabulary and phraseology. Justifications for using this approach in the current study are provided in the following paragraphs.

One of the essential reasons for adopting specialized corpora in the current study is the comparative nature of its methodology that allows for several explorations of different studies using specialized corpora (Flowerdew, 2004). He also declared that "many other studies of a contrastive nature have been carried out using sets of specialized corpora, which are particularly prominent in the area of learner writing where non-native speaker (NNS) corpora are compared with native speaker (NS) corpora" (p.18). Based on Flowerdew's claim, the nature of the current study is comparative, corresponding to the selected approach, where I compared the use of NPs in the writing of two groups from distinct language backgrounds with expert writers.

Another reason is that investigating specific grammatical/structural elements of particular texts would be suitable for the context of English Academic Purposes (EAP) research (Flowerdew, 2004, 2005). Likewise, Sinclair (2004), the father of corpus linguistics, contended that small corpora are inefficient and pose a threat to generalizability. However, most of the qualitative research's primary aim is to identify individual experiences case studies (Polit & Beck, 2010). Also, Sinclair indicated that "small is not beautiful; it is simply a limitation" (p. 189). However, he also conceded that small corpora could, in many cases, provide valid results if robust corpus techniques were used. To come to an agreement by mutual concession about the size of a corpus, Koster (2010) posited that the nature of the research questions determines when to compile a large or small set of data (Koester, 2010). For the present study, 100 dissertations (about 100,000 tokens) are appropriate for studying the development of 11 noun modifiers in the two different corpora.

Carter and McCarthy (2001) argued that small corpora have several advantages over large corpora as researchers could manage the data and efficiently examine all the occurrences of the investigated items. Flowerdew (2004) underscored that large corpora might not be appropriate for investigating academic and professional language since, instead of comprising the entire text, some large corpora encompass segmental texts of 2,000 words. In the same vein, Tribble (2002) argued against the compilation of large corpora to investigate pedagogical aspects, especially in the field of English for Specific Purposes (ESP) or EAP, because they yielded "either too much data across too large a spectrum or too little focused data, to be directly helpful to learners with specific learning purposes" (p. 132). On the other hand, focused corpora, in recent years, have been collected to generate more pedagogical issues at the linguistic level (Flowerdew, 2002, 2004). Also, gaining insightful and educational thoughts related to learning

and teaching for a particular purpose can be revealed through focused corpora (Flowerdew, 2002; Tribble, 2002).

Further, when using specialized corpora, the corpus compiler is usually the examiner; therefore, the examiner is mostly acquainted with the context being investigated. As such, the quantitative results—yielded by a corpus analysis—in conjunction with the qualitative results would provide a holistic approach to analysis since the size of the corpus (i.e., using small size) and composition render the data more useable for qualitative examinations (Flowerdew, 2004). More importantly, specialized corpora provide the researchers with the freedom to collect written corpora that are difficult to be compiled on one large corpus. For example, it is not feasible to manage the dissertation's introductory sections from one group (i.e., contacting 1000 native speakers and if they speak English as a first language). In addition to the above reasons for adopting specialized corpora, the current study's corpora features aligned with Flowerdew's parameters (2004, p. 21) as shown in Table 2:

Table 2

General Parameters, examples, and application to current study

General Parameters	**Flowerdew's (2004) Examples**	**Parameters for the Current Study**
Targeting a particular purpose	Group of nouns	11 noun modifiers
Aiming at a specific setting	Participants' role	Graduate student writers
Setting up a specific genre	Professional or academic writing	Academic writing
Following a specific discourse	Grant proposal	Dissertations
Following a particular topic	Economics	Education

Following a variety of English	Learner English	NS and NNS learners

Finally, since the current research questions concentrate on counting and comparing a subset of NPs of advanced academic writing in a particular field (education) since the data were quantitatively and qualitatively examined, the magnitude of the corpora is deemed specialized rather than broad (general corpora). Having discussed the reasons for adopting specialized corpora, the next section will address the description of the two corpora.

Description of the Corpora

It is crucial to indicate the reasons for choosing the genre of the dissertation as primary texts of the current study. As mentioned previously, two sets of corpora will be collected from a total number of 100 essays written by NNS, L2 graduate Saudi, and NS in the field of Education: 50 NS students and 50 NNS students. After carefully considering the genre for data collection, i.e., comprehensive exams, essays, articles, etc., I decided to compile dissertations because dissertations have undergone heavy editing and revisions. This eliminates the rate of grammatical errors and facilitates analysis since the refinery of the text will be faster. Also, non-native PhD students are considered high-advanced language users as they are seen as "close to the end of the interlanguage continuum and are keen to move even closer to the NS norms" (Granger, 2004, p. 133). They are expected to use a wide range of complex language that is compatible with the academic genre, especially noun phrase modifications. On top of that, according to Granger (2004), investigating advanced NNS learner corpora lead to the discovery of the strengths and weaknesses of their language in different linguistic aspects.

Furthermore, the availability of dissertations electronically and publicly eases the process of collecting the two corpora. Finally, as an academic in the field of Education, I find it

advantageous to compile dissertations from this field because my domain knowledge makes it easier for me to analyze the structure and to understand the meaning of the content being investigated. Finally, to my best knowledge, they NPs complexity have not been investigated in in dissertation genre. The following section describes in greater detail the strategies for acquiring the corpora of the study.

Criteria for selecting the corpora

To select the corpora for the present study, a purposeful list of criteria was generated, along with a sampling plan to guarantee the comparability of the two corpora and ensure the representativeness of the target texts: dissertations. Even supposing that there are no such specific fixed rules or criteria for researchers using corpora as primary data, all researchers in all corpus-approach studies should accurately build their criteria to correspond with the goals of their studies (Farooqui, 2016). Several considerations have been taken into account in designing the two corpora: (1) representativeness, (2) students' background, (3) dissertation topic, and (4) size of corpora.

Representativeness

One of the most critical steps before compiling a corpus is considering the representativeness of a specific corpus, which is the cornerstone of corpus-based studies. Biber (1993) defined the term representativeness as "the extent to which a sample includes the full range of variability in a population" (p. 243). The situational and linguistics variability, as Biber stated, are the two types/aspects of variability that are significant in determining representativeness. Hence, what does he mean by situational parameters and linguistic variability? The first type (situational variability) refers to the type of text (e.g., written or spoken mode) of a specific genre or register in the population.

In contrast, the second type (linguistic variability) refers to the range of linguistic allocations in the population (e.g., prepositional phrases and participial clauses). To accomplish the ultimate goals of the current study, I strived to ensure that the current study's corpora are compatible with the criteria above by selecting the field of the dissertation, the time frame of the dissertations, the introductory sections of the dissertations, and the number of words per text. All these criteria will be thoroughly discussed in the following paragraphs.

The texts were sampled from 50 dissertations from a single discipline: Education. I selected the texts from different majors in the field of education, such as applied linguistics, English, sports management, and educational leadership. Within each major, dissertations were selected randomly and represented a wide range of topics. The field of education was also one of the disciplines selected by Biber et al. (2011) in which they sampled education as one of four disciplines, i.e., science, medicine, education, and social science. This selection for the present study would assure that the lexico grammatical features investigated are compatible with the framework of Biber et al. I concentrated on the education field to build on previous research where education was the main field of choice and because I am myself an academic in the field of education.

The time frame of the selected dissertations is from 2011 to 2019. In my search for dissertations via ProQuest, I entered a date range from 2011-2019 so that only dissertations published within this period were resulted. The developmental stages of complex grammatical features associated with advanced writing by Biber et al. (2011) were hypothesized in 2011. For this reason, I based my framework from this data (2011) to test their hypothesis with a new time (starting from their finish lines). I also attempted to limit any possible changes in the academic writing prose regarding the use of noun modifications (i.e., the use of prepositional phrases in the

academic register). Further, I avoided technical problems by selecting this more recent time frame as some older dissertations were written in an unclear font or could not be converted from PDF (Portable Document Format) to Word, and vice versa.

Four reasons drove me to examine introductory sections: first and foremost, the academic writing of PhD students does matter as their dissertations are considered a cornerstone of their future careers. Second, to date, no large-scale and/or empirical studies have been performed to investigate Biber et al.'s (2011) hypothesis of the developmental stages of complex writing using Introduction chapters. Third, the dissertation genre's introduction sections usually have fewer quotations, tables, figures compared to other sections, such as literature review and discussion. This made the two corpora's refinery more convenient since I did not have to spend much time detecting and deleting the quotations from each text. Third, other similar studies (e.g., Ansarifar et al., 2018; Parkison & Musgrave, 2014) used different writing genres, such as abstracts and essays. Thus, this study contributed a new writing genre using only the introductions. Lastly, the introduction, being the first chapter, would contribute an impression of the writing quality.

Each text of the introductions used in the current study passed through a refinery process. For instance, an introduction with less than 1000 words was discarded. The rationale for sampling only 1000 words will be discussed in the next paragraph. Moreover, concerning the heading and the title were exempted and not counted for the two corpora because they did not give valid results since they naturally contained a few words. Further, the long and short direct quotations were not counted towards the 1000 because the writers did not initially produce them; thus, measuring quotations might not reflect the actual written skills of the students. In addition, sentences with grammatical errors that would have led the reader to uncertainty were omitted

from the word count. Finally, the in-text citations were omitted from the word count and analysis because they often contained unmeaningful tokens such as numbers and names.

The first 1000 words were sampled from each text to ensure the comparability and frequency counts between the two corpora. According to Crawford and Csomay (2006), "the unequal sizes of corpora did not allow for straight frequency" (p. 80) and investigating 1000 words would be adequate to determine the writing skills. Namely, they usually followed specific structures that were unique to them through the entire text, whether it was a dissertation or other written genre (i.e., essays and proposals).

Grammatical Features of Interest

As mentioned in the previous section (for further information, see the framework section), the current study is based on Biber et al.'s (2011) hypothesized developmental index of writing development. Biber et al.'s hypothesis is divided into three different linguistic functions: adverbials, complements, and pre and post noun modifiers. This dissertation intended to extract, from the two corpora, the linguistic elements functioning as noun modifiers as a subset of Biber et al.'s hypothesis. (see Table 3).

I also followed the same subset of 11 noun modifiers of Biber et al. (2011) developmental stages of writing development, which was used by Lan et al. (2019b) and Lan and Sun (2019). The noun modifiers have different linguistic features: (1) attributive adjectives, (2) relative clauses, (3)nouns as modifier, (4)PPs (of), (5) PPs (other), -(6)-ing clauses, (7)-ed clauses, (8)infinitive clauses, (9)prepositions followed by -ing clauses, (10) noun complement clause, and (11) appositive NPs. These noun modifiers are distributed in Biber et al.'s index beginning from stage two to stage five (stage one is not included because there are no noun modifiers in this stage). Stage two, for example, includes only the attributive adjectives; stage three includes the

premodifying nouns and relative clauses; stage 4 includes -ing clauses, -ed clauses, prepositional phrases (of), and prepositional phrases (others). In contrast, stage five includes prepotions+ing, noun complement clauses, infinitive clauses, and appositive noun clauses. Two out of the 11 noun modifiers are positioned as pre-noun modifiers (attribute adjective and pre-modifying nouns), while others are positioned as noun post-modifiers. Concerning the types of noun modifiers, five noun modifiers are phrasal, and the remaining are clausal modifiers (see Table 3).

Table 3

Noun modifiers in Biber et al.'s index

Stage	**Noun modifiers**	**position**	**Type**	**Example**[5]
2	Attributive adjectives	pre	phrasal	huge differences
3	Premodifying nouns	pre	phrasal	school manager
	Relative clauses	post	clausal	interactions that have helped students to be better writers
4	-ing clauses	post	clausal	many high school teachers showing their new methods
	-ed clauses	post	clausal	strategies used in the study
	Prepositional phrases (of)	post	phrasal	the enjoyment of new release
	Prepositional phrases (other)	post	phrasal	their present research within sport studies

[5] The examples are taken from the current corpora.

5	prepositions+ing clauses Noun complement clauses infinitive clauses Appositive noun phrases	post post post post	phrasal clausal clausal phrasal	the significance of increasing the presence of expert teachers I understand that the idea that reading skills need to be discussed a good reason to account for choosing this topic Teaching English as a Second Language (TESOL)

Data Sampling

As mentioned earlier, a sample of 100 dissertations was randomly selected (50 for NS and 50 for NNS) from differing U.S. universities from the field of education, including a wide range of majors such as special education and educational leadership. Several criteria were considered when selecting the texts to ensure the comparability and the representativeness of the two corpora: primarily, the dissertations should be in a digital format (online accessibility) from an openyu-source, e.g., ProQuest engine and the university's digital repository. This eased the accessibility for exploring data using different devices (my laptop, UNM computers, etc.).

For example, using the computer allowed me to investigate, organize, and compare the two corpora more easily using multiple screens. Another important criterion was that all the topics of the dissertations had to be from the field of education. For instance, I selected texts from a wide range of subfields, such as applied linguistics, educational leadership, and special

education. The selection of the field of education was not arbitrary. The education field is one of the fields examined in Biber et al.'s (2011) framework. Furthermore, I am familiar with the education field since I teach English as a second language. Lastly, expanding my selection to several sub-fields also allowed me to select more dissertations, especially for the NS students.

In addition, the dissertations had to be written in a traditional structure; that is, all the dissertations started with an introduction as a first chapter. Dissertations that began with anything other than introductions were excluded from the dissertations pool because they did not meet the criteria. Following the criteria mentioned above, the next section will discuss the process of data collection, starting with the first corpus (NNS corpus) and ending with the NS corpus.

Identifying Saudi students' corpus

As mentioned earlier in this section, 50 dissertations were be collected from the pool of Saudi graduate students. The dissertations were extracted from the Saudi Digital Library (SDL) [6](https://sdl.edu.sa/SDLPortal/Publishers.aspx). If it is available in the SDL, this means the writer is 100% Saudi because the SDL is only authorized to Saudi graduate students.

Having discussed how to identify the Saudi's corpus, the next section discusses the approach to identifying the NS corpus.

Identifying native English corpus

In contradistinction to the compilation of the Saudi corpus, which was relatively easy and error-free, certain problems were encountered during the compilation of the NS corpus. One of these was that there were no applicable criteria for identifying the nationalities or the

[6] The SDL is a free source only for Saudi students and scholars in which it requires users to get approval from the Ministry of Education. All Saudi graduate students, all over the world, have to upload their dissertations and thesis via SDL; it now has more than 27,000 dissertations stored in its repository. Most importantly, downloading the dissertation from the SDL ensures that the students are from Saudi Arabia, which increases the validity of the corpora. A more detailed account of data sampling is given above.

demographic information of the authors. For example, one should not assume an author to be NS from their last names, which was what other studies did (e.g., Farooqui, 2016) using Swales [7]'(1985) as a criterion to examine the so-called nativeness of the authors. This is because the United States is one of the most culturally and ethnically diverse countries in the world; hence**,** it is extremely difficult to assume that whether or not a student or writer is a native English speaker just from looking at their name.

That Farooqui also used the acknowledgment sections to identify the nationalities of the writers is another issue I found that would lead to all kinds of questions about the background of the writers. In other words, questions like: What if the writers who have western names do not speak English as a first language? However, going through the acknowledgment sections would be an effective strategy if it was used as an initial identification, not the last step of such an identification.

To respond to the difficulty, I contacted the authors individually by emailing and explaining the purpose of the study and asking them if they speak English as a first language. I collected as many dissertations as I could, and those who did not respond to my email were discarded from the pool of dissertations.

Tagging Data

[7] "Swales (1985) has designed a test to determine the (non-) nativeness of a research article's authors by awarding or subtracting points depending on (i) whether the author's last name is Anglo-Saxon or anglicised in some way (+/1); (ii) whether the author is affiliated with an institution in an English-speaking country (+/-3); (iii) whether all of the author's citations are to English language publications (+/-1); (iv) whether the author's first name is anglicised (+/2); (v) whether all of the author's self-citations are to English language publications (+/-2); finally, (vi) whether there is any evidence of (non-) nativeness from the article footnotes or endnotes (+/-3). If the total number of scores were (+5 to +12) it is a native speaker of English, but if it is (-5 to -12) it is a non-native speaker of English. However, two criteria (i and iv) were adopted in identifying both NNS and NS writers" (p. 80, Farooqi, 2016).

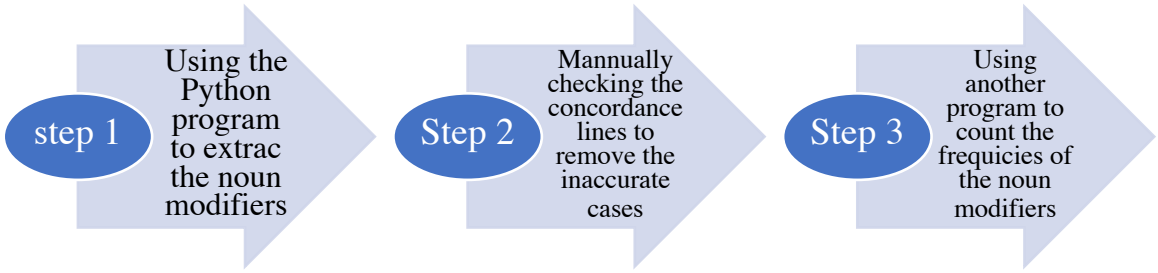
To extract the 11 noun modifiers in the two corpora, I used Biber Tagger.[8] This Tagger allows to tag part of speech (e.g., adjectives and adverbs) and various lexico-grammatical elements such as relative clauses and complement clauses. It is one of the well-known taggers that is usually applied to a high concentration on linguistic variations in a wide range of written texts and genres. It is deemed as an accurate tagger over 90% in terms of precision and recall for both NS and NNS writings ((Biber & Gray, 2013a, 2013b). Among the 11 noun modifiers, eight (i.e., attributive adjectives, nouns, prepositions, relative clauses, -ing clauses as modifiers, -ed clauses as modifiers, to as infinitive markers, noun complement clauses) noun modifiers were conducted tag checking to ensure the tagging accuracy.

The F-scores[9] showed that five out of the eight modifiers were greater than 90%. After that, the tagging of the remaining three features (i.e., -ing clauses as modifiers, -ed clauses as modifiers, and noun complement clauses) were fixed (see Appendix A for the report of the F-scores).

Extraction of the Noun Modifiers

Figure 3

The automatic step of extracting the noun modifiers



[8] The researchers contacted one of the Biber Tagger teams to ask for help in tagging the corpora.
[9] F-score measures the accuracy on a dataset, which combines the results of precision and recall.

Once I had my corpora tagged and the tagged files were received, along with a Tag-Count description file[10], the two corpora were divided into automated and manual parts. These two processes were used in Lan et al.'s (2019b). The first process was applied by using a Python program, developed by a PhD candidate from Purdue University, to extract the noun modifiers from the two corpora. To illustrate the drawing out of the modifiers (see example 1 below).

Example 1: and the education sectors are links to a <<<national objective>>>

Example 1 shows the Python program's output, including a concordance line with the particular noun modifier. In Example 1, for instance, an attributive adjective between the angle brackets is the concordance line of the specific noun modifier.

Example 2: completely alter their teaching style to work as <<<facilitators of>>>

learning, no longer acting as instructors but allowing

In the above example, the Python program outputted the concordance line for the prepositional phrase 'facilitators of' located between the angle brackets. The same condition can be applied for the other noun modifiers.

It is worth mentioning here that the automated process has gone through two types of extractions: direct extraction and indirect extraction, as applied first by Lan et al. (2019b). The first step is the direct extraction meaning that the Python program can only detect the noun modifiers that can be tagged by Biber Tagger. For this reason, the part-of-speech tags were extracted directly in the current study. The Biber Tagger directly tagged five of the 11 noun modifiers grammatical function (used in this dissertation): attributive adjectives, relative clauses, -ing clauses, -ed clauses, and noun complement clauses. On the other hand, other noun modifiers

[10] A file describes the codes for lexico-grammatical features. For instance, jj +atrb + + + adjective + attributive function.

have different functions. Thus, the Tagger can detect and tag all prepositional phrases, but not prepositional phrases function as noun modifiers.

With regard to the indict extraction, which was based on chunking patterns[11], the Python program can detect the possible examples of noun modifiers that cannot be tagged. In other words, Lan and Sun (2019) articulated the extraction of chunking patterns by providing an example of a sequence of noun-PP (i.e., a noun right after a prepositional phrase) as a post noun modifier. In this case, the extraction detects any possible cases functioning as PPs post-noun modifiers. Using chucking patterns would not be the most appropriate for the accuracy of detecting noun modifiers; however, these patterns are the most effective patters that I can use in this study. Premodifying nouns, PPs (of), PPs (other), prepositions followed by -ing clauses, and infinitive clauses are the noun modifiers with the indirect extraction.

An exception is appositive NPs, which are extracted based on four patterns. Two patterns are considered highly frequent in academic texts according to Biber et al. (1999), namely appositive NPs separated by parentheses, as in "*a predominantly language test (i.e., TOEFL)*," and when separated by commas as in, "*task-based instruction, an important teaching method*." We also added two other patterns to extract this modifier after we qualitatively checked 20 randomly selected files: appositive NPs separated by square brackets as in "the author (Prof. Burnham)" and those separated by a hyphen (or dashes) as in "quantitative research method --- a commonly used method."

Exceptionally, appositive noun phrases could not be applied in Biber's Tagger; for this reason, I used AntConc to obtain the type of appositive noun phrases identified in Biber et al. (1999), including any phrases separated by commas as in, *(digital literacy, as a new methods);*

[11] Chunking refers to many words that would purposefully lead to communicative contributions to language chunks (Bird et al., 2009).

parentheses as in, (*TESOL*); brackets, as in, (*the king (Arthur*); and sentences separated by hyphens/dashes as in (*social justice theory—a well know theory*). To be more specific, I uploaded the first corpus to AntConc and searched in the regular expression box with the specific code, for instance, phrases separated with commas and parentheses. Then, the program promptly showed phrases separated with commas from which I qualitatively counted the correct ones. The accuracy is extremely low[12]. After successfully finishing the two exceptions, I calculated the frequency of the entire 11 noun modifier for further analysis.

With regard to the manual processing, I qualitatively examined all the output of the Python program, the concordance lines, to increase the accuracy of the noun modifiers in the two corpora. By doing so, I was able to eliminate the entire inaccurate cases in the concordance lines outputted from the program. Example 3 shows a sample of chunking patterns as in<<<ends to>>>This inaccurate case was removed. The program extracted "ends" as an infinitive clause, while it functions as a verb. However, some uncertain cases led me to consult two doctoral candidates in applied linguistics to make a final determination of each unsure cases (See Appendix C).

Example 3: Graff s book <<<ends to>>> look at the emergence of two distinct but related

Numerical data

For the first question, I built a set of data based on manually adjusted frequencies of the noun modifiers in the texts of NS and NNS PhD students. More specifically, the 11 noun modifiers were compared in the two corpora with the published frequencies in previous students for expert writers. It is worth noting that my corpora's genre (i.e., introductory sections of

[12] Low means below 40%.

dissertations) is different from the expert writers' published research articles. As reported in Biber et al. (2011) the expert writes were sampled from 429 journal articles[13], from four general fields (e.g., science/medicine, education, social science and humanities). From each field, journal articles were randomly picked to represent a wide range of topics. The expert writers of the research articles are trained academics at university level (e.g., professors and professional scholars, Biber et al., 2011).

the introductory sections of dissertation and the journal articles are all academic writing, which "consists of a range of genres with different audiences and different social purposes" (Parkinson and Musgrave, 2014, p 53). The different genres here in the study would affect the use of register features, including the utilization of noun modifiers. Nevertheless, in my case, the difference in the two compared genres cannot be avoided, as these published data were the only choice if I want to compare the academic writing of the two doctoral students with the expert writers. The same case was reported in Parkinson and Musgrave's study where they stated that they only had one option when they compared the two sets of their data with the expert writers. More justifications of the compassions between the two doctoral students and the expert writers in the following paragraphs.

Moreover, it should be noted that the published frequencies were first utilized in Biber et al. (1999) and Biber and Gray (2011). They were summarized in Parkinson and Musgrave (2014), in which they used these frequencies to compare them with their corpora (EPA and MA

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[13] Name of the journals: Science/medicine: Journal of Cell Biology, Biometrics, American Journal of Medicine, Journal of Animal Ecology, Journal of Physiology
Education: American Educational Research Journal, Journal of Educational Measurement

students). The same published frequencies were recently used in Lan et al. (2019b), where they compared them with L2 undergraduate Chinese students. I also used the same published frequencies in the current study for two reasons. First, I considered the comparison logical since the writers in the two corpora in the present study were deemed advanced high writers in the academic community (as they both PhD students). Second, comparing the academic writing of PhD students and expert writers, academic writing would allow "fruitful areas of language instruction in the writing classroom" (Parkinson & Musgrave, 2014, p. 55). The same situation can be applied in graduate academic writing, where faculty members appoint pedagogical gaps and help students from different language backgrounds enhance their writing.

Statistical Analysis

For the second question, I slightly modified the two corpora's size (i.e., 51,606 and 51,382) and normalized the frequencies of the noun modifiers to 50,000 words to avoid the influence of text length. Thus, to answer the second question, I used a Chi-square test to examine the effect of the language factor on the utilization of the noun modifiers in the corpora, using SPSS. I also reported the effect size (i.e., Cramer's V), along with the value of the Chi-square.

The Chi-square value is omnibus; as a result, it cannot be determined which particular noun modifier has a large contribution to the influence of the language factor on NPs. To answer the third question using SPSS, I calculated standardized residuals[14] to depict the contribution of each noun modifier to the entire Chi-square value. As a result of doing this, the standardized residuals determined the significance of the contribution of each noun modifier to the influence of language factor on NPs.

[14] A standardized residual is a ratio which measures the strength of the distinction between observed and expected values.

Chapter 4

RESULTS

This first part of this chapter recapitulates the objectives of the study by reviewing the purpose of the study and the research questions. The second part reports the results for each research question of the study.

Purpose of the Study

As mentioned earlier in Chapters, this study aimed to compare the frequencies of the 11 noun modifiers in academic writing across the three groups (NS doctoral students, NNS doctoral students, and expert writers) and investigated how the language background influenced NP complexity in academic writing the three questions are:

1- Based on the normalized frequencies per 1000 words, which of the PhD level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?

2- How do the first language and the second language influence the utilization of NPs complexity?

3- Among the 11 noun modifiers, which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

The Normalized Frequencies of the 11 Noun Modifiers Across the Three Groups

The first question aimed to investigate which of the PhD level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers based on the normalized frequencies per 1000 words. Before reporting the first question results, it is essential to illustrate the number of tokens for the two corpora (see Table 4)

and how I calculated the normalized frequency per 1000 words to provide a patent conceptualization of the current descriptive statistics.

Table 4

Number of the Entire Tokens in the Corpora

Name of file	**Token**
Output_NNS	51382
Output_NS	51606

As mentioned in the previous chapters, I first counted the frequencies of each noun modifier in the two corpora. For instance, the number of the raw frequency of attributive adjectives in the NNS corpus was 3547. Then, using Excel, I calculated the normalized frequency per 1000 words by multiplying 1000 with the raw frequency and dividing the gross with the total token of the particular corpus (i.e., 1000*3547/51382= 69). That is, the noun modifiers might occur 69 times for every 1000 words in the specific text. It is worth mention that the normalized frequencies can assure the comparability of the current study's results with the published frequencies.

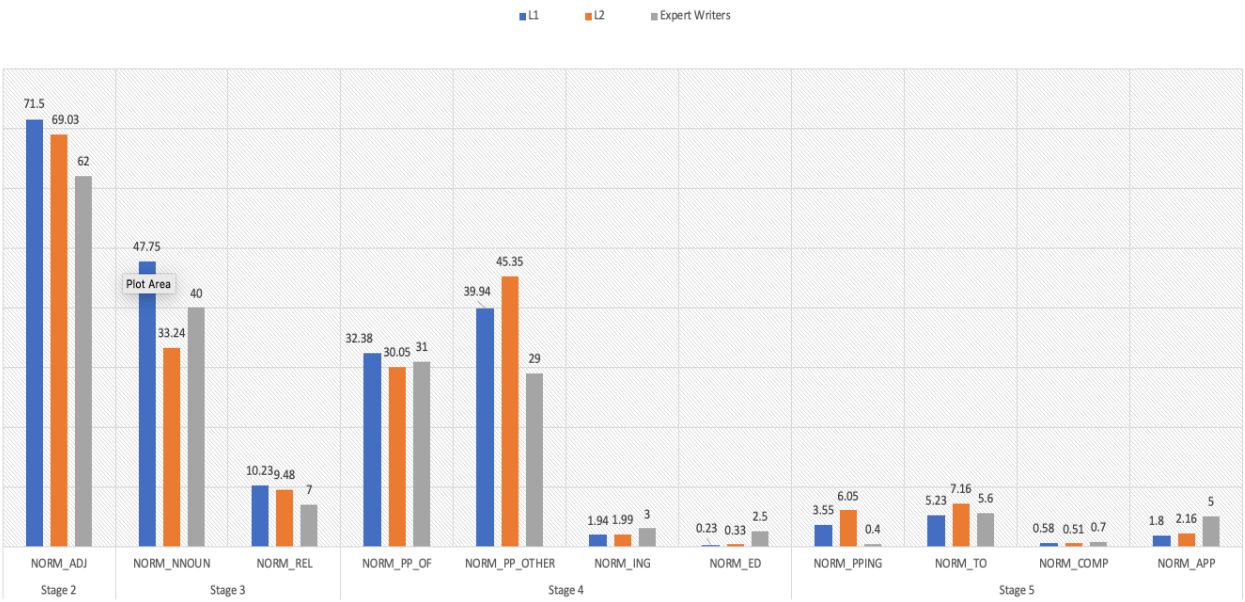
Figure 4 depicts the frequency comparisons of each noun modifier between NS, NNS illustrated in a bar graph, which presents the extent to which the three groups relied on noun phrases in the current study. The blue bars represent the NS group, and the orange bars represent the NSS group, and the gray bars represent the expert writers. As can be seen from figure 4, it consists of four stages (go to the theoretical framework section for more information).

The results showed high and low frequencies of the 11 noun modifiers in the writing of three groups. Attributive adjective, premodifying nouns, PP (of), and PP (other) are the patterns of high frequencies category. On the other hand, the remaining seven noun modifiers (e.g., -ing clauses and noun complement clause) are the patterns of low modifiers.

To start with the high-frequency category, a remarkable difference can be seen from PPs (other) among the writings of the three groups. For instance, the NNS group had the highest rate of PPs (other) with 45.35 per 1,000 words, and likewise, NS used 39.94 per 1,000 words. Conversely, the published frequencies of PPs (other) in the academic writing of expert writers used 29 per 1,000 words, which is much lower than the NNS and NS groups. Another noticeable difference can be observed in the use of premodifying nouns. For instance, the NS group had the highest cases of premodifying nouns with 47.75 per 1,000 words, while expert writers group had the second highest cases with 40 per 1,000 words. The NNS had the lowest frequency, with 33.24 per 1,000 words. The NNS group had the lowest cases, which is less than the other two groups (NS and expert writers). Nevertheless, the count of PPs (of) was similar across the three groups of writers. For instance, 30.05 per 1,000 words in the writing of NNS, 31 per 1,000 words in the writing of expert writers, and 32.38 per 1,000 words in the writing of the NS group.

Figure 4

Normalized Frequency Analysis of the 11 Noun Modifiers



Note. The 11 noun modifiers are normalized to 1000 words.

Adj: attributive adjectives; Noun: noun as modifier; Rel: relative clauses; Of-PP: prepositional phrase (of); Other-PP: prepositional phrase (other); -ing: -ing clause; -ed: -ed clause; To; infinitive clause; Noun-comp: noun complement phrase; APP: appositive noun phrase.

With respect to the low-frequency category, considerable differences existed across the three groups of writers in the use of -ed clause, appositive NPs, and prepositions + -ing clauses. The expert writers included more -ed clauses and appositive NPs (i.e., 2.5 per 1,000 ed-clauses and 5 per 1,000 appositive NPs). In contrast, the PhD groups (including NS and NNS writers) included far fewer noun modifiers of the same types (i.e., 0.23 and 0.33 per 1,000 words, respectively) and for the appositive NPs (i.e., 1.8 and 2.16 per 1,000 words, respectively). PP+ing clause, however, showed an opposite pattern. For instance, the two PhD groups utilized more PP+ing clauses (i.e., 3.55 and 6.04 per 1,000 words, respectively) than expert writers with 0.40 per 1,000 words.

The Association Between the Language Background and 11 Noun Modifiers

To demonstrate the association between the language background and NP complexity in the two corpora, a Chi-square test[15] was applied. The result of the current study showed an association between the categorical variables (language backgrounds and NPs) with an observed value of χ^2 value is 198.184. This value is considered higher than the Chi-square-crit χ^2 value, 23.209 (df=10, alpha level equals 0.01). Based on this result, the language backgrounds and NPs are dependent variables (this means they are not independent from each other). To provide an in-depth explanation, the use of NP complexity in the writings of NNS and NS corpora is affected by their NNs (English vs. Arabic languages). Further, Cramer's V was applied, and the result showed a weak strength of association between the two variables.

Table 5

Chi-square Test and Cramer's V

Observed χ^2	Chi-square-crit χ^2	P value	Cramer's V
198.184	23.209	P < 0.01	0.096

Note. The degree of freedom is 10, and the alpha level is 0.01.

Four Noun Modifiers Out of 11 Contributed Most to the Association

To demonstrate the contribution of noun modifiers to the association between the two variables (language factor and NPs complexity), the standardized residuals was used in the two groups of PhD students (see Table 6). According to Lan et al. (2019), higher absolute values of the standardized residuals show a higher contribution to the association between the two variables. Therefore, as shown in Table 6, among the 11 noun modifiers, four noun modifiers produced in the two corpora had a large contribution to the association: premodifying nouns

[15] I chose the Chi-square test as it determines if there is an association between categorical variables (language backgrounds and NPs)

(|6.935|, |-7.098|), PPs (other) (|-3.957|, |4.050|), prepositions followed by -ing clauses (|-4.344|, |4.447|), and infinitive clauses (|-3.115|, |3.188|). For instance, based on Table 6, it is possible to say that the language backgrounds of the two groups influence the use of NP complexity in the texts of dissertation introductions, mainly because of the contribution of the four particular noun modifiers mentioned above.

Table 6

Standardized Residuals of the 11 Noun Modifiers

	NS	L2
Attributive adjectives	-0.333	0.341
Premodifying nouns*	6.935	-7.098
Relative clauses	0.325	-0.332
PPs (of)	0.549	-0.562
PPs (other)*	-3.957	4.050
-ing clauses	-0.353	0.361
-ed clauses	-0.747	0.764
prepositions +ing clauses*	-4.344	4.447
Infinitive clauses*	-3.115	3.188
Noun complement clauses (that)	0.211	-0.216
Appositive NPs	-1.123	1.149

Note. The noun modifiers with the significant standardized residuals are marked with asterisks.

In this section, I will explain the meaning of having positive and negative values in standardized residuals. The positive standardized residual in the cells means that the noun modifiers are used more than expected. In contrast, the negative standardized residual in the cells indicates that the noun modifiers are used less than expected (Sharpe, 2015). Hence, based on Table 6, NS students utilized more premodifying nouns than expected, while they used less than expected in the three modifiers. However, NNS students used PPs (other), prepositions+ -ing clauses, and infinitive clauses more than expected; meanwhile, they used premodifying nouns less than expected.

Chapter 5

DISCUSSION

This chapter is a comprehensive discussion of the results presented in the previous chapter. The chapter starts with an introductory section that reviews the purpose of the study and the research questions. It is followed by a description of the two corpora used in the current study, a summary of the results, an in-depth discussion of the research questions in light of the result results and their pedagogical implications.

Purpose of the Study

As mentioned earlier in the previous chapters, this corpus-based study aimed to compare the development of NPs in the writings of NS PhD students and NNS PhD Saudi students compared with those by expert writers with published works based on the 11 noun modifiers in Biber et al.'s (2011) developmental progression index. Also, it aimed to investigate the influence of language factor on the use of NPs. Here, I review the research questions of the current study:

1- Based on the normalized frequencies per 1000 words, which of the PhD level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?

2- How do the first language and the second language influence the utilization of NPs complexity?

3- Among the 11 noun modifiers, which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

Overview of the Methodology

A corpus-based approach was used to conduct this comparative study. To serve the current research purposes, 100 dissertations written/submitted between the period of 2011 to

2019 in U.S universities were collected from the Quest and Saudi Digital Library search engines, with fifty dissertations for each group of students. I analyzed the introductory section of each dissertation. A normalized frequency was used to compare the use of the 11 noun modifiers between the two groups. These noun modifiers were tagged via Biber Tagger. Two sequential steps were used to extract the 11 noun modifiers from the tagged corpus: (1) automatically, (2) manually (see the Methodology Chapter for more details).

Which of the PhD level English (NS) and PhD-level Saudi L1 Arabic (NNS) groups approaches expert writers in the use of the 11 noun modifiers?

The first research question sought to investigate the patterns of reliance on the 11 noun modifiers across the academic writing of PhD-level English native speakers and PhD-level L2 Arabic students, and published data from expert writers based on the normalized frequency counts per 1000 words. As presented in Chapter 4, in general, the frequency comparison revealed that the three groups have some similarities and differences in the use of the 11 noun modifiers. Detailed interpretations of the findings of the first, second, third questions will be discussed below. Concerning the first question, I will first interpret the remarkable pattern in the high-frequency category of the 11 noun modifiers. Then I will interpret the notable patterns in the low-frequency category of the 11 noun modifiers to make the discussion's flow easy to follow.

High-frequency category of the 11 noun modifiers

The results of the first question seemed to be consistent with other similar studies (e.g., Ansarifar et al., 2018; Lan et al., 2019; Parkinson & Musgrave, 2014), which found that the most frequent noun modifiers are attributive adjectives, premodifying nouns, prepositional phrases (of), and prepositional phrases (other) in the writings of the three groups (i.e., NS, NNS, and expert writers). These lexico-grammatical features, according to Biber et al. (1999), by far the

most common features in academic prose. Their frequencies are higher than other lexico-grammatical features (e.g., appositive noun phrase and noun complement) in academic writing. Staples and Reppen (2016) also pointed out that "Phrasal features, including both attributive adjectives and pre-modifying nouns, are considered to be notable features of academic writing, and both have been associated with higher proficiency and higher writing quality in both NS and NNS academic writing" (p. 18). Supporting Staples and Reppen's claim, the three advanced groups of writers have frequently used the phrasal modifiers in their academic writing. For instance, Excerpt 1 and 2 demonstrate the compressed NPs in the writing of an NS and NNS doctoral student through the usage of adjectives (underlined), nouns as modifiers (bolded), and prepositional phrases as postmodifiers (italicized) in the writing of NS and NNS.

> **Excerpt 1 (NS):** Sports can contribute to role, <u>societal</u>, and **community** development. Since sport is such an <u>influential</u> factor in many children and young adults' lives, **sport** specialization provides a <u>unique</u> scope to explore **sport** socialization. Despite the support and opposition to **sport** specialization in the **sport** psychology literature, **sport** specialization does allow athletes to experience commitment, learn values, and develop relationships and identity, just within a <u>singular</u> and <u>specific</u> **sport** context. Through the *exploration of sport socialization* and its effects on **sport** participants, it is not surprising that **sport** specialization is one of the more researched and <u>popular</u> topics in **sport** management and sport psychology fields where **sport** specialization and specifically **youth** specialization has been greatly explored.
>
> **Excerpt 2 (NNS**): With no doubt, English is no longer a language that one can choose whether to learn or to ignore. <u>Recent</u> research assures that English is still used as a <u>lingua</u> franca in contemporary society. Due to the **colonization** period and the <u>economic</u> and

power strength of the United States, English has become the most spoken language in the world. It is currently the third most widely used language throughout the entire world. Although learning a new language is a highly complex phenomenon, English –for its increasing spread– has attracted approximately 1.5 billion learners. Hence, it is considered the most studied second language (L2) among learners around the world. In many countries, English is no more than a subject to be taught to fulfill the **school** requirements or to pass a standardized test. It is the favored language to learn for finding a **future** job or for professional communication. English now dominates not only business but also international politics and culture, which makes it the most commonly spoken and accepted language among **world** communities.

Scholars have proposed a reason why this preference occurs: The structural compression, based on NPs and phrasal modifiers, allows advanced writers, both PhD students and established scholars, to express dense information in a compact space (e.g., Ansarifar et al., 2018; Biber & Gray, 2011; Parkinson & Musgrave, 2014; Staples et al., 2016).

More importantly, the study revealed notable differences in using phrasal modifiers among the three groups of writers, except for PPs (of). For example, NS and NNS doctoral students produced more attributives and PPs (other) than expert writers. This outcome is contrary to that of Ansarifar et al. (2018), who found that expert writers utilized more attributive adjectives than the L2 doctoral students, while the L2 doctoral students utilized roughly the same amount of PPs (other) as the expert writers. Furthermore, the NNS doctoral students used less premodifying nouns than the expert writers, but the NS doctoral students used more of them than the expert writers. This is consistent with Ansarifar et al. (2018), who demonstrated that the L2 doctoral students used more premodifying nouns than expert writers.

More importantly, it is possible to hypothesize that it is difficult to point out to a particular stage of the development of PPs (of) and PP (other) as noun modifiers although Biber et al. (2011) placed them under Stage four, which is deemed an advanced stage. The current study raises the possibility that PPs (of) should be placed in Stage three instead of four because of the high-frequency in the use of both high and low proficiency students. Further, Biber et al. (2011) drew attention to the fact that the use of PP as post modifiers was built with an "extreme wide range of functions served by this preposition" (p. 635). This means that both NS and NNS students, regardless of their language development, would acquire earlier the construction of PPs (of). For instance, in the current study, the two groups produced more proportions of PPs (of) than PPs (other) than expert writers. Drawing on the literature, Parkinson and Musgrave (2014) showed a significant difference between the two groups, where MA students used more PPs (other) in their writing. This was in line with Casal and Lee's (2019)'s findings which revealed that essays with high-grades written by first-year L2 students significantly employed more PPs than the other mid-scored and low scored essays. Casal and Lee's results were confirmed by Lan and Sun (2019) who found the most substantial distinction in the normalized frequency for PPs (other) between the first year L2 writing students and expert writers. Unexpectedly, Lan et al. (2019b) revealed that low-proficiency students relied on utilizing more proportions of PPs (of) than the advanced students. They justified that the exciting differences between two groups may have been influenced by simple grammatical functions in which the low-proficiency students employed the simple grammatical functions presented in the Biber et al. (1999) study. For example, simple grammatical function modifies species noun (i.e., sort of); and also quantifying determiners (i.e., many of). Thereby, the simple grammatical functions uncovered the surprising results of why low-proficiency students utilized PPs (of) more than high-proficiency students.

Lan et al. contended that despite considering PPs (of) in Stage 4 (which considered being advanced), this is not inevitable that low-proficiency students will use fewer PPs (of) as postmodifiers.

In sum, multiple factors may cause the differences in using the four phrasal modifiers among the three groups of writers. In the current study, genre is considered an important aspect. For example, Staples et al. (2016) found that genre mediates the use of a large set of lexico-grammatical features, including premodifying nouns and PPs. The two corpora in the current study are based on the introductions of doctoral dissertations, whereas the academic texts of the expert writers are based on different genres (e.g., research publications, academic essays).

Low-frequency category of the 11 noun modifiers

The most obvious findings emerged from the low-frequency category are the frequencies of prepositional phrases+ ing (PPs+ing) and appositive noun phrases (APP).

To start with the first pattern (PPs+ing), the two PhD groups, especially NNS, overwhelmingly used PPs+ing more than expert writers: the NNS group used six PP+ing, NS group used three PPs+ing, while the expert writers produced 0.04 PPs+ing per 1000 words. This result is inconsistent with Lan and Sun's (2019) findings, where they found that first-year students and expert writers produced PPs+ing less than one. Further, the findings of the results contradicted Biber et al. (1999)'s point that PPs+ing are associated with specific head nouns in academic writing prose. Several factors can explain this observation.

First, the nature of the introductory sections in dissertations are descriptive; namely, writers repeatedly refer to their domain in which they produced a wide range of PPs+ing. For instance, Excerpt 3 bellow illustrates how many times the writers use the elaborated meaning of "of writing" within only 1000 words. This might be influenced by the topic of the dissertation or

even by the unvaried grammatical structure of the text. Second, unlike the previous studies, this study compared high-proficiency students with highly experienced writers. In this manner, it is implausible to expect that they should follow the same patterns of reliance that can be seen in the variations of the results between the three groups. Thus, based on the current results, it is uncertain to say that PPs+ing is a valid indicator of highly advanced writing development.

Excerpt (3)

- spend a great deal of time providing individualized <<<feedback on writing>>> through marginalia comments written in isolation.
- . Even the National <<<Census of Writing>>> 2013 survey neglected to include any questions
- their mission is to improve student's overall language <<<proficiency in reading>>>, writing, listening, and speaking,
- directors. In my own experience as an <<<instructor of writing>>> classes at both Iep and Fyc programs,
- saw as the lack of focus on rhetorical <<<aspects of writing>>> in Iep writing instruction.

The second noticeable finding of the low-frequency was in the use of APPs. The two groups produced two APPs per 1000 words, while the expert writers utilized 5 APPs per 1000 words. Overall, previous studies demonstrated that low-proficiency students tended to use fewer APPs than high-proficiency students. For instance, Parkinson and Musgrave (2014) found that MA and EAP groups were far less frequent than the expert writers in terms of the frequencies of APPs. Similarly, Lan and Sun (2019) demonstrated the same results of Parkinson and Musgrave's finding where the first-year students produced fewer APPs than the expert writers.

These results might be influenced by two contributing factors: the gap between the students with respect to language proficiency (first-year students, EAP, and MA students) and expert writers in terms of language proficiency and experience, and the different genre between measured texts (i.e., argumentative essay vs scholarly articles). This is in contrast to earlier findings by Ansarifar et al. (2018) which that reported no significant difference existed with respect to APPs in the three corpora. Even though they compared three corpora with different language proficiency levels, they accounted for not having meaningful results as the genre found in the abstracts often included acronyms (i.e., name of the theory, name of the tests, and name of the questionnaires, which are considered by Biber et al. (2011) as a form of APPs. Further, the strict limitation of word counts in abstracts might have played a vital role in reducing the extent of use of APPs.

Because of the paramount importance of using APPs in academic writing and the noticeable difference observed in the normalized frequencies between the two groups and expert writers in the use of APPs, it is worthy of describing it at length in the following section.

For the first stages of Biber et al's (2011) index, I did not expect to see a considerable number of differences between the two groups and the expert writers of the noun modifiers because the lexico-grammatical features at the first stages (1,2,3) were acquired earlier than the remaining lexico-grammatical features in stages four and five. Nevertheless, I expected to see the noticeable differences in stage five. In any case, it was not in my expectations as the two groups produced nearly the same proportions of the normalized frequencies in the usage for most noun modifiers except for the aforementioned noun modifiers (PPs+ing & APPs).

The APPs, in general, are infrequent in academic writing prose. Still, they can act as an effective distinguisher in writing development between low proficiency and high-proficiency students since they are placed at a higher stage in Biber et al.'s index. The current results

concerning APPs would raise a red flag in the development of the APPs in the writing of NNS and NS. However, considering confounding factors that hinder the tracking of writing development as a genre of writing is of great importance as mentioned earlier (i.e., abstract style might not be an excellent example of tracking back the progress of students' writing about APPs).

Going back to discuss the current findings of the APPs between the two groups and expert writers was of immense importance. Compared to the expert writers who used 5 APPs in their writing, the two groups in the current corpora used only two APPs per 1000 words in the introductory sections of their dissertations. Based on this data, I can infer that the NSS and NS Ph.D. writers need to be aware of the significant role of the APPs in academic prose since Biber et al. (1999) indicated that they "are favored in the registers with highest information density" (p. 639). In addition, the sentences in academic language are formed in a compressed way including APPs (Biber & Clark, 2002; Biber & Gray, 2011). Therefore, I anticipated a higher number of frequency of APPs in the introductory sections of the two texts.

Furthermore, the APPs have a broad range of functions. Most of their common uses (approximately 65% in academic prose) are related to the modification of proper or technical nouns (Biber et al., 1999). After conducting a qualitative analysis (see Excerpt 4), the current results showed that the majority of APPs are related to technical nouns, which are in line with the finding of Biber et. al. (1999). This finding revealed something about the nature of the introductory sections of dissertations, and that is that technical terms are usually used in the first chapter (introductory sections).

Excerpt (4) from the two corpora:

- **NS_ Corpus**: When students enter the first-year composition (FYC) classroom, there is often a disconnect between the writing that they find valuable
- **NS_Corpus:** Online coursework implementing a digital learning environment which uses LMSs and Classroom Management Systems (CMSs) such as Blackboard, Moodle.
- **NNS_Corpus**: Instructor-Student Conferencing Pedagogy (ISC Pedagogy), is comprised of five key principles

How do the first language and the second language influence the utilization of NPs complexity?

In the last section, I provided a comparison of the use of the noun modifiers between the NS and NNS doctoral students and expert writers. In this section, I move forward to discuss the influence of the language background between the two groups of PhD students. As mentioned in Chapter 4, The Chi-square test showed an association between the language background and NP complexity, indicating that the use of the noun modifiers is influenced by the language background (i.e., NS vs. NNS) in doctoral dissertations. In general, this result is in line with previous research about grammatical complexity, which were studied in different written contexts, such as ESL/EAP writing, first-year undergraduate writing, and general academic writing in college (e.g., Ai & Lu, 2013; Eckstein & Ferris, 2018; Hinkel, 2003; Lu & Ai, 2015; Staples & Reppen, 2016). In addition, the result of the study added empirical evidence to the existing literature about comparing NS and NNS academic writing from a different statistical perspective: a Chi-square test for probability, instead of a test of significance as in the past studies.

The effect size (Cramer's V is 0.096) of the association between language backgrounds and NPs is weak. To the best of my knowledge, Lan et al. (2019b) is the only study about NP

complexity that is statistically comparable to this study. They found a weak association between writing proficiency and NP complexity (i.e., Cramer's V is 0.043). I agree with Lan et al. (2019b) that a weak association is not surprising because it is expected in my research context. Cramer's V is a type of effect size, which indicates how much variance one variable can have to explain another. In this case, the portion of the difference between NS and NNS dissertation writing can be explained by NP complexity. This study only included the 11 noun modifiers proposed in Biber et al.'s (2011) index. It is not reasonable to achieve that these 11 noun modifiers alone can explain a large portion of a highly complex variable (i.e., the NS vs. NNS because the difference of NS and NNS writing is supposed to be comprehensively explained through a cumulation of linguistic features, semantic features, discoursal features (e.g., coherence, cohesion), and content of academic writing. Thus, I consider the weak association (i.e., Crammer's V is 0.096) is reasonable and expected in my study.

Which particular noun modifiers lead to the association between language factor and the NPs complexity the most?

The residual analysis determines which specific noun modifiers largely contribute to the association between language background (i.e., English vs. Arabic) NP complexity in the writings of PhD NS and PhD NNS students. In the current study, premodifying nouns, PPs (other), prepositions followed by -ing clauses, and infinitive clauses largely contributed the association between the two factors (language background and NP complexity). Based on a qualitative analysis of the two corpora, three noteworthy points will be discussed:

1. NS doctoral students tend to more effectively use premodifying nouns than NNS doctoral students in their dissertations.

2. NNS doctoral students tend to produce more diverse NP patterns, but NS doctoral students tend to produce more compressed NPs in their dissertations.
3. The two most frequent noun modifiers make little contribution to the influence, which are attributive adjectives and PPs (of).

First, the NS doctoral students tended to use premodifying nouns more effectively than the NNS doctoral students in their dissertations. In line with the present study's results, previous studies have demonstrated significant statistical differences in the use of premodifying nouns between participants in their studies. For instance, Parkinson and Musgrave (2014) found that MA writers relied heavily on premodifying nouns than the EPA writers (19.6% of MA modifiers compared to 8.9% of EAP modifiers). Lan and Sun (2019) revealed that first year Chinese students used 17 premodifying nouns per 1000 words, and the expert writers used 40 nouns as modifiers. Another significant statistical difference emerged in Ansarifar et al.'s (2018) study between MA and PhD groups. Putting the four studies together, they all compared students with different language proficiencies showing significant statistical differences in the use of nouns as modifiers. These findings are not surprising given the fact that they compared groups with distinct language proficiency levels and experience, especially Lan and Sun (2019), who compared first-year writing students with expert writers.

The relationship between premodifying nouns and head nouns is less explicit but more complex than the relationship between other modifiers such as attributive adjectives and relative clauses even though noun- noun sequence is deemed as the second most comment types of pre-modification. As Biber et al. (1999) mentioned, while noun-noun sequences can pack intensive information, "they result in extreme reliance on implicit meaning, requiring addressees to infer the intended logical relationship between the modifying noun and head noun" (p. 590). Biber et

al. (1999) then summarized multiple logical relationships within noun-noun sequences, such as composition (e.g., zinc supplement), identity (e.g., exam paper), and content (e.g., credit agreement), among others. The logical and modifying relationship will be much more complex for a three-noun sequence (e.g., *corpus research approach*). Compared to the NS doctoral students, NNS doctoral students are much more likely to have difficulty using and interpreting the logical relationships within noun-noun sequences or multiple noun sequences. A qualitative analysis of the corpus reveals that: (a) both NS and NNS doctoral students produced a number of technical terms (i.e., *sport management*, *speech acts*) and fixed expressions (e.g., *research centers*, *language learners*, *curriculum design*); (b) NS students also produce many more nonterms noun-noun sequences with abstract modifying relations (e.g., *media genres*, *consumer lifestyles*, *community identity*) and three-noun sequences (e.g., *minority student enrollment*, *language management policies*). Thus, NS doctoral students demonstrate a more effective use of premodifying nouns than NNS Arabic students.

Due to disciplinary variations, it is difficult to explain this result. However, it might be related to the topic of the dissertations of the NNS in which they had to use fewer nouns as modifiers in their writing. Staples and Reppen (2016) advocated addressing premodifying nouns to L1 Arabic writers in their L2 classes. My study and Staples and Reppen's suggestion create an opportunity for researchers, especially Saudi researchers, to further explore nouns as modifiers in Saudi's academic writing would provide a way to understand better the development of NNS's essential issues with terms as modifiers in their academic writing.

Moreover, Fries (1945) proclaimed that first language interference is a central issue for L2 leaners. I wholly excluded the interference of the first language (i.e., Arabic) on the NNS since the difference between the NS and NNS language in premodifying nouns is not sharp. This

is because the Arabic language is rich in varieties of syntactic structures, including nouns as premodifiers where the interference of NS is not a potential cause. After all, the quantity of such a linguistic feature is stored in the NNS's repertoire. This is taking the same stance with Lan and Sun (2019) who arguably asserted that "it seems plausible that because of the lexical nature of noun-noun sequences, the use of nouns as modifiers are largely influenced by writing topics" (p. 21). As the topic in the current study is not controlled. Therefore, the dissertations encompassed a wide range of educational issues (e.g., whiteness studies, sport management, etc.). Hence, it seems plausible that the nature of the topic led to this surprising finding. To illustrate this, excerpt 1, mentioned above, (for NS) provides a concrete example of the topic effect in which the writer, within a small paragraph, produced 'sport', as noun modifiers, numerous times in different lexical situations (i.e., sport management, sport context, sport specialization, and sports psychology.

Second, NNS doctoral students had a tendency to use more varied NP patterns than NS students, whereas NS doctoral students had a tendency to use more compressed NPs in their dissertations. Excerpts 5, 6, and 7 demonstrated that NNS doctoral students produced NPs patterns more than expected, such as of PPs (other), prepositions +ing clauses, and infinitive clauses. The NPs that made a large contribution to the association between NPs complexity and language background are included in Excerpts 6, 7, and 8. For instance, they included PPs (other) as modifiers (*in Saudi English*); prepositions+ing as modifiers (*in helping students*), and infinitive clauses as modifiers (*to serve their education*). On one hand, these Excerpts also included the frequent NPs such as attributive adjective and PPs (of), where they also made a significant contribution to the association between the two factors (i.e., language background and NPs complexity).

However, the NS doctoral students had a tendency to produce less varied NPs in their dissertation. Excerpts 9 and 10 illustrated the preference of their NPs patters, including attributive adjective (meaningful reflection); PPs(of) (| a sense of community); and premodifying nouns (Instructor-Student Conferencing). This result is in agreement with Staples et al. (2016), who showed that L1 English students used more compressed NPs in their writing as they transfer from undergraduate studies to graduate studies. On the other hand, for the NNS, the findings were not supported by past results in other contexts of L1 writing. For example, Parkinson and Musgrave (2014) reported that L2 TESOL writers had a tendency to use more compressed patterns of NPs at their higher educational studies. Moreover, Ansarifar et al. (2018) revealed that L1 Persian doctoral students in the field of applied linguistics used compressed NPs as the expert writers from journal articles of applied linguistics. Hence, my result would give me enough space to say that doctoral potentially (L1 Arabic) students would be cautious about using phrasal modifiers to help them develop their academic writing at advanced stages (i.e., doctoral level).

Excerpt 5

- The students' views and preferences were <important> in **delineating and building** on these views and **in helping** students become life-long, <autonomous> learners *who could work collaboratively* amongst themselves and make the utmost use |of| technology **to serve their education**.

Excerpt 6

- [Saudi] writers may include discourse and <linguistic> features available |in| Saudi English (SE) |in| their English writing, *which may differ from* those used |in| standard <written>English prose.

Excerpt 7

- Teachers also have their own expectations regarding the [teaching] experience. Examples include the <appropriate> behavior |of| <adult> students *that complies with the educational* and <cultural> norms |of| a particular society.

Excerpt 8

- [Instructor-Student Conferencing] Pedagogy (ISC Pedagogy), is comprised of five key principles: creating a sense |of| community, increasing [student] self-efficacy, conducting frequent [instructor-student] conferences, incorporating <meaningful> reflection

Excerpt 10

- [First-generation] students are concentrated at [two-year community] colleges because such institutions are within their <financial> reach. Unfortunately, the <national> trend shows that states have reduced funding to public institutions by a margin of 35-50% over the past few decades

Finally, it is interesting to see that two of the most frequent noun modifiers made little contribution to the influence of language background on NP complexity, namely attributive adjectives and PPs (other). This might seem counterintuitive at first glance. I interpret the counterintuitive phenomenon in the context of a Chi-square test, which is a test from the perspective of probability, comparing observed frequencies with expected frequencies. In other words, attributive adjectives and PPs (of) have been used frequently because they are expected to be frequent in academic writing. Attributive adjectives are the most basic noun modifier in Biber et al.'s (2011) complexity index, which are universally common in academic writing and many

other written genres (e.g., news articles, online documents). Therefore, it is important to identify some of the roles of attributive adjectives as one of the most occurring lexico-grammatical features in academic writing prose. According to Biber et al. (1999), attributive adjective precisely determines various semantic classes, including two semantic domains of attributive adjectives: descriptors such as colors (red), size (big), time (early), and evaluative (bad); and classifiers such as classification (different), affiliative (Chinese), and topical (social). Nevertheless, the of two types of semantic classification can be influenced by a specific genre (i.e., argumentative essay, proposal, dissertation). Hence, I performed a qualitative review of the two corpora of the semantic domains and found that students tended to use classifiers more than descriptors. My findings corroborated with Biber et al.'s (1999) findings that reported classifiers are primarily utilized in informational written registers. I considered introductory dissertation section as an informational text since it usually provides factual information about the topic of the dissertation. However, the findings do not mean that the descriptors are not used in informational texts where the descriptors, as mentioned in Biber et al., are found in all writing registers (i.e., news, fictional, and academic).

Example (1) from the two corpora:

Classification: The <<<previous experience>>> of international students, <<<Previous studies >>>addressing Dwcf have been inconsistent in...

Affiliative: Women who are portrayed in <<<Western media>>> as oppressed with no rights

Topical: <<<syntactic structures>>>; thus, it stands to reason recognition

In addition, there is a similar case with PPs (of). Although PPs (of) are an advanced noun modifier in Biber et al.'s (2011) index, this grammatical feature has an extremely broad range of English writing use. The uses include of-possessive (e.g., the population of the United States), of + -ing clauses (the idea of doing online business), and fixed expressions (e.g., a couple of, a lot

of), to name a few. The wide range of uses makes *of* the most frequent preposition to lead PPs as modifiers, taking up about 60% of PPs as modifiers in academic writing. Both NS and NNS doctoral students are unable to avoid using PPs (of) as modifiers. Thus, the language background of the doctoral students should not drive the use of these two frequent noun modifiers in their dissertations.

Conclusion

Using a specialized corpus-based research design, this study aimed to compare the frequencies of the 11 noun modifiers in academic writing across the three groups (NS doctoral students, NNS doctoral students, and expert writers) and investigated how the language background influenced NP complexity in academic writing prose. This study drew on Biber et al. 's (2011) index which suggested that a decent amount of the meaning in academic writing is condensed into NPs as opposed to being phased out in clausal forms. Mainly, 11 noun modifiers were used in the two corpora of written texts based on Biber et al.'s index.

To summarize, the study has found that to a certain extent corroborate the hypothesis of the developmental index by Biber et al. (2011) which declared the meaning in academic writing is mostly condensed into complex NPs rather than being formed in clausal sentences, as the 11 noun modifiers in the writings of NS of English graduate writers, NNS Arabic graduate writers, and expert writers emerged predominantly from the high-frequency noun modifiers (e.g., attributive adjectives, nouns as pre-modifiers, and prepositional phrases as post-modifiers) to the low-frequency noun modifiers (e.g., PPs+ing and appositive noun phrases).

Generally, both NS and NNS students frequently used phrasal modifiers in their dissertations, which is similar to expert writers. However, a few patterns of noun modifiers revealed a remarkable difference between the two groups of PhD writers and expert writers. As

such, this study showed an influence of language background on NP complexity, and this influence is mainly contributed to by four noun modifiers: premodifying nouns, PPs (other), prepositions followed by -ing clauses, and infinitive clauses. NS and NNS doctoral students used these modifiers differently in their dissertations.

Pedagogical Implications

From a linguistic standpoint, the current research provided a novel understanding of the distinctions between NS and NNS doctoral writing. Some pedagogical implications can be offered from the findings of the two corpora in this study. Aston et al. (2004) professed that NS and NNS corpora render language learning and language teaching. EAP instructors, college-level professors, writing curriculum teachers, and writing consultants in academic writing can better conceive the development stages of complex noun phrases and gain insights into the better/proper usage of the 11 noun modifiers varied among NS and NNS graduate students as compared to expert writers. However, more research on this topic needs to be undertaken to ascertain whether the current study patterns will be similar or distinct from other NNS Arabic students or other different NS backgrounds. Some initial insights can still be offered based on the current findings to NS and NNS Arabic graduate students.

Firstly, providing explicit instructions for complex noun phrases to EAP is assumed to be an effective method to graduate students regardless of their NSs (Musgrave & Parkinson, 2014). For instance, teaching explicitly can allow instructors to specify and improve the needs of graduate students to enhance their academic writing skills. The evidence from this study suggests the need to explicitly teaching noun modifiers from stage 4 and stage 5, especially complement nouns and appositive noun phrases, to NS and NNS graduate students. To be more specific, it is a great of importance for faculty who teach L2 Arabic students to raise the awareness of using

premodifying nouns in their classes. Staples and Reppen (2016) recommend addressing premodifying nouns to NS Arabic students as NNS Arabic students in the current study tended to use premodifying noun less effectively than NS students. Faculty can introduce directly the most common premodifying nouns in students' domains to have their students use them in their writing. NNS students will improve their academic writing by producing more compressed NP to concisely package more information in their writings.

Secondly, NS writers should be encouraged to produce more diverse NP patterns in their dissertation. According to Staples and Reppen (2016), "creating variety in these noun phrases can be a focus, in that synonyms and summary nouns can be introduced as useful devices to express a deeper understanding and exploration of the topic" (p. 31). One way of explicitly teaching the more diverse NP is having students extract the published articles in their fields (i.e., articles from applied linguistics, sport management, and teaching English as a second language). Second, they can be asked to examine their functions in the texts that will allow them to understand the structure and help them conceive the role of each noun modifier that will ultimately assist them in becoming better writers. Third, once they understand the importance of the complex noun phrases in their writing, they can use them in their academic writing with the instructors' explicit assessment based on Biber et al.'s (2011) index.

Finally, I hope this research's findings will generate a more practical material design with an extra concentration on noun phrases; for instance, premodifying nouns, appositive nouns in non-formal settings (e.g., graduate writing support centers and writing workshops). One feasible way of teaching students in non-formal settings is using Data-driven Learning (DDL) to teach lexico-grammatical features as it has been claimed as a powerful method in teaching L2 writing courses *since* they provide real language use (Lan et al. 2019b). There are numerous free-access

resources of online corpora that provide teachable materials, for instance, the Corpus and Repository of Writing (Crow) and the Michigan Corpus of Upper-level Student Papers (MICUSP). Via these corpora, students can investigate common usages of complex noun phrases in academic writing since they contain millions of written texts from different genres and registers. To illustrate this, students can look for the most frequent adjectives and nouns as pre-modifiers in their disciplines by using concordance lines in their domain. Moreover, based on the most needed lexico-grammatical features brought to attention, teachers can utilize these corpora to create lessons for their students to encourage students to write in a way accepted in written academic prose.

Limitations and Future Research

Even though this study provided important contributions to the field of syntactic complexity, it must be admitted that the current study is not without limitations. First, sound generalizability is not a predictable attribute of the current project due to the need to use bigger corpora size of the NS and NNS. For instance, one major limitation is the small size of the two corpora, 50 dissertations for each corpus. This is because of the nature of the study that requires a great deal of time to analyze texts qualitatively and quantitatively and requires access to professional taggers that are usually enormously expensive for unfunded projects. Although small corpora could, in many cases, provide valid results if robust corpus techniques were used (Sinclair, 2004), a larger and well-designed corpus will more effectively represent doctoral dissertations in general. For this reason, future work might endeavor to enlarge the two corpora if the work is entirely funded. Second, it is extremely difficult to build a large-scale corpus from native speakers because you need to contact a large number of students to ask them if they speak English as a first language. Thus, I would suggest that future researchers rely on texts from

established-corpus when targeting NS speakers. It would save time. Third, the two corpora were taken from the dissertation genre from a wide range of domains. Although the dissertation genre represents academic prose, it cannot be guaranteed that the difference in academic genres would possibly affect the use of noun phrases (i.e., dissertation genre has more noun modifiers than thesis genre (Parkinson & Musgrave, 2014). Fourth, adding more participants from a wide range of different NSs backgrounds or other academic fields and comparing their lexical diversity, versus comparing only Saudi students with native English students, would reveal more interesting outcomes. Future research might explore a broad range of NSs background students to investigate the reliance patterns of noun phrases in their texts. Last, an uncontrolled limitation is that individual students might get additional help during composing their dissertations from other sources, such as their advisors or writing centers.

Appendix A

Precisions, Recalls and F scores of the Targeted Features for Tag Checking

Noun Modifier	**Precision**	**Recall**	**F score**
attributive adjectives	96.54%	93.17%	94.83%
Nouns	95.89%	97.62%	96.75%
relative clause	90.91	95.31%	93.06%
PPs	97.64%	97.99%	97.72%
-ing clause	51.32%	85.72%	64.20%
-ed clause	85.71%	62.50%	72.29%
infinitive marker (to)	89.34%	97.83%	93.39%
noun complement clause	77.50%	100%	87.32%

Appendix B

The Two Types of Automatic Extraction

Noun Modifier	Tags in Biber Tagger	Chunking Patterns	Extraction
attributive adjective	Jj+atrb+++ Jjr+atrb+++ Jjt+atrb+++	N/A	POS tag
relative clause	Tht+rel+++ Whp+rel+++	N/A	POS tag
noun as modifier	N/A	Noun + noun	Chunking
PP (of)	N/A	Noun + prep (of)	Chunking
PP (other)	N/A	Noun + prep (other)	Chunking
-ing clause	Vwbn+++xvbg+	N/A	POS tag
-ed clause	Vwbn+++xvbn+	N/A	POS tag
infinitive clause	N/A	Noun + infinitive-to	Chunking
Preposition+ ing clause	N/A	Noun + prep + -ing verb	Chunking
noun complement clause	Thtþ+ncmp+++	N/A	POS tag
appositive noun phrase	N/A	Regular expressions	Chucking

Note. Appositive noun phrase cannot be tagged by Biber tagger, so regular expressions were used to extract patterns in Biber et al. (1999). *Adopted from Lan and Sun (2019), (p. 23).*

Appendix C

Accuracy Rates of Manual Processing

Noun Modifier	Categories of Accuracy Rates	Accuracy Rate after Qualitative Check
attributive adjective	POS Tag	99.80%
Relative clause	POS Tag	99.22%
Noun as modifiers	Chunking	95.36%
PP (of)	Chunking	96.67%
PP (other)	Chucking	93.78%
-ing clause	POS Tag	97.55%
-ed clause	POS Tag	99.48%
Infinitive clause	Chunking	95.77%
preposition +ing clause	Chunking	94.17%
Noun complement clause	POS Tag	98.14%
Appositive noun phrases	Chunking	98.47%

Note. (1) "Low" suggests that the accuracy rates are lower than 50%, because the chunking patters do not extract the modifiers effectively, (2) After the qualitative check, all most of the incorrect cases were excluded. The accuracy rates after the qualitative check were calculated by the number of unsure/inconsistent cases from the two coders divided by the total cases, namely the intercoder reliability. The unsure/inconsistent cases were further coded by a third coder" (Lan and Sun, 2019, p. 23).

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