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Phrasal complexity in academic writing: A comparison of abstracts written by graduate students and expert writers in applied linguistics

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ABSTRACT

Academic research articles often involve the frequent use of lengthy noun phrase structures, and those seeking to write such texts, both native and non-native alike, would need to become familiar with this characteristic feature of the register. Biber, Gray and Poonpon (2011) have hypothesized a series of stages predicting development in writing complexity through the increased use of complex phrasal constructions. The purpose of this study is to compare abstracts by MA-level L1 Persian writers, PhD-level L1 Persian writers, and published writers from the field of applied linguistics in terms of phrasal modification features. Our findings revealed that the MA group differed significantly from the expert writers in the use of four types of modifiers: pre-modifying nouns; -ed participles as post-modifiers; adjective-noun sequences as pre-modifiers; and multiple prepositional phrases as noun post-modifiers. The PhD group however did not show any significant difference in producing noun modifiers when compared to expert writers except for multiple prepositional phrases as noun post-modifiers. The findings of this study help further our understanding of how academic writing becomes more complex with experience.

1. Introduction

In addition to accuracy and fluency, syntactic complexity or "the range of forms that surface in language production" and their respective sophistication (Ortega, 2003, p. 492) form the main components of the Complexity, Accuracy and Fluency (CAF) triad (i.e., the three-dimensional L2 proficiency model proposed by Skehan, 1989). Ellis (2003, p. 340) defines complexity as "[t]he extent to which the language produced in performing a task is elaborate and varied", while he refers to accuracy as the ability to produce language that is error free and characterizes fluency as the extent to which the language produced involves pauses, hesitations and/or reformulations (Ellis, 2003). These three components have been the focus of many studies into second/foreign language learning (Housen & Kuiken, 2009). Although the three constructs are recognized to be closely interrelated, much research has focused on one of the three dimensions: syntactic complexity (Vyatkina, 2012). Since the growth of a learner's syntactic repertoire is believed to be key to his/her development in the language being learned (Ortega, 2003), syntactic complexity is now recognized as an important construct in L2 writing instruction and research.

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Among the list of measures used to analyze syntactic development and complexity in second language academic writing, phrasal embedding has been largely ignored and has only recently been receiving attention from researchers. This is because most of the studies in the field (e.g., Beers & Nagy, 2009; Ellis & Yuan, 2004; Hunt, 1965; Jiang, 2012; Stockwell & Harrington, 2003) have traditionally focused on clausal embedding and subordination measures based on the assumption that academic writing derives its complexity from the elaborate use of clausal constructions (Biber & Gray, 2010). A number of studies (e.g., Biber & Clark, 2002; Biber & Gray, 2010; Biber, Gray & Ponpoon, 2011) have found academic writing to be characteristically dense with non-clausal phrases and complex noun phrases, while at the same time reporting a relative absence of clausal elaboration. As a consequence, more studies are needed to investigate the role of phrasal embedding in the development of academic writing complexity. Studies such as Lu (2011), Parkinson and Musgrave (2014) and Biber, Gray, and Staples (2014) have shown that phrasal features tend to increase across levels of study in second language writing. Ravid and Berman (2010) and Staples, Egbert, Biber, and Gray (2016) have also found that phrasal features develop during university years in the writing of L1 English students.

Similarly, this study aims to investigate the development of noun phrase complexity in the academic writing of graduate students at different levels of academic study, comparing the observed patterns of use to those by expert writers.

1.1. Measures of syntactic complexity in L2 writing

Numerous studies have sought to find an objective and reliable metric for successfully gauging learners' syntactic development in L2 writing (e.g., Larsen-Freeman, 1978, 2009; Lu, 2011; Ortega, 2003; Wolfe-Quintero, Inagaki, & Kim, 1998). Most of the proposed indices have taken on the form of ratios, frequencies or formulas (Norris & Ortega, 2009), and are calculated using one of the following criteria: (a) the length of the production unit, (b) the amount of subordination, (c) the amount of coordination, (d) the range of syntactic structures and degree of phrasal sophistication.

Larsen-Freeman (1978) noted the need for a measure to serve as a yardstick in making a distinction between learners with different levels of writing proficiency. In a quest for global indices, Wolfe-Quintero et al. (1998) examined more than 100 measures of CAF in 39 L2 developmental studies. Having reviewed a highly representative set of measures used in the body of research in this area, the authors of this seminal study concluded that clauses per T-unit and dependent clauses per independent clause were the best measures of syntactic complexity. As a possible consequence of this recommendation, most studies into L2 writing development since Wolfe-Quintero et al. (1998) have primarily relied on T-unit-based measures (e.g., Beers & Nagy, 2009; Casanave, 1994; Elder & Iwashita, 2005; Ellis & Yuan, 2004; Jiang, 2012; Larsen-Freeman, 2006; Stockwell & Harrington, 2003). Ortega (2003) also reviewed 27 studies on grammatical complexity and found that no measure was used as pervasively as mean length of T-unit (MLTU) and clause per T-unit (C/TU). In her meta-analysis, 25 studies relied on MLTU, while 11 used the measure of C/TU.

Biber et al. (2011) used a large-scale corpus of academic texts to describe the distribution of 28 grammatical features in formal academic writing and compared them with their distribution in conversation. The study involved an academic writing corpus of 429 research articles including approximately 3 million words and a conversation corpus of 4.2 million words of American English. Biber et al. (2011) went on to challenge two stereotypes which they believed to be deeply rooted in developmental studies of L2 writing: first, that subordination is the best measure of syntactic complexity; and second, that academic writing is obviously more complex than conversation in terms of subordination. The two major findings of their study included the following: (1) complex noun phrases (i.e., a head noun modified by noun modifiers such as attributive adjectives, prepositional phrases, etc.) are much more appropriate measures of grammatical complexity in academic writing as opposed to embedded clauses (e.g., *I don't know [[why I was expecting [to see something else]]*; Biber et al., 2011), and (2) conversation is more complex than academic writing, if only clausal subordination measures (e.g., mean length of T-Unit) are to be considered (as in the case of most previous studies into L2 writing). In the discussion of their findings, Biber et al. (2011) challenged the usefulness of MLTU and C/TU in developmental studies of L2 writing, arguing that dependent clause-based measures are more characteristic of conversation than they are of academic writing. They claimed that despite the widespread acceptance of these two metrics, little empirical evidence exists to corroborate the use of T-unit measures and dependent clause measures for evaluating writing development. Instead, they proposed phrasal embedding (e.g., the use of multiple prepositional phrases) as an alternative index for gauging complexity in academic writing.

In their critical evaluation of T-unit measures, Biber et al. (2011) also challenged the assumption that T-unit-based measures and simple subordination could be used to trace the development of complexity in L2 writing across proficiency levels. They maintained that perhaps because of the shortcomings of T-unit-based measures of grammatical complexity, developmental studies of L2 writing have failed to produce consistent results (see Ortega, 2003; Wolfe-Quintero et al., 1998). They further argued that the biggest shortcoming of T-unit measures is their failure to capture non-clausal features that are embedded in noun phrase constructions. Lu (2011) also stated that measures of complex nominals (i.e., complex nominals per clause, and complex nominals per T-unit) along with coordinate phrases have "stronger discriminative power than most other measures" (p.57). He too recommended a closer examination of complexity at the phrasal level in future studies. In another study, Taguchi, Crawford, and Wetzel (2013) found no positive correlation between proficiency and complexity at the clausal level, and therefore argued that considering subordination as the only measure of complexity is an oversimplification of the construct; and that dependent clause complexity measures do not necessarily characterize academic writing. In line with Biber et al. (2011), they concluded that noun phrase modification is a strong contributor to writing quality. Finally, in a longitudinal analysis of L2 writing development over one university semester, Crossley and McNamara (2014), demonstrated

a shift in syntactical features of texts produced by L2 writers. They also observed that until the end of the semester, L2 writers more often produced texts which show greater reliance on phrasal (longer noun phrases, more words preceding verbs) rather than clausal syntactic features or verb phrases.

Based on the register differences observed between L1 spoken and written language, Biber et al. (2011) hypothesized a series of developmental stages for both L1 and L2 writers of academic English. Biber et al.'s (2011) proposed developmental stages are based on the assumption that novice writers progress from competence in features that represent conversation (clause-based measures) to phrasal complexity features that were found to distinguish academic writing from academic spoken discourse.

As shown in Table 2, Biber et al.'s (2011) developmental index includes five stages. The first stage does not involve complexity in noun phrase constructions. "This stage includes finite complement clauses (*that* and *WH*) controlled by extremely common verbs (e.g., *think*, *know*, *say*)' (P. 30). The second stage includes only noun modification features starting with simple modification through attributive adjectives and participle pre-modifiers (not specifically differentiated in Biber et al.'s original study). The third stage proceeds to more complex noun modification patterns (i.e., nouns as pre-modifiers, prepositional phrases as noun post-modifiers with concrete meaning and relative clauses). In the fourth stage, the emergence of nouns modified by non-finite clauses as well as modification by prepositional phrases as noun post-modifiers with abstract meaning and combined adjective-noun pre-modification (adjective-noun sequences refer to noun phrases that have both an attribute adjective and a noun modifying the head noun) is hypothesized; and the final stage includes appositive noun phrases and complement clauses as noun modifiers in addition to multiple phrasal embeddings.

These five stages can be summarized as developmental progression along two grammatical parameters:

Grammatical form:

finite dependent clause → non-finite dependent clause → dependent phrase

Syntactic function:

Using clausal constituents (e.g. direct object or adverbial) → using noun phrase modifiers

A number of issues have been raised regarding the validity of these proposed stages. Many of these issues were outlined by Yang (2013), who argued that firstly, the hypothesis is not based on a developmental study, but a corpus-based study of syntactic complexity features in two different registers (spoken vs. written). Secondly, she maintains that the data in that study were gathered from proficient L1 writers and speakers, not L2 learners (i.e., the group for which the claims were being made). Furthermore, Biber et al. (2011) did not make any reference to SLA findings that could support their hypothesis or at least explain the underlying reasons for their proposed developmental stages. As a result of these shortcomings, Yang (2013) stated that Biber et al.'s (2011) proposed stages cannot be used to address "development-related questions" (p. 190). In response to these criticisms, Biber, Gray, and Poonpon (2013) argued that their 2011 study was an attempt to provide a full description of the range of grammatical features found in advanced academic writing, and noted that learning to produce academic discourse, which is characteristically dense with complex noun phrase constructions, can pose a challenge for both students and professionals regardless of their L1 background. However, Biber et al. (2013) acknowledged that no single study can comprehensively pin down the development of complex structures in learner writing, and that this area is "an enterprise worth pursuing" (Biber et al., 2013, p. 200).

Several studies, such as Lu (2011), Biber et al. (2014), Staples and Reppen (2016), and Staples et al. (2016), have also found that phrasal features tend to increase in complexity in the writing of university students as their academic writing skills develop through time. However, few studies have specifically tested the developmental progression index proposed by Biber et al. (2011). In one of the rare studies that have attempted this, Parkinson and Musgrave (2014) designed and conducted a study specifically aimed at observing patterns of complex noun phrase development. They compared the frequency of these grammatical features across the writings of two groups of international students: an EAP and an MA group. They also drew comparisons between what previous studies (Biber & Gray, 2011; Biber, Johansson, Leech, Conrad, & Finegan, 1999) had found in published articles and the writing of their own two groups of participants.

Their findings revealed that the less proficient group of their study (i.e., the EAP group) used attributive adjectives, hypothesized to be acquired early on in the process, much more frequently compared to their more proficient group (i.e., the MA group) and the reported frequencies for published academic writing. On the other hand, the MA group was found to use other noun modifiers more frequently than the EAP group. In comparison to published frequencies for academic writing, writing by participants in the MA group showed a similar pattern of noun modification in all cases except for the appositive.

Despite its value in being one of the first studies to investigate Biber et al.'s (2011) developmental progression stages, Parkinson and Musgrave's (2014) study involved a number of limitations. First, the discipline and register of the writings from the EAP and MA groups was not the same. The EAP student writing was in the form of argumentative essays, while writings by MA students included literature reviews and responses to various extended questions in the field of Applied Linguistics/

TESOL. With regard to this, Lu (2011) has found that not only can register and text type remarkably influence syntactic complexity, but even essays that are considered to be of the same register can be quite different in terms of their syntactic features. For example, argumentative essays have been found to be syntactically more complex than narrative essays (see also Beers & Nagy, 2009; Way, Joiner, & Seaman, 2000). Hence, this difference in the register of texts in Parkinson and Musgrave's (2014) study could have possibly influenced their findings. A second limitation of the study involved the relatively small size of the data sets used (The EAP corpus included 13,711 words and the MA corpus included 12,577 words). Third, the students whose writing was analyzed came from different L1 backgrounds. The 21 EAP students in the study were from 10 different countries and the 16 MA students were from 6 different countries. This could also limit the conclusions drawn based on the observed data. Lu and Ai (2015) investigated the effect of L1 on the development of L2 syntactic complexity. They compared essays written by learners from seven diverse L1 backgrounds in terms of 14 syntactic complexity measures. Their findings revealed that learners with different first language backgrounds, even at the same level of proficiency, may not develop the same patterns of L2 syntactic complexity. As a result, a study on learner academic writing by students from the same L1 background could potentially yield more reliable results. To overcome some of the shortcomings noted above, in this study we sampled our texts from the same discipline and the same L1 background.

1.2. Noun modification and its role in complexity

Noun phrases (NPs) are "strings of words with an internal structure centered around an obligatory head, which may be supplemented by determiners, pre-modifiers and post-modifiers" (Ni, 2003, pp. 159–160). According to Biber et al. (1999), the basic structure of noun modification includes four key components:

Determiner + (pre-modification) + head noun + (post-modification and complementation).

There are several different types of noun pre-modifiers and post-modifiers. Pre-modifiers include adjectives (e.g., significant predictor), participial modifiers (e.g., the proposed model), nouns (e.g., vocabulary knowledge) and possessive nouns (e.g., students' view); while post-modifiers include relative clauses (e.g., Models that include only linguistic factors), ing-clauses (e.g., statements representing deliberative, rational and critical moral approaches), ed-clauses (e.g., transcripts obtained from the participants), prepositional phrases as noun post-modifiers (e.g., a pedagogy of happiness), and noun phrases as appositives (e.g., Teacher attribution scale (TAS)). These noun modifiers have been found to perform specific discourse functions in a register. For instance, Lim (2012, p. 236) reports that when referring to the research gap in academic writing, expert writers use "adjectives signaling insufficiency (e.g., 'little', 'few', etc.) … to modify nouns denoting investigations (e.g., 'research', 'studies')."

Scientific prose has been singled out for its dense use of nominalizations (Banks, 2008; Halliday & Martin, 1993; Halliday, 1979; Ni, 2003). This involves the transformation of verbs into nouns through processes such as the addition of derivational suffixes or the use of noun equivalents (Halliday & Martin, 1993). This preference towards nominal constructions entails a number of advantages for modern scientific prose. Firstly, it helps to concentrate meaning into a noun phrase structure, which can then be referenced in proceeding text. Secondly, by using nominal constructions, ideas can be treated as objects in noun form, which allows them to be more easily examined (Halliday & Martin, 1993). This is in contrast to clausal constructions where meaning is expressed as "a tension between things and actions" (Parkinson & Musgrave, 2014, p. 49). Ni (2003) has argued that the high density with which writers are required to present information in academic prose has led to the heavy dependence of this register on unified noun phrase structures. Informational content may be packaged more or less densely through the use of different NP heads and the use of noun phrases with different levels of complexity in terms of the number of modifiers they contain. Nominal modifiers can be used to pack extra information into relatively few words. Biber and Clark (2002) have argued that the rapid increase in the use of compressed noun phrases over the past 100 years is the result of an 'information explosion' forcing writers to communicate information efficiently and economically. Biber and Gray (2013), in a historical investigation of register diversification in academic research texts, observed a decline in dependent clauses and a remarkable increase in phrasal modification. Biber (2003) also linked the dense use of complex noun phrases to space-saving considerations. Other studies such as Biber (1988), Biber and Gray (2010), and Biber et al. (2014) have also shown that phrasal complexity features better characterize academic writing than clausal features.

1.3. The purpose of this study

Given the paucity of research into Biber et al.'s (2011) hypothesized developmental stages of grammatical complexity, this study aims to test this suggested developmental index in the writing of graduate students by specifically focusing on complex noun phrases. Through examining some specific phrasal features of academic writing, Ravid and Berman (2010) showed that even for native speakers of English, writing development continues at the university level. Staples et al. (2016) also claimed that for L1 writers, "phrasal complexity develops most noticeably during university years, much later than researchers have normally considered" (p. 6). They attributed this late writing development during university years to the students' need to "use increasingly complex and sophisticated language in order to convey precise and specialized meanings within disciplinary writing" (p. 6). Since developments in phrasal complexity have been observed in the writing of L1 English students across university levels, a similar developmental pattern is expected for L2 English students (see, Biber et al., 2014; Lu, 2011;

Parkinson & Musgrave, 2014). L1 background should also be considered as a potential factor influencing trends in L2 syntactic development. Ai and Lu (2013) examined patterns of difference in the development of syntactic complexity between Chinese and L1 English students and concluded that more studies need to be conducted into learner writing from other native language backgrounds in order to determine the role of L1 in the development of L2 syntactic complexity. This study therefore narrows its focus to L1 Persian university students.

Based on the findings of previous research into syntactic development for both L1 and L2 English students, in this study we wish to analyze how phrasal complexity is different in master's-level, PhD-level and published Research Article (RA) abstracts and whether these differences can be explained using the stages hypothesized by Biber et al. (2011). As a result, we sampled our data from a group of MA-level students of applied linguistics and a group of PhD-level students from the same field. The students in each of the two groups of this study are assumed to be at the same level of language proficiency, because they have all been educated through the same national curriculum, have taken part in the same nationwide entrance examination (both for the MA and PhD levels) and have passed the same courses at university, as mandated by the Ministry of Science Research and Technology. The PhD level students are also taken to be more experienced in their use of academic English for two reasons. Firstly, in Iran, students are admitted to PhD programs through a rigorous selection scheme that involves participation in a nationwide examination and an evaluation of their research background at the MA level. As a consequence, those who make it into PhD programs can be safely assumed to have more academic expertise relative to their peers who did not. Secondly, the PhD theses, from which the abstracts for this group of participants are sampled, are written after four years of intensive study, through which students gain academic expertise by way of extensive reading and academic writing practice. However, we acknowledge that the three categories of texts that constitute our corpus (i.e., MA, PhD and Research Article abstracts) are different in some respects. Kawase (2015) categorizes theses as belonging to an “educational genre” while RAs are classified as part of a “professional genre” (p. 114); In spite of this, both can be said to represent academic prose. In addition, the fact that we compare these three groups of abstracts should not imply that we view one as being superior to the others. Our justification for choosing these three groups is that they all represent academic writing and that they are written by writers who, as explained above, can be said to be of different ability and experience levels.

Considering the purposes mentioned above, this study will address the following set of research questions:

1. What are the patterns of reliance on noun modifiers in the academic writing of MA-level L1 Persian students, PhD-level L1 Persian students and expert writers?
2. Is there a significant difference in the use of noun modification features among academic writing by MA-level L1 Persian writers, PhD-level L1 Persian writers and expert writers? If so, in which features can these be observed?
3. Does the academic writing of L1 Persian PhD students better approximate that of expert writers in the use of noun modifiers? If so, in which aspects?

2. Corpus and methodology

The data for this study consists of abstracts from 99 master's theses and 64 PhD dissertations written by L1 Persian students of Applied Linguistics, in addition to 149 RA abstracts by expert writers from the same field. In this study, expert writers are defined as the writers of texts or papers in established international peer-reviewed journals (e.g., Thompson, 2005; Basturkmen, 2009; Lim, Loi, Hashim & Liu, 2015). We chose to examine writing from the discipline of applied linguistics because in Iran, almost all theses and dissertations are written in the students' first language (i.e., Persian). The only exceptions to this are English-related disciplines (i.e., applied linguistics, English literature and translation studies), in which students are obliged to compose their theses and dissertations in English. The abstract was chosen as the unit of analysis of this study for two reasons. First, the abstract is a brief, comprehensive summary of the contents of the research article. It needs to be “dense with information”, but at the same time “readable, well organized, brief, and self-contained” (American Psychological Association, 2010, pp. 25–26). Due to space-saving considerations, writers are often forced to impose a word limit on their abstracts, and because of this, the register often involves a very dense, integrated packaging of information (Biber & Gray, 2010; Biber, 2003; Biber et al., 2011). Second, the labor-intensive process of hand-coding the data made the use of larger data sets extremely difficult. Choosing the abstract section as the unit of analysis also has the advantage of allowing the inclusion of a greater number of texts into the corpus. As demonstrated in Table 1, PhD abstracts are usually longer than MA and expert writer (EW) abstracts; therefore, we included a smaller number of PhD abstracts to balance the number of words in the three corpora. Crawford and Csomay (2016) have suggested that to make straight frequency comparisons between features of interest between two corpora, they should preferably be of equal sizes. They additionally point out that “[f]requency comparisons are done on the basis of the number of words, not by the number of texts” (p.80). Therefore, in this

Table 1
Descriptive details of the three corpora.

	number of abstracts	mean length of abstracts	total number of words
MA	99	259.73	25714
PhD	64	397.23	25423
EW	149	166.49	24808

study, we followed suit and balanced our three corpora based on the number of words they contained. Keeping the three corpora of the same size, of course, imposed a limitation on our study: It is possible that the level of complexity is higher in only some moves of the abstracts. Therefore, reducing the number of PhD abstracts (i.e., the number of texts in this case) may have an unwanted effect on the levels of complexity studied. For instance, when comparatively more abstracts written by expert writers are included in the corpus (and more noun modifiers occur only in certain rhetorical moves of an abstract), using a larger number of abstracts by expert writers is likely to increase the number of modifiers (even though the increase in that type of modifier may have nothing to do with the level(s) of writers in academic writing.

The master's thesis and PhD dissertation abstracts were randomly selected from online university databases. The abstracts in this study were collected from theses completed at different Iranian universities including *Tehran University*, *Ferdowsi University of Mashhad*, *Tarbiat Modares University*, *AllameTabatabai University*, *Shiraz University*, *Isfahan University*, and *Islamic Azad University Science and Research Branch*. All abstracts were published between the years 2004–2015. RA abstracts by expert writers were selected based on a stratified sampling technique from four established journals of applied linguistics and English language teaching, namely, *Applied Linguistics, TESOL Quarterly, English for Specific Purposes,* and *Journal of Second Language Writing* within the same time period.

2.1. Grammatical features of interest

The focus of the present study is on the frequency and distribution of 16 specific noun phrase features (see Table 2) in three corpora of abstracts. As mentioned before, the grammatical features of interest were obtained from the developmental stages of syntactic complexity introduced in Biber et al.'s (2011) study.

As shown in Table 2, the developmental index involves five stages. According to Biber et al. (2011), these grammatical features can mainly be grouped according to three major grammatical types: finite dependent clauses, nonfinite dependent clauses, and dependent phrases, which can serve three main grammatical functions such as adverbial, complement, and noun modifier. In this study we examined.

1 Finite dependent clauses including relative clauses as noun modifiers, complement clauses controlled by nouns.
2 Nonfinite dependent clauses including, -ing and -ed participles as noun post-modifiers, and preposition + nonfinite complement clauses as post-modifiers.
3 Dependent phrases including, attributive adjectives, participles, nouns as pre-modifiers, possessive nouns, of phrases as noun post-modifiers, other prepositional phrases as noun post-modifiers, adjectives, noun as pre-modifiers, appositives, and multiples prepositional phrases as noun post-modifiers.

2.2. Coding

The process of coding began with a discussion phase in which we the two raters, both trained linguists with syntactic coding experience, studied the coding scheme and jointly applied it to a number of sample texts. The aim of this phase was to reach an overall agreement regarding the major types of noun modifiers in the coding scheme (i.e., attributive adjectives, participial adjectives, nouns, possessive nouns, adjective-noun sequences, prepositional phrases as noun post-modifiers,

Table 2
Biber et al.'s (2011) Hypothesized Developmental Stages for Noun phrase modification.

Stage	Grammatical structure	Examples from our corpora
2	Attributive adjectives	Significant predictor
[a]	Participle pre-modifiers	The proposed model
	Relative clauses	Models that include only linguistic factors
3	Nouns as pre-modifiers	Vocabulary knowledge
	Possessive noun as pre-modifiers	students' view and reflection
	Of phrase (concrete/locative meanings)	EFL context of Iran
	Prepositions as noun post-modifiers other than of (concrete/locative meanings)	a moral dilemma in their class
4	-ed participle as post-modifiers	transcripts obtained from the participants
	-ing participle as post-modifiers	statements representing deliberative, rational and critical moral approaches
	Attributive adjectives, nouns as pre-modifiers	Preparatory language test
	Of phrase (abstract meanings)	a pedagogy of happiness
	Prepositions as noun post-modifiers other than of (abstract meanings)	implication for pedagogy and future research
5	Preposition + nonfinite complement clause	the possibility of applying DA to the web
	Complement clauses controlled by nouns	The fact that reading in second language is a difficult task
	Appositive noun phrases	Teacher attribution scale (TAS)
	Multiple prepositional phrases as post-modifiers, with levels of embedding	an evaluation criterion for the effectiveness of mediation on the learners' progression toward self- regulation in their ZPDs

[a] Not included in Biber et al. (2011).

relative clauses, participial clauses, appositive noun phrases, multiple prepositional phrases, and noun-complement clauses). This study mainly relied on the manual analysis of texts since some of these structures could not be identified with an acceptable rate of accuracy through automatic syntactic taggers. This method of coding is advantageous in that it yields more accurate results, but cannot be easily used to analyze very large amounts of data. Though automated tagging could be used to analyze very large corpora, Biber and Gray (2011) admit that the automated tagging system is not completely accurate and that for structures such as prepositional phrases and appositive noun phrases, manual coding needs to be employed. During the second phase (i.e., piloting), the raters independently coded a small sample of texts from the same register as those included in our corpora. The pilot phase was followed by a second discussion session, in which the coders compared their coding and resolved any disagreements. The reconciled codes from the pilot phase were used as a benchmark for subsequent coding. After the pilot phase, 25 percent of the texts were coded independently by both raters, while the remaining 75% were coded by only one rater. To ensure inter-coder reliability, Cohen's Kappa was calculated for the double-coded texts. The Kappa coefficient for this study was 0.91. Such a Kappa value in discourse-based coding decisions indicates that the inter-coder agreement was outstanding (see also Landis & Koch, 1977; Lim, 2010; Lim, Loi, Hashim, & Liu, 2015).

2.3. Data analysis

To test Biber et al.'s (2011) stages of syntactic development, we compared those sets of features believed to add complexity to noun phrase constructions. More specifically, we compared the three corpora in terms of the frequency of attributive adjectives, participial adjectives, nouns, possessive nouns (as pre-modifiers), prepositional phrases, relative clauses, participial clauses, adjective-noun sequences, appositive noun phrases, multiple prepositional phrases (as post-modifiers), and noun-complement clauses. Parkinson and Musgrave (2014) hypothesized that participle adjectives may be acquired later than other adjectives; therefore, they considered them as a separate category. Biber et al. (2011), on the other hand, did not distinguish between attributive adjectives and participles. In the present study, we also considered participles as a separate category from other adjectives. To ensure comparability, frequency counts in each individual text were subsequently normalized to 1000 words. This made it possible for us to compare our findings with those of other studies. In addition, it allowed us to use parametric statistical tests to compare the means for each feature across the three corpora. A one-way ANOVA test with a Bonferroni post hoc adjustment (to statistically account for multiple comparisons) was used for comparing each feature across the three corpora.

3. Results and discussion

In our analysis, we first considered the distributional patterns of different noun modifiers in the three groups of abstracts based on their normalized frequency counts per 1000 words of text. Table 3 presents the frequency of each type of noun modifier in the three corpora, and Fig. 1 graphically illustrates the distribution of these features.

As shown in Fig. 1, the most common types of noun pre-modifiers in the three corpora are attributive adjectives and nouns, while prepositional phrases were the most common form of post-modification. This noticeable use of phrasal nominal modifiers is a common feature in the writing of both college-level L1 Persian and expert writer abstracts. Biber et al. (1999) argued that, while infrequent in conversation, noun phrases with nouns and adjectives as phrasal pre-modifiers as well as prepositional phrases as post-modifiers are highly characteristic features of academic prose. Biber et al. (1999) also noted that because of their explicit identification of diverse semantic classes such as time, frequency and affective evaluation, adjectives are the most common type of pre-modifiers in expository written texts. They also mentioned that nouns are the second most common type of pre-modification, and despite the varied range of inexplicit textual meaning relations they may convey, they are still highly favored in academic prose for their brevity in condensing a large amount of referential meaning (Biber et al., 1999). Biber et al. (1999, pp. 590–591) introduced some of the textual meaning relations conveyed by noun modifiers including composition (e.g., glass windows = windows made from glass), purpose (e.g., pencil case = case used for pencils), identity (e.g., women algebraists = women who are algebraists), content (e.g., algebra text = a text about algebra), time (e.g., summer conditions = conditions that occur during the summertime), location (e.g., corner cupboard = a cupboard that is located in the corner), institution (e.g. insurance companies = companies for (selling) insurance). We also found that the abstracts by both L1 Persian and expert writers in our study relied heavily on these types of noun modifiers.

Other studies have also shown heavy reliance on these three kinds of noun modifiers in written academic English. For example, by comparing linguistic features in the writings of two groups of college-level students, Taguchi et al. (2013) found that the writing of their more proficient group contained a greater number of pre-modifying attributive adjectives and post-modifying prepositional phrases. Staples and Reppen (2016, p. 18) also noted that "Phrasal features, including both attributive adjectives and pre-modifying nouns, are considered to be important features of academic writing, and both have been associated with higher proficiency and higher writing quality in both L1 and L2 academic writing" (see also Biber & Gray, 2011; Biber et al., 2011, 2014; Parkinson & Musgrave, 2014). Excerpts 1 and 2 illustrate how features such as attributive adjectives (**bolded**), pre-modifying nouns (*italicized*), and prepositional phrases as post-modifiers (underlined) were frequently used in abstracts by both L1 Persian and expert writers.

Table 3
Descriptive statistics of noun modifiers for MA, PhD, and EW groups.

		No. of texts	Mean	Std. Deviation	Std. Error	Minimum	Maximum
adjective	MA	99	50.07	21.03	2.11	5.78	1.07
	PhD	64	50.31	22.03	2.75	4.65	103.06
	EW	149	56.20	25.20	2.06	5.24	123.29
	Total	312	53.24	23.41	1.33	4.65	123.29
participle	MA	99	6.32	6.79	0.68	0.00	29.76
	PhD	64	7.87	6.31	0.79	0.00	34.38
	EW	149	9.93	10.20	0.84	0.00	60.24
	Total	312	8.36	8.64	0.49	0.00	60.24
relative.cl	MA	99	4.46	4.94	0.50	0.00	18.02
	PhD	64	4.71	3.74	0.47	0.00	15.71
	EW	149	4.92	8.61	0.71	0.00	39.77
	Total	312	7.60	7.48	0.42	0.00	39.77
noun	MA	99	19.47	14.77	1.48	0.00	75.63
	PhD	64	38.68	17.35	2.17	5.42	93.98
	EW	149	47.86	28.90	2.37	0.00	136.61
	Total	312	36.97	26.12	1.48	0.00	136.61
possessive	MA	99	7.45	8.64	0.87	0.00	41.40
	PhD	64	7.77	7.97	1.00	0.00	37.97
	EW	149	7.05	9.51	0.78	0.00	46.67
	Total	312	7.32	8.92	0.50	0.00	46.67
of.concrete	MA	99	4.70	5.02	0.50	0.00	20.00
	PhD	64	3.95	4.79	0.60	0.00	26.18
	EW	149	4.36	6.03	0.49	0.00	32.26
	Total	312	4.38	5.47	0.31	0.00	32.26
pp.concrete	MA	99	4.78	4.43	0.45	0.00	19.23
	PhD	64	2.52	3.36	0.42	0.00	14.55
	EW	149	4.56	5.86	0.48	0.00	25.77
	Total	312	4.21	5.06	0.29	0.00	25.77
ed	MA	99	2.95	4.38	0.44	0.00	20.11
	PhD	64	4.55	4.48	0.56	0.00	17.17
	EW	149	6.41	7.47	0.61	0.00	37.04
	Total	312	4.93	6.25	0.35	0.00	37.04
ing	MA	99	3.31	4.55	0.46	0.00	23.70
	PhD	64	3.04	3.08	0.38	0.00	14.16
	EW	149	2.10	3.60	0.29	0.00	17.39
	Total	312	2.68	3.86	0.22	0.00	23.70
adj.noun	MA	99	4.74	6.44	0.65	0.00	28.09
	PhD	64	7.77	7.55	0.94	0.00	36.70
	EW	149	11.17	10.78	0.88	0.00	67.57
	Total	312	8.43	9.37	0.53	0.00	67.57
of.abstract	MA	99	17.35	9.76	0.98	0.00	56.14
	PhD	64	20.46	11.49	1.44	2.87	63.93
	EW	149	17.94	11.93	0.98	0.00	54.69
	Total	312	18.27	11.21	0.63	0.00	63.93
pp.abstract	MA	99	13.30	8.63	0.87	0.00	42.11
	PhD	64	12.60	7.37	0.92	0.00	32.46
	EW	149	13.99	10.61	0.87	0.00	51.28
	Total	312	13.49	9.40	0.53	0.00	51.28
pp.complement	MA	99	1.31	2.39	0.24	0.00	11.14
	PhD	64	0.96	2.51	0.31	0.00	12.90
	EW	149	2.51	5.33	0.44	0.00	30.49
	Total	312	1.81	4.13	0.23	0.00	30.49
complement.noun	MA	99	0.44	1.40	0.14	0.00	8.70
	PhD	64	0.43	1.31	0.16	0.00	6.33
	EW	149	0.33	1.49	0.12	0.00	10.15
	Total	312	0.39	1.42	0.08	0.00	10.15
appositive	MA	99	6.78	6.68	0.67	0.00	30.00
	PhD	64	6.48	5.76	0.72	0.00	25.81
	EW	149	6.23	7.64	0.63	0.00	41.38
	Total	312	6.45	6.97	0.39	0.00	41.38
multiple.pp	MA	99	12.37	7.57	0.76	0.00	34.48
	PhD	64	13.79	6.56	0.82	0.00	25.64
	EW	149	21.39	12.06	0.99	0.00	66.67
	Total	312	16.97	10.68	0.60	0.00	66.67
of.phrase	MA	99	22.05	10.31	1.04	0.00	56.14
	PhD	64	24.41	11.82	1.48	2.87	63.93
	EW	149	24.43	29.51	2.41	0.00	341.67
	Total	312	23.67	21.88	1.24	0.00	341.67
pp	MA	99	18.08	10.11	1.02	0.00	47.62

(*continued on next page*)

Table 3 (*continued*)

	No. of texts	Mean	Std. Deviation	Std. Error	Minimum	Maximum
PhD	64.	15.12	8.10	1.01	0.00	37.42
EW	149	18.63	11.61	0.95	0.00	57.69
Total	312	17.74	10.56	0.60	0.00	57.69

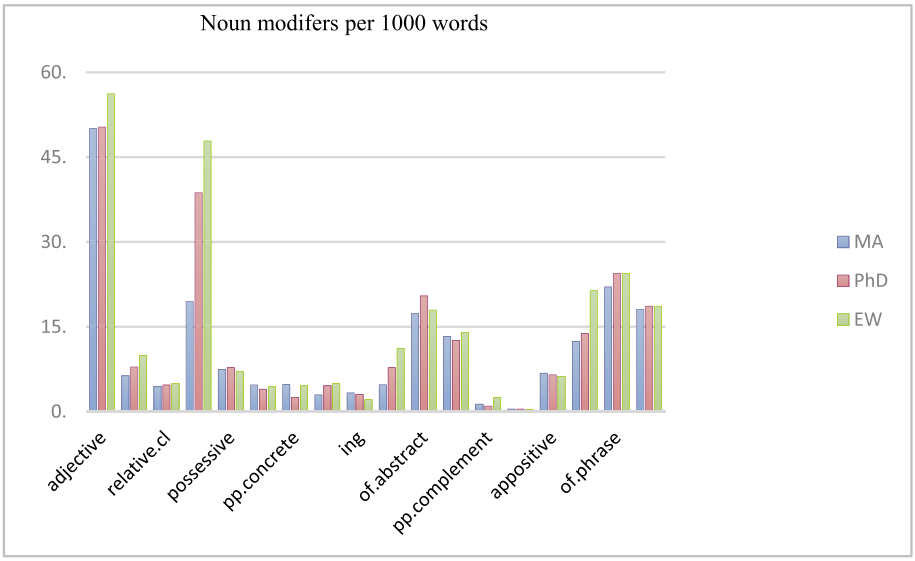

Fig. 1. The normalized frequency rates per 1000 words.

Excerpt 1 (L1 Persian, PhD)

The merits of form-focused instruction have been widely debated and investigated in *language* classrooms. Consequently, the last ten years have witnessed a **steady** increase in the number of studies that have examined the effects of **corrective** feedback on L2 learning. This includes both **descriptive** and **experimental** research examining a **wide** range of variables (e.g., type and amount of feedback, mode of feedback, learners' *language proficiency* level, **instructional** context, and attitudes towards feedback. One of the **relevant** variables in **corrective** *feedback studies* which seems to be less operationalized is the **differential** impact of **different** types of feedback on the accuracy of the **oral** performance of the participants. Therefore, the **present** research aimed to investigate the **differential** impact of prompts and recasts on the **phonological**, **grammatical**, and **lexical** errors of **Iranian** *EFL university* students.

Excerpt 2 (EW)

In this article, we examine **current** practices in the measurement of **syntactic** complexity to illustrate the need for more **organic** and **sustainable** practices in the measurement of complexity, accuracy, and fluency (CAF) in second *language* production. Through an **in-depth** review of examples drawn from research on **instructed** second *language* acquisition, we identify and discuss challenges to the **evidentiary** logic that underlies **current** approaches. We also illuminate **critical** mismatches between the interpretations that researchers want to make and the *complexity* measures that they use to make them. Building from the case of complexity, we point to **related** concerns with **impoverished** operationalizations of **multidimensional** CAF constructs and the lack of attention to CAF as a **dynamic** and **interrelated** set of constantly **changing** subsystems.

Having identified the most common patterns of phrasal modification in the three corpora, we then compared their use across the three groups of abstracts. This comparison, which is summarized in Table 4, reveals the extent to which the two groups of graduate writers' use of complex noun phrases is similar to or different from that of expert writers. As previously noted, since we examined 16 grammatical features and therefore performed 16 tests simultaneously, we used the Bonferroni correction to avoid spurious positives. This adjusts the alpha value for each comparison to 0.002 (i.e., 0.05/16 = 0.002). The one-way ANOVA was run to determine whether the means for the MA, PhD, and EW groups differ significantly from each other.

The one-way ANOVA, comparing the three groups, showed statistically significant differences ($p < .002$) in the mean values of four of the 16 noun modifiers: pre-modifying nouns, -ed participles as post-modifiers, attributive adjectives/noun

Table 4
Differences in the mean frequencies of noun modifiers among MA, PhD, and NS groups.

Stage	Grammatical Structure	F	Sig	η2	MA vs. PhD	MA vs. EW	PhD vs. EW
2	Attributive adjectives	2.29	0.103	0.015	–	–	–
[a]	Participle pre-modifiers	5.471	0.005	0.034	–	–	–
3	Relative clauses	0.82	0.074	0.032	–	–	–
	Nouns as pre-modifiers	45.418	0.000	0.227	*	*	–
	Possessive noun as pre-modifiers	0.158	0.854	0.001	–	–	–
	Of phrase concrete/locative meanings)	0.36	0.698	0.002	–	–	–
	Prepositions other than of as noun post-modifiers (concrete/meanings)	4.663	0.01	0.029	–	–	–
4	-ed participle as post-modifiers	9.854	0.000	0.06	–	*	–
	-ing participle as post-modifiers	3.315	0.038	0.021	–	–	–
	attributive adjectives/nouns as pre-modifiers	15.501	0.000	0.091	–	*	–
	Of phrase (abstract meanings)	1.617	0.2	0.01	–	–	–
	Prepositions other than of as noun post-modifiers (abstract meanings)	0.517	0.597	0.003	–	–	–
5	Preposition + nonfinite complement clause	4.354	0.014	0.027	–	–	–
	Complement clauses controlled by nouns	0.194	0.823	0.001	–	–	–
	Appositive noun phrases	0.187	0.83	0.001	–	–	–
	Multiple prepositional phrases as post-modifiers	29.28	0.000	0.159	–	*	*

*Indicates a statistically significant difference ($p < .002$).
- indicates a non-significant difference ($p > .002$).
[a] not included in Biber et al. (2011).

sequences as pre-modifiers, and multiple prepositional phrases as post-modifiers were found to differ significantly across the three groups. For the four modifiers that showed statistically-significant between-group differences, the Bonferroni post-hoc test was run to determine where the differences lay in the three groups of abstracts for each of the categories of modification. Results of the post hoc tests are summarized in Table 4 with significant differences shown with an asterisk.

The first significant difference turned out to be in the use of nouns as pre-modifiers [$F(2, 309) = 45.41$, $p = .00$, $\eta2 = 0.227$]. A review of the mean scores for this feature shows that more experienced writers tend to use more pre-modifying nouns in their academic writing (MA = 19.47; PhD = 38.68; EW = 47.86), with statistically significant differences found between the MA/PhD and the MA/EW groups. However, it should be noted that the difference between the PhD/EW groups was not statistically significant. The second observed difference was in the use of -ed participles as post-modifiers [$F(2, 309) = 9.85$, $p = .00$, $\eta2 = 0.06$]. The mean values for this feature also increased linearly from MA to EW (MA = 2.95; PhD = 4.55; EW = 6.41). The difference between the MA/EW groups was significant for this feature, while the results did not reveal any significant difference between the MA/PhD and PhD/EW groups.

The use of adjective/noun combinations as pre-modifiers was the third feature to yield statistically-significant differences between the three groups of abstracts in our study [$F(2, 309) = 15.50$, $p = .00$, $\eta2 = 0.091$]. Once again, a linear increase in the mean value of this category of noun modifiers was observed across the groups (MA = 4.47; PhD = 7.77; EW = 11.17). The post hoc test results pointed to a significant difference between the MA/EW groups while the difference between the MA/PhD and PhD/EW groups did not turn out to be significant.

Finally, the last significant difference between the three groups of abstracts lies in the use of multiple prepositional phrases as post-modifiers [$F(2, 309) = 29.28$, $p = .00$, $\eta2 = 0.159$]. The EW group (M = 21.39) used multiple prepositional phrases significantly more than both the MA (M = 12.37) and the PhD groups (M = 13.79). This is while no statistically-significant difference was observed between the MA/PhD groups.

Based on Cohen's (1988) interpretation of effect sizes, an eta squared value ($\eta2$) of 0.01 is considered small, while $\eta2$ values of 0.06 and 0.14 are considered as medium and large, respectively. In our study, the effect sizes are large for nouns as pre-modifiers ($\eta2 = 0.22$) and multiple prepositional phrases as post-modifiers ($\eta2 = 0.15$). This is while medium effect sizes are observed for -ed participles as post-modifiers ($\eta2 = 0.06$) and adjective/noun combinations as pre-modifiers ($\eta2 = 0.09$). As can be seen in Table 4, for the features that are not significantly different across the three groups, the effect sizes are all small ($\eta2<0.06$).

In summary, out of the 16 types of noun modifiers examined in our study, graduate students of Applied Linguistics did not differ significantly from expert writers in producing 12 of the categories. Out of four kinds of modification in which significant differences were found, one could be categorized as a nonfinite dependent clause (-ed participle as post-modifier) and the other three as dependent phrases (pre-modifying nouns, adjective/noun combination as pre-modifiers, and multiple prepositional phrases as post-modifier). This is consistent with Biber et al.'s (2011) hypothesis, according to which finite dependent clauses are predicted to be acquired at earlier stages of writing development, while nonfinite dependent clauses are said to be mastered at intermediate stages followed by dependent phrases which are predicted to appear in the final stages of academic writing development.

In addition, in this study, we found that abstracts by PhD-level graduate students better approximated those of expert writers. Of the four categories that turned out to be significantly different across the three groups (i.e., nouns as pre-modifiers,

ed participles as post-modifiers, adjective/noun sequences as pre-modifiers, and multiple prepositional phrases as post-modifiers), the PhD group of abstracts, when compared to expert writers, only lacked multiple prepositional phrases as post-modifiers (i.e., the last stage in Biber et al.'s (2011) developmental stages of syntactic complexity). The abstracts by the MA group, on the other hand, fell short in all of the four features when compared to expert writers.

Our findings partially corroborate Biber et al.'s (2011) prediction that with a gain in experience, more phrasal constructions can be observed in academic writing. However, the exact stages outlined in Biber et al. (2011) could not be traced in our corpus. The use of attributive adjectives and participles, from stage 2, did not turn out to be significantly different across the three groups. Since both these features are said to be acquired during the early stages of syntactic development, it is not surprising that all three groups of abstracts by graduate students and expert writers used these features to an equal extent. Parkinson and Musgrave (2014) classified participles as a separate category of adjectives and predicted that participles are acquired later than other adjectives. Our findings, however, did not support this prediction as we found no significant difference in the use of participles across the three groups of abstracts. Differences among the abstracts began to emerge at the third stage, where only pre-modifying nouns were found significantly more in PhD and EW abstracts compared to MA writing. This finding is largely consistent with previous studies in which more skilled groups were found to rely more on nouns as pre-modifiers compared to their less-skilled counterparts (e.g., Parkinson & Musgrave, 2014). Biber et al. (2014) also mentioned findings from an unpublished investigation of complexity features in a writing course for British university students, largely consistent with what we found in the present study. They reported an increase in the use of pre-modifying nouns over the course of 4 years of university study.

Biber et al. (2011) drew a distinction between prepositions with a concrete meaning and those that had an abstract meaning, placing the former in stage 3 and the latter in stage 4. In the present study, no such distinction could be found in the frequency of prepositions of either kind across the three groups of abstracts. At stage 4, of the two types of non-finite dependent clauses, only -ed participles marked a difference among the three groups with PhD and EW including more such structures than MA. This finding suggests that the PhD group of our study better approximated the EW group in their use of these modifiers. Based on Biber et al.'s (2011) hypothesized developmental stages of syntactic complexity, finite dependent clauses are acquired at earlier stages of writing development while nonfinite dependent clauses (e.g., -ed participles and -ing participles) are more frequently observed at later stages of development. This observation is also largely consistent with that of Staples et al. (2016), who reported that nonfinite clauses (except for -ed participles as post-modifiers) remained stable across academic levels. They also noted that intermediate features (e.g., nonfinite dependent clauses) "may not play much of a role in the overall writing development of L1 university level students" (p. 29). Our observations also corroborate their claim. This shows that these forms (-ed participles and -ing participles) should perhaps appear in separate stages, since other studies have also found them to be different in academic writing by learners of different experience levels (Staples et al., 2016). Another feature from stage 4 which turned out to be significantly different across the three groups was the use of adjective/noun sequences as nouns premodifiers with the PhD and EW corpora including more instances of this feature than the MA corpus. Biber et al. (2011) previously noted that finite dependent clauses are acquired at earlier stages of writing development, while nonfinite dependent clauses are often learned at later stages and it is not until advanced levels that we begin to see more frequent use of phrasal modifiers. In line with this finding, we also found that adjective/noun combinations as phrasal noun pre-modifiers were more commonly seen in the academic writing of more experienced writers.

The fifth and final stage is where we would expect to see the highest amount of variance among the graduate students and expert writers. In this stage, only the use of multiple prepositional phrases turned out to be significantly different across the three groups of abstracts. We found that EWs used more multiple prepositional phrases than the MA and PhD groups. This finding is in line with Biber et al.'s (2011) hypothesis that multiple prepositional phrases are the last grammatical feature in the final stage of the developmental index. As a result, we would expect to see this form of noun modification quite frequently only in abstracts written by highly-experienced writers (i.e., EWs). Excerpt 3 provides an example of how expert writers rely on multiple prepositional phrases in their writing.

Excerpt 3

Building on previous studies of the effects of planning on second language (L2) learners' oral narratives and drawing on Kellogg's (1996) model of writing, this article reports a study of the effects of three types of planning conditions (pre-task planning, unpressured on-line planning, and no planning) on 42 Chinese learners' written narratives elicited by means of a picture composition.

The mean values for Preposition + nonfinite complement clause (MA = 1.31, PhD = 0.96, EW = 2.51) and Complement clauses controlled by nouns (MA = 1.81, PhD = 0.44, EW = 0.43) were too small, and a larger corpus would perhaps be more revealing of how these structures develop with experience. The use of appositives as post modifiers was also not significantly different in the three corpora (MA = 6.78, PhD = 6.48, EW = 6.23). Biber et al. (1999) consider acronyms as a form of appositive in academic writing. Almost all abstracts written by MA and PhD groups included acronyms (names of the tests, scales and questionnaires) since most followed an experimental or survey design. This could account for the high frequency with which appositive constructions are observed in graduate-student writing. The following excerpt shows how frequently acronyms (underlined) are employed by L1 Persian graduates.

Excerpt 4 (L1 Persian, MA)

Grammar-specific language impairment (G-SLI), recognized as a core deficiency in inflectional morpho-syntax, is a subgroup of specific language impairment (SLI). Having observed a number of SLI children floundering in comprehending the reversible passive structure, Van der Lely (1994) proposed the Minimalism-based theory of representational deficit in dependent relations (RDDR) as a theoretical explanation. The present study, however, securing Linguistic coding deficit (differences) hypothesis (LCDH) (Ganschow, Sparks & Javorsky, 1998) as its theoretical basis, examines Grammar-specific language impairment (G-SLI) as a disorder in foreign language learning (FLL).

4. Conclusions and implications

Using a corpus-based cross-sectional research design, this study examined noun modification in the academic writing of three groups: an L1 Persian MA-level group of graduate students, an L1-Persian PhD group of graduate students and a group of published expert writers all writing within the field of Applied Linguistics. Our results revealed that phrasal complexity in abstracts by both L1-Persian and expert writers arose primarily from their use of attributive adjectives (e.g., *a steady increase*), prepositional phrases as post-modifiers (e.g., *range of variables*) and nouns as pre-modifiers (e.g., *feedback studies*) corroborating Biber et al.'s (2011) claim that in academic prose, meaning is for the most part condensed into complex noun phrases rather than being expressed in clause form. The comparisons we drew among the three groups of abstracts allowed us to empirically test the developmental progression index of noun phrase complexity proposed by Biber et al. (2011). Our findings revealed the extent to which abstracts by L1-Persian graduate students and expert writers differ in the use of each of these 16 noun modifier categories, and determined whether PhD-level students, who have more experience in dealing with academic English, better approximate the level of complexity found in texts by expert writers through their use of phrasal features compared to their MA-level counterparts. The data from our study indicate that PhD-level students only differed in the use of one feature (i.e., they used fewer multiple prepositional phrases) compared to expert writers. This finding lends support to Biber et al.'s (2011) hypothesis, since in their proposed index, multiple prepositional phrases are the last stage in the developmental cline. At the same time, we found that the MA and PhD abstracts were only significantly different in one feature (i.e., nouns as pre-modifiers). This observation signals a gradual shift towards phrasal complexity in the writing of university students. While our findings suggest a tendency towards greater use of phrasal constructions by more experienced writers, the exact predicted sequence of development hypothesized by Biber et al. (2011) could not be traced in our data and in some instances (e.g., -ed participles and -ing participles), a re-consideration of features among these stages is advised.

The findings of the present study can help graduate students and L1 academic writing instructors gain a more in-depth understanding of how features of syntactic complexity are employed by more experienced academic writers and how the features of complexity are employed differently by less experienced academic writers at different stages of higher education. However, as with most studies, ours was not without its limitations. First of all, the labor-intensive nature of manual coding prevented us from exploiting a larger corpus, and so we cannot provide detailed comments on less frequent categories of phrasal modification. Future research could possibly focus on grammatical features of this kind. Second, we only managed to examine patterns of noun phrase modification in L1 Persian university students' writing samples from the discipline of Applied Linguistics. Lu and Ai (2015) pointed out that learners with different L1 backgrounds, even at the same or comparable proficiency levels, may not necessarily follow the same patterns of development in terms of syntactic complexity. Disciplines may also vary in terms of the frequency and range of complexity features they include. Therefore, it would be interesting if future research were to examine the patterns of noun modification in the writing of students from other L1 backgrounds and across other disciplines. Doing so would allow us to investigate the possible effect of L1 and disciplinary variation on students' syntactic development. Our study also did not attempt to link phrasal modification features to the discourse functions they perform in text. This is very important because the frequency of certain categories of noun modifiers could be linked to the frequency with which those discourse functions recur in the text. Another limitation of this study was in its comparison of MA, PhD and RA abstracts. It is likely that some of the differences we observed among the three groups resulted from the inherent differences between these three types of abstracts and not the amount of academic writing experience of the writers. Finally, the present study is a corpus investigation of syntactic complexity and does not deal with the way phrasal modification features are processed by the language learner during production. Future studies can draw upon the existing body of Second Language Acquisition literature to complement the insights provided by corpus-informed studies of this kind.

References

Ai, H., & Lu, X. (2013). A corpus-based comparison of syntactic complexity in NNS and NS university students' writing. In A. Díaz-Negrillo, N. Ballier, & P. Thompson (Eds.), *Automatic treatment and analysis of learner corpus data* (pp. 249–264). Amsterdam: John Benjamins.

American Psychological Association. (2010). *Publication manual of the American psychological association*. Washington, DC: American Psychological Association.

Banks, D. (2008). *The Development of Scientific Writing. Linguistic features and historical context*. London: Equinox.

Basturkmen, H. (2009). Commenting on results in published research articles and masters dissertations in language Teaching. *Journal of English for Academic Purposes, 8*, 241–251.

Beers, S. F., & Nagy, W. E. (2009). Syntactic complexity as a predictor of adolescent writing quality: Which measures? Which genre? *Reading and Writing, 22*(2), 185–200.

Biber, D. (1988). *Variation across speech and writing*. Cambridge, England: Cambridge University Press.

Biber, D. (2003). Compressed noun-phrase structures in newspaper discourse: The competing demands of popularization vs. economy. In J. Aitchison, & D. M. Lewis (Eds.), *New media language* (pp. 169–181). New York/Londres: Routledge.
Biber, D., & Clark, V. (2002). Historical shifts in modification patterns with complex noun phrase structures: How long can you go without a verb? In T. Fanego, M. J. López-Couso, & J. Pérez-Guerra (Eds.), *English historical syntax and morphology* (pp. 43–66). Amsterdam, Netherlands: John Benjamins.
Biber, D., & Gray, B. (2010). Challenging stereotypes about academic writing: Complexity, elaboration, explicitness. *Journal of English for Academic Purposes, 9*(1), 2–20.
Biber, D., & Gray, B. (2011). Grammatical change in the noun phrase: The influence of written language use. *English Language and Linguistics, 15*(02), 223–250. https://doi.org/10.1017/s1360674311000025.
Biber, D., & Gray, B. (2013). Being specific about historical Change: The influence of sub-register. *Journal of English Linguistics, 41*(2), 104–134. https://doi.org/10.1177/0075424212472509.
Biber, D., Gray, B., & Poonpon, K. (2011). Should we use characteristics of conversation to measure grammatical complexity in L2 writing development? *Tesol Quarterly, 45*(1), 5–35. https://doi.org/10.5054/tq.2011.244483.
Biber, D., Gray, B., & Poonpon, K. (2013). Pay attention to the phrasal Structures: Going beyond t-units-a response to WeiWei Yang. *Tesol Quarterly, 47*(1), 192–201. https://doi.org/10.1002/tesq.84.
Biber, D., Gray, B., & Staples, S. (2014). Predicting patterns of grammatical complexity across language exam task types and proficiency levels. *Applied Linguistics, 37*(5), 639–668. https://doi.org/10.1093/applin/amu059.
Biber, D., Johansson, S., Leech, G., Conrad, S., & Finegan, E. (1999). *The Longman grammar of spoken and written English*. London, England: Longman.
Casanave, C. P. (1994). Language development in students' journals. *Journal of Second Language Writing, 3*(3), 179–201.
Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New York, NY: Routledge Academic.
Crawford, W. J., & Csomay, E. (2016). *Doing corpus linguistics*. New York, NY: Taylor and Francis Inc.
Crossley, S., & McNamara, D. (2014). Does writing development equal writing quality? A computational investigation of syntactic complexity in L2 learners. *Journal of Second Language Writing, 26*, 66–79. https://doi.org/10.1016/j.jslw.2014.09.006.
Elder, C., & Iwashita, N. (2005). Planning for test performance: Does it make a difference? In R. Ellis (Ed.), *Planning and task performance in a second language* (pp. 219–238). Amsterdam: J. Benjamins.
Ellis, R. (2003). *Task-based language learning and teaching*. Oxford University Press.
Ellis, R., & Yuan, F. (2004). The effects of planning on fluency, complexity, and accuracy in second language narrative writing. *Studies in Second Language Acquisition, 26*(1), 59–84. https://doi.org/10.1017/S0272263104261034.
Ganschow, L., Sparks, R. L., & Javorsky, J. (1998). Foreign language learning difficulties: An historical perspective. *Journal of learning disabilities, 31*(3), 248–258.
Halliday, M. A. K. (1979). Differences between spoken and written language: Some implications for language teaching. In G. Page, J. Elkins, & B. O'Connor (Eds.), *Communication through reading: Proceedings of the 4th Australian reading conference* (pp. 37–52). Adelaide: Australian Reading Association.
Halliday, M. A. K., & Martin, J. R. (1993). General orientation. In M. A. K. Halliday, & J. R. Martin (Eds.), *Writing science* (pp. 2–21). London: The Falmer Press.
Housen, A., & Kuiken, F. (2009). Complexity, accuracy, and fluency in second language acquisition. *Applied Linguistics, 30*(4), 461–473. https://doi.org/10.1093/applin/amp048.
Hunt, K. W. (1965). *Grammatical structures written at three grade levels*. Champaign, IL: National Council of Teachers of English.
Jiang, W. (2012). Measurements of development in L2 written production: The case of L2 Chinese. *Applied Linguistics, 34*(1), 1–24.
Kawase, T. (2015). Metadiscourse in the introductions of PhD theses and research articles. *Journal of English for Academic Purposes, 20*, 114–124.
Kellogg, R. T. (1996). A model of working memory in writing. In C. M. Levy, & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp. 57–72). Mahwah, NJ: Erlbaum.
Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159–174.
Larsen-Freeman, D. (1978). An ESL index of development. *Tesol Quarterly, 12*(4), 439. https://doi.org/10.2307/3586142.
Larsen-Freeman, D. (2006). The emergence of complexity, fluency, and accuracy in the oral and written production of five Chinese learners of English. *Applied Linguistics, 27*(4), 590–619.
Larsen-Freeman, D. (2009). Adjusting expectations: The study of complexity, accuracy and fluency in second language acquisition. *Applied Linguistics, 30*(4), 579–589.
Lim, J. M. H. (2010). Commenting on research results in applied linguistics and education: A comparative genre-based investigation. *Journal of English for Academic Purposes, 9*(4), 280–294.
Lim, J. M. H. (2012). How do writers establish research niches? A genre-based investigation intomanagement researchers' rhetorical steps and linguistic mechanisms. *Journal of English for Academic Purposes, 11*(3), 229–245.
Lim, J. M. H., Loi, C. K., Hashim, A., & Liu, S. M. (2015). Purpose statements in experimental doctoral dissertations submitted to U.S. universities: An inquiry into doctoral students' communicative resources in language education. *Journal of English for Academic Purposes, 20*, 69–89.
Lu, X. (2011). A corpus-based evaluation of syntactic complexity measures as indices of college-level ESL writers' language development. *Tesol Quarterly, 45*(1), 36–62. https://doi.org/10.5054/tq.2011.240859.
Lu, X., & Ai, H. (2015). Syntactic complexity in college-level English writing: Differences among writers with diverse L1 backgrounds. *Journal of Second Language Writing, 29*, 16–27. https://doi.org/10.1016/j.jslw.2015.06.003.
Ni, Y. (2003). Noun phrases in media texts: A quantificational approach. In J. Aitchison, & D. M. Lewis (Eds.), *New media language* (pp. 159–168). New York/Londres: Routledge.
Norris, J. M., & Ortega, L. (2009). Towards an organic approach to investigating CAF in instructed SLA: The case of complexity. *Applied Linguistics, 30*(4), 555–578. https://doi.org/10.1093/applin/amp044.
Ortega, L. (2003). Syntactic complexity measures and their relationship to L2 proficiency: A research synthesis of college-level L2 writing. *Applied Linguistics, 24*(4), 492–518. https://doi.org/10.1093/applin/24.4.492.
Parkinson, J., & Musgrave, J. (2014). Development of noun phrase complexity in the writing of English for Academic Purposes students. *Journal of English for Academic Purposes, 14*, 48–59. https://doi.org/10.1016/j.jeap.2013.12.001.
Ravid, D., & Berman, R. (2010). Developing noun phrase complexity at school age: A text-embedded cross-linguistic analysis. *First Language, 30*(1), 3–26. https://doi.org/10.1177/0142723709350531.
Skehan, P. (1989). *Individual differences in second language learning*. London: Edward Arnold.
Staples, S., Egbert, J., Biber, D., & Gray, B. (2016). Academic writing development at the university Level: Phrasal and clausal complexity across level of study, discipline, and genre. *Written Communication, 33*(2), 149–183. https://doi.org/10.1177/0741088316631527.
Staples, S., & Reppen, R. (2016). Understanding first-year L2 writing: A lexico-grammatical analysis across L1s, genres, and language ratings. *Journal of Second Language Writing, 32*, 17–35. https://doi.org/10.1016/j.jslw.2016.02.002.
Stockwell, G., & Harrington, M. (2003). The incidental development of L2 proficiency in NS- NNS email interactions. *CALICO Journal*, 337–359.
Taguchi, N., Crawford, W., & Wetzel, D. Z. (2013). What linguistic features are indicative of writing quality? A case of argumentative essays in a college composition program. *Tesol Quarterly, 47*(2), 420–430. https://doi.org/10.1002/tesq.91.
Thompson, P. (2005). Points of focus and position: Intertextual reference in PhD theses. *Journal of English for Academic Purposes, 4*, 307–323.
Van der Lely, H. K. J. (1994). Canonical linking rules: Forward versus reverse linking in normally developing and specifically language-impaired children. *Cognition, 51*(1), 29–72.
Vyatkina, N. (2012). The development of second language writing complexity in groups and individuals: A longitudinal learner corpus study. *The Modern Language Journal, 96*(4), 576–598. https://doi.org/10.1111/j.1540-4781.2012.01401.x.

Way, D., Joiner, E., & Seaman, M. (2000). Writing in the secondary foreign language Classroom: The effects of prompts and tasks on novice learners of French. *The Modern Language Journal, 84*(2), 171–184. https://doi.org/10.1111/0026-7902.00060.
Wolfe-Quintero, K., Inagaki, S., & Kim, H.-Y. (1998). *Second language development in writing: Measures of fluency, accuracy, and complexity* (Technical Report No. 17). Honolulu, HI: Second Language Teaching & Curriculum Center, University of Hawaii at Manoa.
Yang, W. (2013). Response to Biber, Gray, and Poonpon (2011). *Tesol Quarterly, 47*(1), 187–191.

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