A Corpus-based Analysis of Phrasal Complexity across Different Sections of Research Articles in two Academic Disciplines

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Abstract
Complexity measures in academic writing have experienced a shift from clausal to phrasal indices in recent years. Drawing on a subset of Biber et al. (2011) hypothesized stages of writing development, we explored phrasal complexity across sections of research articles (RAs) in applied linguistics and clinical medicine. A 389,332-word corpus consisting of 80 randomly selected RAs from leading journals in applied linguistics and clinical medicine was compiled for the purposes of the present study. One-way analysis of variance (ANOVA) and independent-samples t-test, as implemented in SPSS (version 25), were employed to find differences across the RA sections and between two groups of academic writers. The findings indicated that RAs in clinical medicine relied more heavily on noun phrase modifiers in all sections than those in applied linguistics, suggesting that the distributional pattern of these linguistic expressions is discipline-independent. The implications of the findings are also discussed.

Introduction
The past three decades have witnessed a growing interest in the study of research articles (RAs) from different perspectives. The bulk of the studies has focused on rhetorical move structure (Kanoksilapatham, 2015; Khany & Malmir, 2019; Wannaruk & Amnuai, 2016), lexico-grammatical features (Green, 2019; Staples, & Reppen, 2016; Zhang, 2019), and disciplinary variation (Crossley et al., 2017; Jiang, 2017).

RAs, as the most important sub-register of professional academic writing (Biber & Gray, 2010), has received a great amount of attention, as they provide a valuable academic means for exploring genre variation and disciplinary studies. RAs are generally considered a genre that encompasses strict linguistic and rhetorical academic requirements (Lim, 2006). These stringent requirements make RA writing a daunting task even for those with a relatively good command of academic writing (Lu & Hyland, 2016). A considerable proportion of previous studies on academic writing embodies genre-based, and textual investigation of RAs across a wide range of disciplines. While these studies broaden our knowledge of disciplinary variation of macro and micro structures of the texts, they regard RAs as rigid genres with similar distribution of language features across its different sections (e.g., Dahl, 2004). Although some studies put a more specialized perspective on RAs and investigated sub-registers of Introduction (e.g., Samraj, 2005; Oztruk, 2007), Methods (e.g., Bruce, 2008; Lim, 2006; Peacock, 2011), Results (e.g., Basturkmen, 2009; Lim, 2010), or Discussion (Basturkmen, 2012; Parkinson, 2011) within or across a number of disciplines, these studies produce fragmented knowledge of these disciplines in their entirety (Kanoksilapatham, 2015) of the constructions and language features. Thus, there has been little research to explore linguistic differences across text-internal sections of RAs. Therefore, using a subset of Biber et al.’s (2011) hypothesized stages of writing development, we intend to explore noun phrase complexity across sections of RAs in two disciplines of applied linguistics and clinical medicine. This study, accordingly, seeks to address the following two research questions.

1. Are there any significant differences in the frequency of noun phrase modifiers between two writer groups in applied linguistics and clinical medicine?
2. Are there any significant differences in the frequency of noun phrase modifiers across sections of RAs in applied linguistics and clinical medicine?

Literature Review
Noun Phrase complexity as a hallmark of advanced academic writing
Noun phrase complexity has received extensive treatment in academic writing since as early as 1960 when Rulon Wells (as cited in Biber & Gray, 2010) stated that in academic writing the use of nouns is preferred to that of verbs. Similarly, Halliday and Martin (1993) characterized academic register as a synoptic style of writing which is contrasted with dynamic style of writing. Synoptic style of expression occurs when the utterance, which is constructed as a series of interdependent clauses, is
reconstructed as groups of words and phrases. Extract 1 indicates how dynamic style of expression changes to synoptic one (verbs and nouns are underlined and in bold type).

**Text Extract 1:**

(1) Since some university professors *require* that the students *summarize* several essays during the semester, they *prepare* the way for article abstract writing in graduate programs.

(2) Some university professors’ *requirement* of essay *summary* writing during the semester results in the students’ *preparation* for article abstract writing in graduate programs.

Nominal style of writing in academic register is informed by the demand of packing more information into fewer words as far as possible. Such factors as economy of space, economy of expression, and reading efficiency contribute to nominal style of writing (Biber & Gray, 2010). Noun phrases can be extended by adding multiple modifiers (pre-, and post-modifiers). As shown in Excerpt 1, nouns are made more complex by means of possessive pre-modifiers, and post-modifying prepositional phrases. Halliday and Martin (1993) argue that there are two major functions of expressing meaning through nominal phrases rather than clausal structures: First, the meaning that can be conveyed as a clause can be compressed into a phrase which can subsequently function as a part for the next clause. Second, information can be packed into phrases to express things/nouns instead of dealing with the tension between things and actions which are commonly found in clausal constituents. Nominalization and complex noun phrases can also allow writers to focus on things/nouns which can be frozen in time (Nesi & Gardner, 2019). This nominal expression is an asset to academic prose which distinguishes it from other registers, particularly spoken register.

Recently, traditional measures of writing complexity have been undermined on the grounds that they reflect the characteristic of spoken language rather than written language (Biber, 2003; Biber, et al., 2011; Biber et al., 2002). Biber and Gray (2016) state that many of the complexity features commonly found in spoken language are nonexistent or are very rare in written language. For example, finite dependent clauses functioning as constituents in other clauses and finite clauses functioning as verb complements are much more common in conversation

**Table 1**

*Biber et al.’s (2011) Hypothesized Stages of Writing Development*
conversation than in academic writing. Complexity in academic writing is constructed in noun phrases but in conversation it is realized in clausal embedding or subordination (Biber et al., 2011).

Drawing on the difference between spoken and written registers, Biber et al. (2011) proposed hypothesized stages of writing development which are organized into two parameters, i.e., grammatical type and syntactic functions. The developmental index entails five stages which are categorized based on three grammatical types: Finite dependent clauses, nonfinite dependent clauses, and dependent phrases.

As Table 2 shows, the developmental stage starts from attributive adjectives functioning as noun modifiers. The progression goes through more complex structures like –ed participles and –ing participles functioning as post modifiers. The last stages of progression involve using appositive noun phrases, and multiple prepositional phrases functioning as post-modifiers.

A number of studies have examined noun phrase modifiers introduced by Biber et al., (2011) in different academic contexts. Parkinson and Musgrave (2014) investigated academic writing produced by two groups of graduate L2 learners, i.e., MA academic writers (more proficient group) and EAP writers (less proficient group). The results revealed that the EAP group relied heavily on attributive adjectives which are hypothesized as being an early stage of writing development. However, the MA group’s performance was much closer to those of expert academic writers in published RAs. The results lend support to the Biber et al.’s (2011) hypothesized stages of writing development. Lan and Sun (2019) also performed a similar study and found that first-year Chinese students were much less likely to use noun phrase modifiers than the expert writers of academic RAs. While these studies contribute significantly to advancing our understanding of the importance of noun phrase modifiers in academic writing, results are fragmented and do not give a complete picture of complexity in academic register without considering disciplinary differences (Staples et al., 2016).

### 2.2. Writing Complexity across Academic Disciplines

| Stage | Grammatical Structure | Examples from our corpus |
|-------|-----------------------|--------------------------|
| 2     | Attributive adjectives | Quantitative measures    |
|       | Relative clauses      | Universities that provided the corpus |
| 3     | Nouns as pre-modifiers | Complexity measures      |
|       | Possessive noun as pre-modifiers | Learners’ development |
|       | Of phrase (concrete/locative meanings) | Group of learners |
|       | Prepositions as noun post-modifiers other than of (concrete/locative meanings) | Clauses in the sentences |
| 4     | ed-participle as post-modifiers | Features identified through manual check |
|       | ing-participle as post-modifiers | Measures targeting different components |
|       | Attributive adjectives, nouns as pre-modifiers | Overall writing quality |
|       | Of phrase (abstract meanings) | Perception of progress |
|       | Prepositions as noun post-modifiers other than of (abstract meanings) | A wealth of research on writing development |
| 5     | Preposition + nonfinite complement clause | Difficulty in using these properties |
|       | Complement clauses controlled by nouns | Tasks that the learners accomplish |
|       | Appositive noun phrases | EFL (English as a foreign language) |
|       | Multiple prepositional phrases as post-modifiers, with levels of embedding | Repetition of structures in sentences with discourse-level coherence within writing productions. |
Attempts to define academic disciplines can be examined from at least five perspectives, namely, philosophical, anthropological, sociological, historical, and management perspectives (see Krishnan, 2009). These perspectives differ in the emphasis they put on the nature and theory of knowledge (epistemology), cultural practices, labor and professionalization, historical conditions and development of disciplines, and the relationship between disciplinary division of knowledge with relation to education and market demands (Abbott, 2001).

From among different research paradigms outlined above, philosophical perspective for knowledge classification seems the most pertinent to the current study’s choice of applied/pure linguistic studies, since it excludes such factors as cultural identity, power structures, professionalization, the influence of discipline founders, and past success of disciplinary organization (Krishnan, 2009). Probably the only paradigm in knowledge classification, which takes into account epistemological features of disciplines, philosophical perspective mainly concerns with the nature and organization of knowledge (Russel, 2002). Conventional division of knowledge into pure and practical is rooted in philosophical paradigm (Beecher & Trowler, 2001).

Although academic writing is characterized by objective and accurate reflection of reality, it “becomes persuasive when it employs social and linguistic conventions that colleagues find convincing” (Hyland, 1999, p.99). These conventions are informed by discipline/register into which academic texts fit. This means that texts are shaped based on the recipients’ sociocultural expectations, lexico-grammatical preferences, agreed-upon rules, and their sensitivity and orientation (Hyland, 2015). This recipient-oriented approach to writing reflects differences among disciplines in terms of content word classes, nouns and pronouns, semantic classes of verbs, verb phrases, discourse connectors, and dependent clauses (see Biber, 2006 & Gray, 2015).

There is a growing body of research on linguistic variations across academic disciplines (e.g., Biber, 2006; Hyland, 2010; Hyland, 2006). Researchers often comment that disciplines draw on different lexico-grammatical features to achieve their communicative purposes. It seems that this impression is well founded, since “disciplines differ in their epistemological beliefs, research practices, and knowledge structures” (Gray, 2015, p.1). Linguistic variations across disciplines emerge as a result of different expectations of the members of discourse community (Hyland, 1998). Similarly, Charles (2003) states that variation in linguistic features is due to inherent differences between the disciplines in research practices and the construction of knowledge. Given that disciplines differ in their lexico-grammatical features, one of the major goals of the current study centers on investigation of noun phrase complexity in hard science and soft science. In this study, the researchers follow Becher and Trowler’s (2001) classification of academic discipline based on two continua of applied/pure and hard/soft sciences. Accordingly, two disciplines of medicine (hard applied) and applied linguistics (soft applied) were chosen for investigation in the current study.

2.3. Macro Structure of RAs

Although there is not a uniform format to apply to all scientific journals for publishing RAs, IMRD (Introduction, Methods, Results, and Discussion) is probably the most established organizational structure of RAs (Swales, 1990). This format is self-explanatory (Ruiying & Allison, 2004) and identifies the sections by their overall functions (Swales, 2004). Introduction section provides the background, identifies the gap, and introduces the means for contributing to new knowledge (Swales, 1990). Methods is the section that functions as a thread to bind a particular research method with previous research procedures and to bind itself with other key sections particularly the Introduction and Results (Lim, 2006). Results is the section where the authors present their findings and seek to establish their importance (Ruiying & Allison, 2003). In the Discussion section, the authors make claims about how their results relate and contribute to disciplinary knowledge (Basturkmen, 2012).

As a functional category within the genre of RAs, IMRD has been studied from different perspectives. While Swales (1990) claimed that IMRD macrostructure is the robust format of RAs, Ruiying and Allison (2003) argue that IMRD structure cannot be taken for granted in that the headings do not always reflect the rhetorical functions of each section explicitly, and that there are variations among the authors in the use of the established IMRD format in RAs. In the same vein, Ripple et al. (2011) called for inclusion of abstracts in the IMRD format, as it can enhance the chance of finding optimal readership. Similar
concerns have been echoed by Mondal et al. (2019) who stated that traditional IMRD format does not capture the macro structure of RAs, and they proposed “IaMRDS” format which is the acronym for “Introduction with aim, Materials and Methods, Results, Discussion, and Conclusion”. In spite of the criticisms levelled against IMRD, it is a well-established tradition in RA studies (Ruiying & Allison, 2003). Thus, this study employed IMRD format for investigating the distribution of noun phrase modifiers across macro structures of RAs in applied linguistics and clinical medicine.

Methodology

3.1. Construction of the Corpus

The corpora compiled in this study include the corpus of RAs in applied linguistics (henceforth AL) and the corpus of RAs in clinical medicine (henceforth CM). All RAs followed IMRD format and were published between 2015 and 2018. Special editions such as book reviews, forums, meta-analyses, etc., were excluded from the study, as they differ from RAs in their communicative purposes, which may motivate the variations in the use of different linguistic means. Volumes, issues, and articles were chosen randomly. Before the main phase of analysis, we performed data cleansing that included correcting inaccurate data, and removing tables, titles, headings, figures, and footnotes. This was done using a special computer program written in Python environment.

The articles were randomly selected from peer-reviewed journals of Applied Linguistics, Language Learning, TESOL Quarterly, Modern Language Journal, and English for Specific Purposes in applied linguistics and from Molecular Psychiatry, American Journal of Psychiatry, British Journal of Psychiatry, Schizophrenia Research, and Journal of Clinical Psychiatry in medicine. The inclusion of these journals was based on the criteria of their publication history, their index in the major bibliographic databases and h-index which is defined as the number of the researchers’ papers (h) that has been cited at least (h) times (Barnes, 2017). That is, a researcher who has published 20 articles each with 20 citations has a h-index of 20. The advantages of using h-index over the previous journal impact factor (JIF) measures are that the researchers and the journals’ credibility is assessed based on both their productivity, and their recognition among the communities of scholars. In addition, h-index is a transparent measure of scholarly impact that minimizes biases which may occur due to idiosyncratic over-citations (Ruscio, 2016).

Totally, the researchers compiled a corpus of 389,332 words from the leading journals in applied linguistics and clinical medicine. Thirty RAs from applied linguistics journals and 50 RAs from clinical medicine journals were selected. Descriptive features of the two corpora are presented in Table 2.

Table 2.

Descriptive Statistics of two Corpora of Applied Linguistics and Clinical Medicine

| Statistics | Group                | Introduction | Methods | Results | Discussion | Total   |
|------------|----------------------|--------------|---------|---------|------------|---------|
| Words      | Applied linguistics  | 50,150       | 50,085  | 47,436  | 40,932     | 188,603 |
|            | Clinical medicine    | 28,343       | 60,725  | 48,148  | 63,513     | 200,729 |
| Mean       | Applied linguistics  | 1671.67      | 1669.50 | 1581.20 | 1411.45    | 6286.77 |
|            | Clinical medicine    | 566.86       | 1214.50 | 962.96  | 1270.26    | 4014.58 |
| Standard deviation | Applied linguistics | 708.82       | 730.79  | 946.67  | 537.09     | 1667.51 |
|            | Clinical medicine    | 204.64       | 362.44  | 410.02  | 345.68     | 579.11  |

3.2. Grammatical features of interest
The present study aimed to investigate 15 noun phrase modifiers as identified by Biber et al., (2011). Noun phrase modification features are obtained from developmental stages of syntactic complexity proposed by Biber et al., (2011). The developmental index entails five stages which are categorized based on three grammatical types: Finite dependent clauses, nonfinite dependent clauses, and dependent phrases. In this study, the purpose was to examine (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; and (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 multiple prepositional phrases as noun post-modifiers.

### 3.3. Identification of Noun Phrase Modifiers

The current study sought to explore noun phrase modifiers identified by Biber et al., (2011). They include 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 multiple prepositional phrases as noun post-modifiers. These lexico-grammatical features were identified through automatic analysis and manual check of the data. Automatic analysis was employed, because it allowed for the investigation of large corpora with high degree of reliability. Automatic extraction tools, however, are not able to identify particular language features such as prepositional phrases, or zero relativizers. As a result, by employing automatic and manual check of the data, we were able to identify and extract all noun phrase modifiers proposed by Biber et al., (2011).

Automatic analysis of the data was carried out using a computer program called Stanford Core NLP Version 3.9.2. It is a tool for natural language processing in Java and Python environment. Stanford Core NLP has a number of features such as text tokenization, stemming and lemmatization, POS tagging, constituency parsing, named entities, sentiment analysis and so forth. Stanford Core NLP is normally used to assign parts of speech to the words, which is a necessary stage before the main phase of analysis. Then, using a special Perl program, it was possible to extract and count the number of noun phrase modifiers. Depending on the text types (native or non-native), the accuracy of Stanford Core NLP is reported to be between 97.21, and 97.67 (Manning, 2015).

### 3.4. Data Analysis

After identification of noun phrase modifiers, they were normalized to 1000 words. This practice has the advantage of allowing researchers to compare the texts of different lengths (Biber & Barbieri, 2007) and to employ parametric tests (Biber et al., 2011). The normalized data were put into SPSS (Version 25). Multiple one-way analysis of variance (ANOVA) procedures were run to find differences across different sections of RAs in each of the identified features. It was followed by Pairwise comparisons for all significant results. Independent-samples $t$-tests were also used to compare the frequency of occurrence of noun phrase modifiers between two writer groups in applied linguistics and clinical medicine. Given multiple tests involved, Bonferroni correction was employed to adjust for the $p$-values.

### Results And Discussion

#### 4.1. Results

From among 15 pre- and -post noun phrase modifiers identified in Biber et al's (2011) hypothesized stages of writing development, the researchers chose six modifiers of “relative clauses”, “ed-clause post-modifiers”, “ing-clause post-modifiers”, “prepositional phrases”, “attributive adjectives”, and “noun pre-modifiers” for cross-comparisons across sections. There are two reasons why these six modifiers from among the others were chosen. First, some of them did not distribute normally across the sections in two disciplines, making it impossible to employ parametric tests for cross comparisons. Second, the researchers decided not to include those extremely infrequent features like “appositive noun phrases” (3 per 1000 words) as identified by Biber et al. (1999).
Table 3

*Mean Raw Frequency and Mean Normalized frequency of Noun Phrase Modifiers across Sections*
| Language feature                  | Group                  | No. of texts | Introduction | Methods | Results | Discussion |
|----------------------------------|------------------------|--------------|--------------|---------|---------|------------|
| Attributive adjectives           | Applied linguistics    | 30           | 112.60*      | 96.30*  | 87.63*  | 98.59*     |
|                                  |                        |              | 68.27**      | 57.97   | 53.87** | 72.16**    |
|                                  | Clinical medicine      | 50           | 49.71*       | 75.99*  | 67.73*  | 96.88*     |
|                                  |                        |              | 87.69**      | 62.24** | 65.22** | 76.27**    |
| Relative clauses                 | Applied linguistics    | 30           | 7.73*        | 6.24*   | 3.32*   | 5.34*      |
|                                  |                        |              | 4.26**       | 3.74**  | 2.10**  | 3.91**     |
|                                  | Clinical medicine      | 50           | 2.44*        | 3.72*   | 2.16*   | 4.95*      |
|                                  |                        |              | 4.30**       | 3.06**  | 2.08**  | 3.90**     |
| Noun pre-modifiers               | Applied linguistics    | 30           | 50.40*       | 48.80*  | 51.96*  | 39.65*     |
|                                  |                        |              | 29.08**      | 29.23** | 32.86** | 29.02**    |
|                                  | Clinical medicine      | 50           | 20.99*       | 55.26*  | 43.37*  | 46.45*     |
|                                  |                        |              | 37.02**      | 45.50** | 41.76** | 36.57**    |
| Possessives                      | Applied linguistics    | 30           | 10.38*       | 8.55*   | 7.87*   | 7.75*      |
|                                  |                        |              | 6.21**       | 5.12**  | 4.98**  | 5.67**     |
|                                  | Clinical medicine      | 50           | 4.10*        | 5.78*   | 6.23*   | 7.76*      |
|                                  |                        |              | 7.23**       | 4.76**  | 6.00**  | 6.11**     |
| Of prepositional phrases         | Applied linguistics    | 30           | 62.43*       | 53.07*  | 45.41*  | 46.87*     |
|                                  |                        |              | 36.51**      | 31.79** | 28.82** | 34.30**    |
|                                  | Clinical medicine      | 50           | 17.94*       | 31.25*  | 28.07*  | 40.94*     |
|                                  |                        |              | 31.64**      | 25.73** | 27.03** | 32.23**    |
| Prepositional phrases other than | Applied linguistics    | 30           | 62.93*       | 57.18*  | 61.27*  | 56.68*     |
| of                               |                        |              | 37.36**      | 34.25** | 38.75** | 41.48**    |
|                                  | Clinical medicine      | 50           | 26.02*       | 49.98*  | 42.15*  | 59.09*     |
|                                  |                        |              | 45.90**      | 41.15** | 40.59** | 46.52**    |
| ed-participle as post-modifiers  | Applied linguistics    | 30           | 6.30*        | 10.80*  | 11.34*  | 6.97*      |
|                                  |                        |              | 5.83**       | 6.47**  | 7.17**  | 5.10**     |
|                                  | Clinical medicine      | 50           | 3.28*        | 8.23*   | 6.38*   | 6.94*      |
|                                  |                        |              | 5.78**       | 6.78**  | 6.14**  | 5.46**     |
| Category                                      | Applied linguistics | Clinical medicine |
|-----------------------------------------------|---------------------|-------------------|
| **In-g participle as post-modifiers**         |                     |                   |
| Applied linguistics                          | 7.10*               | 2.09*             |
| Clinical medicine                            | 4.46**              | 3.69**            |
| **Attributive adjectives, nouns as pre-modifiers** |                     |                   |
| Applied linguistics                          | 17.37*              | 10.63*            |
| Clinical medicine                            | 10.11**             | 18.76**           |
| **Preposition+nongfinite complement clause** |                     |                   |
| Applied linguistics                          | 2.38*               | 2.38*             |
| Clinical medicine                            | 4.20**              | 4.20**            |
| **Complement clauses controlled by nouns**    |                     |                   |
| Applied linguistics                          | 2.63*               | 0.48*             |
| Clinical medicine                            | 1.49**              | 0.84**            |
| **Appositive noun phrases**                   |                     |                   |
| Applied linguistics                          | 16.90*              | 6.30*             |
| Clinical medicine                            | 10.11**             | 11.12**           |
| **Multiple prepositional phrases**            |                     |                   |
| Applied linguistics                          | 6.87*               | 2.70*             |
| Clinical medicine                            | 4.11**              | 4.76**            |
| **Total**                                    |                     |                   |
| Applied linguistics                          | 373.300*            | 149.04*           |
| Clinical medicine                            | 222.00**            | 262.93**          |

*Note: * Raw frequency, ** Normalized frequency per 1000 words.
In order to answer the first research question, the distribution of noun phrase modifiers across different sections of research articles, namely, introduction, method, result, and discussion (IMRD), was compared between applied linguistics and clinical medicine. Table 3 demonstrates the mean frequency of each of the language features across the sections in applied linguistics and clinical medicine groups. According to Table 3, noun phrase modifiers are not evenly distributed across sections in both disciplines. Introduction and discussion noticeably embody a larger number of modifiers compared to the two other sections in two disciplines. In applied linguistics, discussion placed the heaviest reliance noun phrase modifiers followed by introduction, methods and results. However, in clinical medicine, it was introduction that included the largest number of noun phrase modifiers, followed by discussion, methods, and results respectively. Independent samples t-tests were used to check whether the differences between two disciplines in the use of noun phrase modifiers were statistically significant and to determine the effect size (eta squared). Because we used five tests on the same dataset simultaneously, Bonferroni post-hoc adjustment was used to adjust the alpha level, which was set at $p < 0.01$ after correction ($0.05/5 = 0.01$).

As shown in Figure 1, irrespective of the sections, the RA writers in clinical medicine used noun-modifying features of all types much more frequently than those in applied linguistics did. Normalized mean frequencies of modifiers in each section in two groups of writers are as follows: Introduction, 262.93 vs 222.00; methods, 229.37 vs 197.70; results, 223.71 vs 196.65; discussion, 248.21 vs 225.17.

The results obtained from independent-samples t-tests, as shown in Table 4, suggest that the groups differed significantly in the use of noun phrase modifiers in all IMRD sections of RAs in applied linguistics and clinical medicine. RAs in clinical medicine relied on the larger number of noun phrase modifiers in Introduction (Mean difference = 40.93; $t(78) = 10.20$, $p = 0.000$), Methods (Mean difference = 31.67; $t(78) = 6.98$, $p = 0.000$), Results (Mean difference = 27.06; $t(78) = 4.53$, $p = 0.000$), Discussion (Mean difference = 23.04; $t(78) = 2.79$, $p = 0.006$), and total (Mean difference = 30.67; $t(78) = 6.61$, $p = 0.000$).

**Table 4**

*Independent-samples t-test to Compare Distribution of Noun Phrase Modifiers in Applied Linguistics and Clinical Medicine*

| Section    | Group          | Mean   | Sig. (2-tailed) | Eta squared |
|------------|----------------|--------|----------------|-------------|
| Introduction| Applied Linguistics | 222.00 | 0.000          | 0.23        |
|            | Clinical medicine | 262.93 | 0.000          |             |
| Methods    | Applied Linguistics | 197.70 | 0.000          | 0.36        |
|            | Clinical medicine | 229.37 | 0.000          |             |
| Results    | Applied Linguistics | 196.65 | 0.000          | 0.21        |
|            | Clinical medicine | 223.71 | 0.000          |             |
| Discussion | Applied Linguistics | 225.17 | 0.000          | 0.09        |
|            | Clinical medicine | 248.21 | 0.006          |             |
| Total      | Applied Linguistics | 210.38 | 0.000          | 0.38        |
|            | Clinical medicine | 241.05 | 0.000          |             |

In order to answer the second research question which seeks to check the difference in the frequency of noun phrase modifiers in each section, the researchers employed six one-way ANOVA procedures (one for each modifier) in each discipline. Since multiple comparisons were used, Bonferroni post-hoc adjustment was used to adjust the alpha level which is set at $p < 0.0083$ after correction ($0.05/6 = 0.0083$). After within-discipline analysis, the researchers also performed between-discipline analysis by comparing the frequency and types of noun phrase modifiers in each section.
Table 5

*Differences in the Mean Frequencies of Noun Modifiers across IMRD Sections of RAs in Two Disciplines of Applied Linguistics and Clinical Medicine*

| Group             | Grammatical Structure     | F     | Sig.       |
|-------------------|---------------------------|-------|------------|
| Applied linguistics | Attributive adjectives    | 6.00  | **0.001*** |
| Clinical medicine |                           | 23.56 | **0.000*** |
| Applied linguistics | Noun pre-modifiers        | 0.83  | 0.476      |
| Clinical medicine |                           | 20.00 | **0.000*** |
| Applied linguistics | Relative clauses          | 5.90  | **0.001*** |
| Clinical medicine |                           | 6.71  | **0.000*** |
| Applied linguistics | Prepositional phrases     | 2.39  | 0.072      |
| Clinical medicine |                           | 12.96 | **0.000*** |
| Applied linguistics | ed-clause post-modifiers  | 1.39  | 0.211      |
| Clinical medicine |                           | 1.53  | 0.206      |

*The results are significant at 0.0083.

The results obtained from one-way ANOVA in Table 5 revealed statistically significant differences for two of six non phrase modification types in applied linguistics: attributive adjectives and relative clauses. Other noun modifiers were not statistically significant with regard to their frequency difference across sections. In clinical medicine, on the other hand, attributive adjectives, noun pre-modifiers, relative clauses, and prepositional phrases differed statistically significantly with regard to their frequency across sections.

Table 6

*Pairwise Tukey Comparisons of Noun Phrase Modifiers across Sections in Applied Linguistics RAs*
| Language features       | Sections       | Mean Difference | Sig.  |
|------------------------|----------------|-----------------|-------|
| Attributes adjectives  | Introduction   | 10.297          | 0.165 |
|                        | Methods        | 14.398          | 0.022 |
|                        | Discussion     | -3.892          | 0.860 |
| Methods                | Introduction   | -10.297         | 0.165 |
|                        | Results        | 4.100           | 0.841 |
|                        | Discussion     | -14.189         | 0.025 |
| Results                | Introduction   | -14.398         | 0.022 |
|                        | Methods        | -4.100          | 0.841 |
|                        | Discussion     | -18.289*        | 0.002 |
| Discussion             | Introduction   | 3.892           | 0.860 |
|                        | Methods        | 14.189          | 0.025 |
|                        | Results        | 18.289*         | 0.002 |
|                       |                |                 |       |
| Relative clauses       | Introduction   | 0.520           | 0.787 |
|                       | Methods        | 2.155*          | 0.001 |
|                       | Results        | 0.352           | 0.922 |
|                       | Discussion     | -0.520          | 0.787 |
| Methods                | Introduction   | 1.636           | 0.021 |
|                       | Results        | -0.168          | 0.990 |
|                       | Discussion     | -2.155*         | 0.001 |
| Results                | Introduction   | -1.636          | 0.021 |
|                       | Methods        | -1.804          | 0.009 |
|                       | Discussion     | -0.352          | 0.922 |
|                       | Methods        | 0.168           | 0.990 |
|                       | Results        | 1.804           | 0.008 |

*The results are significant at 0.0083

Table 7

Pairwise Tukey Comparisons of Noun Phrase Modifiers across Sections in Clinical Medicine RAs
| Language features       | Sections   | Mean Difference | Sig.  |
|------------------------|------------|----------------|-------|
| **Attributive adjectives** | Introduction | -25.329*       | 0.000 |
|                        | Methods    | 25.329*        | 0.000 |
|                        | Results    | 19.958*        | 0.000 |
|                        | Discussion | 11.420*        | 0.003 |
|                        | Introduction | -25.329*       | 0.000 |
|                        | Methods    | -5.371         | 0.343 |
|                        | Results    | -13.908*       | 0.000 |
|                        | Discussion | -11.420*       | 0.003 |
|                        | Introduction | -19.958*       | 0.000 |
|                        | Methods    | 5.371          | 0.343 |
|                        | Results    | -8.53794       | 0.043 |
|                        | Discussion | 13.908*        | 0.000 |
|                        | Introduction | -8.557*        | 0.001 |
|                        | Methods    | 8.557*         | 0.001 |
|                        | Results    | 2.209          | 0.758 |
|                        | Discussion | 9.001*         | 0.000 |
|                        | Introduction | -2.138*        | 0.000 |
|                        | Methods    | 0.909          | 0.298 |
|                        | Results    | -0.833         | 0.375 |
|                        | Discussion | -1.741         | 0.008 |
|                        | Introduction | -0.396         | 0.870 |

| Noun pre-modifiers     | Sections   | Mean Difference | Sig.  |
|------------------------|------------|----------------|-------|
|                        | Introduction | -8.557*        | 0.001 |
|                        | Methods    | -6.347         | 0.026 |
|                        | Discussion | 0.445          | 0.997 |
|                        | Introduction | 8.557*         | 0.001 |
|                        | Methods    | 2.209          | 0.758 |
|                        | Discussion | 9.001*         | 0.000 |
|                        | Introduction | 6.347         | 0.026 |
|                        | Methods    | -2.209         | 0.758 |
|                        | Discussion | 6.79270        | 0.015 |
|                        | Introduction | -0.445         | 0.997 |
|                        | Methods    | -9.001*        | 0.000 |
|                        | Results    | -6.792         | 0.015 |

| Relative clauses       | Sections   | Mean Difference | Sig.  |
|------------------------|------------|----------------|-------|
|                        | Introduction | 1.230          | 0.085 |
|                        | Methods    | 2.138*         | 0.000 |
|                        | Results    | 0.909          | 0.298 |
|                        | Discussion | -0.833         | 0.375 |
|                        | Introduction | -1.230         | 0.085 |
|                        | Methods    | 0.909          | 0.298 |
|                        | Results    | -0.833         | 0.375 |
|                        | Discussion | -1.741         | 0.008 |
|                        | Introduction | -0.396         | 0.870 |
The first lexico-grammatical feature, which demonstrated statistically significant difference across the sections in both disciplines, was attributive adjectives. The results of post-hoc Tukey HSD tests concerning its different patterns of distribution are represented in Table 6 and Table 7. The mean frequencies of attributive adjectives in introduction and discussion sections were higher than those of methods and results in both disciplines (Figure 2). As table 5 demonstrates, in applied linguistics, the frequency of attributive adjectives in discussion and results sections differed significantly ($p = 0.002$, $< 0.0083$).

When it comes to clinical medicine (Table 7), the introduction section differed significantly from other three sections (introduction vs methods, $p = 0.000$, introduction vs results, $p = 0.000$, introduction vs discussions, $p = 0.003$). Mean frequency of attributive adjectives in methods section, in the same vein, differed significantly from introduction and discussion ($p = 0.000$). The mean frequency in results section differed significantly only from introduction section ($p = 0.000$).

Relative clauses were the second statistically significant feature in applied linguistics. As shown in Figure 3, in applied linguistics and clinical medicine, relative clauses were used more frequently in Introduction followed by Discussion, Methods and Results. However, the only sections that reached significance in terms of frequency of relative clauses were introduction and results ($p = 0.001$). In clinical medicine, introduction vs results ($p = 0.000$), and the results vs discussion were statistically significant ($p = 0.005$).

In clinical medicine noun pre-modifiers were used unevenly across sections (Figure 4), with Methods and Results displaying more frequent uses of this lexico-grammatical feature than Introduction and Discussion. The difference between introduction vs methods ($p = 0.001$), and methods vs discussion ($p = 0.000$) achieved significance. The last significant feature in clinical medicine was prepositional phrases. According to Figure 5, the use of prepositional phrases in Introduction and Discussion was denser than that of Methods and Results. The difference between introduction vs methods ($p = 0.001$), introduction vs results ($p = 0.000$), methods vs discussion ($p = 0.000$, and results vs discussion ($p = 0.000$) achieved significance.

4.2. Discussion
The present study has shown that RAs in clinical medicine placed heavier reliance on noun phrase modifiers than RAs in applied linguistics did. Unlike hard sciences, soft sciences are characterized by evaluative model of discourse where the persuasion is more interpretive and less explicit (Hyland, 2008). In soft sciences, the researchers rarely deal with new phenomena in the discussion of their experiences, because they discuss the phenomena that are already familiar to us, reflecting little need for new technical vocabulary and complex grammatical constructions (Biber & Gray, 2016). In the same vein, Gardner et al. (2019) argue that “hard sciences are more informational, while Humanities disciplines are more involved” (p. 3). This difference suggests that the writers in humanities disciplines tend to bolster their claims by more elaborated discussions through greater use of clausal features, while phrasal features used in hard sciences (especially pre-modifiers) ensure the communication of a great deal of technical information more concisely (Staples, 2016).

The results of current study lend support to those of Biber and Gray (2016), who documented that science research writing is an outlier with regard to structural compression style of discourse in the continuum of academic disciplines with the other end being humanities. Therefore, noun phrase modifiers are not considered textual features characterizing the genre of academic writing generally; rather, they are “discipline-specific writing conventions” (see Baratta, 2010) with certain disciplines such as hard sciences being structurally more compact than others.

The second finding of the study was that the frequency of attributive adjectives differed significantly from section to section in clinical medicine (with the exception of method vs results); however, in applied linguistics, the only significant difference was between results and discussion. The difference in the frequency of attributive adjectives across RA sections may be related to discourse function and chief aim of each section. The very fact that the introduction and discussion sections in both disciplines contain a larger number of normalized attributive adjectives is not against our expectations, since as Biber et al. (1999) argued, attributive adjectives in academic writing are mainly used for descriptive, evaluative, topical, and relational functions. Unlike methods and results that follow a more straightforward and explicit paradigm, introduction and discussion are evaluative in nature.

The similar frequency of occurrence of attributive adjectives in introduction and discussion sections is directly related to their discourse functions which are mutually interdependent. The discussion picks up where the introduction leaves off (Annesley, 2010). Introduction and Discussion are directly related by means of the research questions formulated in Introduction, and the authors usually find it an effective strategy to use the same wording to reiterate their purpose in the discussion (Bavdekar, 2015). Attributive adjectives, with their diverse language functions, facilitate the link between the two sections.

More frequent use of attributive adjectives in introduction and discussion sections compared to methods and results is in line with the results obtained from the study of Hutter (2015), in which introduction and discussion sections differed significantly from methods and results, although the corpus under investigation was solely restricted to applied linguistics.

Relative clause was the next noun phrase modifier whose distribution was significantly different across IMRD sections in two groups. In applied linguistics, relative clauses were distributed significantly unevenly in introduction and results. In the same vein, in clinical medicine, the normalized frequency of relative clauses differed significantly between introduction and results. In order to account for different frequency counts of relative clauses across RA sections, we need to get rid of traditional categorization of “defining vs non-defining” or “restrictive vs non-restrictive” relative clauses” (see Tse & Hyland, 2010). Restrictive (or defining) relative clauses serve to restrict the possible interpretations of the reference of the noun phrase while non-restrictive (non-defining) relative clauses tend to add information to preceding noun phrases (Cowan, 2008). While this categorization seems to depict surface grammatical structure of relative clauses, it hardly explains their frequency in academic writing, more specifically when it comes to IMRD sections.

In order to have a clearer picture of distributional pattern of relative clauses in the current study, the researchers employed functional-rhetorical characterization of relative clauses as proposed by Tse and Hyland (2010), where the use of relative clauses in academic writing is explained in relation to the nouns modified and type of modification. Although their categorization was originally used to assess journal descriptions as a distinct genre, they suggested that their model be used to assess any kinds of academic texts. A distinct subcategory of the model is the evaluative function of relative clauses which
“contributes to the meaning of the modified entity both in terms of its objective property as well as the value judgements ascribed to it” (p.12).

A closer analysis of noun phrases in our corpus revealed that nearly 43 percent of noun phrases in introduction section of applied linguistics RAs were modified, while for methods, results and discussion they were 35, 33, and 40 percent, respectively. In clinical medicine, however, the ratio of modified noun phrases to total noun phrases for IMRD section is 0.56, 0.43, 0.38, and 0.52, respectively. Relative scarcity of relative clauses in results section in relation to other sections could be expected, since results is the space where the writers try to present the findings of their studies in much the same way as they are without any personal judgements so as readers come up with clear, understandable, and unequivocal evidence obtained from statistical analyses.

On the other hand, introduction section helps readers to move from general research topic with the aim of centrality claim, to gap identification and description of the organizational structure of the current paper (Swales, 1990). Like journal description genres, RA introduction texts establish scope and specialty of the topics to be discussed or welcomed. Introduction, after abstract, is the second part that editors and reviewers read and it determines whether they are likely to continue reading or not (Abrahamson, 2008). Accordingly, introduction may mirror “hidden promotional element of academic texts” (Tse & Hyland, 2010, p.23) in a highly competitive field of activity. For academic writers who want to sell their academic work to their readership, to delimit the scope of their research and subsequently to establish and occupy the niche (Swales, 1990), relative clauses are invaluable tools which “ensure semantic clarity and textual variety” (Cho & Lee, 2016). The evaluative function of relative clauses enables writers to both establish the niche and create the positive attitude in readers to the things discussed (Tse & Hyland, 2010). This is a unique function of relative clauses, which may not be fulfilled by other noun phrase modifiers. Extract 2 shows how academic writers used relative clauses to establish niche and positive attitudes in readers.

Text Extract 2

In particular, this study focuses on learning of the meanings of new technical words that appear in a written context with explicit clues. (Applied linguistics)

Identifying potentially malleable environmental factors that may alter the developmental course of heritable mental health problems is an important step toward guiding prevention strategies. (Clinical medicine)

Abstract nouns are distinctive features of advanced academic writing (Biber, 2006; Biber et al. 1998). Taking macrostructure of research articles into account, the researchers found more abstract nouns in introduction section compared to results section which normally relies on concrete nouns (in current study, abstract nouns were used nearly twice as frequently in introduction section as in results section). Evidently, unlike concrete nouns, abstract nouns generally require more clarification. While abstract nouns can be modified by pre-modifiers like attributive adjectives, and noun pre-modifiers, relative clauses merit special attention since they “open up more space for detailed description” (Tse & Hyland, 2010, p.4), something which seems necessary for establishing and occupying the niche. Against this backdrop, it may safely be argued that relative clauses in RAs are “primed” to occur in introduction section in RAs (see Hoey, 2005).

In clinical medicine, the difference in the mean frequency of noun pre-modifiers between introduction vs methods, and methods vs discussion were statistically significant. In other words, pre-modifying nouns were higher in methods and results sections than introduction and discussion. The results obtained from this section of our analyses ran contrary to our initial expectations. Significantly higher proportion of noun pre-modifiers in methods section compared to introduction and discussion sections in our study could be analyzed in relation to the rhetorical purpose of these sections in RAs. Introduction and method sections are understood to be argumentative (Hood, 2004), while the method section is supposed to be expository (Martinez, 2003). Expository texts expose readers to the facts, reasons and evidences of a particular topic. It follows a pattern of development that encompasses examples, analyses, processes, classifications and so forth (Richards & Schmidt, 2002). It is the processes, facts, and evidences that are foregrounded in methods section and, as opposed to
introduction and discussion sections, there is little room for individuals to establish their own niche of expertise (Tse & Hyland, 2010, p.13) and individualize the unique standing of their filed of inquiry.

Biber et al. (1999) state that noun pre-modifiers are strongly favored in academic writing, because they can establish versatile meaning relations. Qualitative analysis of noun + noun sequences in methods section of our corpus revealed that a vast majority of the sequences were section-specific noun phrases with some others being discipline-specific, that is, noun phrases that are commonly found in a particular discipline, or a section of RAs, confirming Hyland and Tse's (2007) argument that “all disciplines shape words for their own uses” (p.240). In either case, noun sequences associated with each other by means of content relations facilitate the smoothness of procedures, analyses, and information exchange, which are supposed to be defining rhetorical features of methods sections. Extract 3 demonstrates section-specific and discipline-specific functions of noun + noun sequences employed by academic writers in clinical medicine.

**Text Extract 3**

*The schizophrenia data was imputed using the SHAPEIT and IMPUTE2 software programs.*

*Genomic principal component scores were also covaried to control for population stratification in the ZHH-FE.*

Extract 3 shows how noun pre-modifiers are used in method sections of clinical medicine RAs to illustrate the means, procedures, phenomena, and objectives. The first two are representative of discipline-specific noun sequences, and the others highlight section-specific noun phrases. Brevity and implicitness are two defining features of noun + noun sequences. Although, due to lack of function words, noun sequences could be a potential source of ambiguity for readership (Biber et al. 1999), the academics, because of their familiarity with the genre, do not usually have difficulty deciphering the meaning relations. On the other hand, the density of information communicated by noun sequences makes them ideal language features to be used in methods section. In sum, noun sequences in methods section assist writers in “convincing the readership of the validity of the means employed to obtain findings” (Lim, 2006) while meeting the challenge of limited space requirement imposed by journals in the new age of science.

While noun pre-modifiers were used in introduction and discussion sections as well, because of the argumentative nature of the introduction and discussion sections (Hood, 2004) in RAs, other types of pre-modifiers (ed-participal modifiers, ing-participal modifiers, and general adjectives) were used as frequently as, or even more frequently than, noun pre-modifiers. In other words, different rhetorical-communicative functions of the two sections explain their different degrees of reliance on noun pre-modifiers. These findings confirm those of Hong et al. (2017), who reported similar results in International Business Management RAs.

Post-modifying prepositional phrases are the last significant language features whose average distributional difference was significant across sections in clinical medicine. As was expected, higher mean frequencies of prepositional phrases were found in introduction and discussion sections than in methods and results. Introduction and results are the sections where the researchers underscore the new knowledge generated by their study, which may contribute to the field. As a result, these two sections could be placed in the argumentative end of the cline and results and discussions in the expository end of the cline.

Because of the role of prepositional phrases as post-modifiers, the higher proportion of post-modifying prepositional phrases in introduction and discussion sections in relation to methods and results may be accounted for, using the principle of end-weight, which is the tendency to place longer, more complex structures towards the ends of a clause. Biber et al. (1999) maintain that the principle of end-weight is closely related to postponement of direct object before the object predicative. They further argue that postponement occurs particularly in the registers with highest degree of phrasal complexity. Introduction and discussion, as our study and other studies showed, were more complex in terms of noun modifying phrasal features compared to methods and results sections. As a result, uneven distribution of post-modifying prepositional phrases across IMRD sections of medical research articles can be justified.
Conclusion

The results of the first research question indicated that, overall, the academic writers in clinical medicine used noun phrase modifiers more frequently in all sections of RAs than the writers in applied linguistics did. Within-disciplinary analysis of distribution of noun phrase modifiers showed that, in applied linguistics, there were significant differences among the sections in the use of the phrasal modifiers of attributive adjectives and relative clauses. Other noun phrases were not statistically significant. In clinical medicine, modifying features of attributive adjectives, noun pre-modifiers, relative clauses, and prepositional phrases reached significance across sections. Between-section analyses using post-hoc Tukey HSD tests revealed that, both in applied linguistics and clinical medicine, attributives adjectives and relative clauses were used more frequently in introduction and discussion sections than in methods and results sections.

This study examined academic genres in two disciplines of applied linguistics and clinical medicine. The results revealed that irrespective of discipline, noun phrase modifiers were not distributed evenly across IMRD sections of research articles, with introduction being the most complex, followed by discussion, results, and methods. This indicates that the variation of noun phrase modifiers across sections is discipline-independent, and is due to functional attributes of the sections. Thus, RAs are not a rigid genres with similar distribution of noun phrase modifiers across sections; rather, sub-registers of Introduction, Methods, Results, and Discussion inform the pattern of phrasal distribution across disciplines.

The present study showed that academic writers in clinical medicine placed more reliance on noun phrase modifiers than their counterparts in applied linguistics did. Therefore, it seems that noun phrase complexity in academic writing is influenced by the factor of discipline with those in hard/applied end of the cline being more complex than those in soft/pure end of the cline. Although the two disciplines fulfill the communicative purpose of reporting the research and belong to the same genre of academic research articles, the communicative purpose may be too general for thorough investigation of noun phrase complexity. Accordingly, various sub-genres that are produced in the context of different disciplinary courses (Samraj, 2004) may have some impact on the noun phrase complexity of a text constructed by academic writers.

The results of the study may have important implications for language pedagogy. Our study has shown that hard science relies on noun phrase modifiers more heavily than soft science. Moreover, the pattern of reliance of the two disciplines on noun phrase modifiers were different. Soft science employed almost equal number of pre- and postmodifiers, while hard science utilized far larger number of pre-modifiers for modifying noun phrases. This suggests that hard science is, by its very nature, more compact than soft science. L2 academic writers in the field of hard sciences may need to be explicitly and contextually aware of the ways by which pre-modifiers contribute to compact discourse style. The use of nouns as pre-modifiers, in particular, seems to be somewhat challenging especially for novice academic writers who need to work out diverse meaning relations between the modifier and the modified. Since most noun sequences are discipline-specific (Elliot, 2019), it might be useful to raise the students’ awareness of these lexico-grammatical features in academic writing and contextually explore the rhetorical functions that these sequences fulfill within disciplines.

Uneven distribution of noun phrase modifiers across RA sections (introduction and discussion place heavier reliance on noun phrase modifiers than methods and results), and the use of section-specific modifiers stress the genre-based approach to academic writing courses which underline genre conventions of IMRD sections in RAs. Three-phase teaching-learning approach which consists of deconstruction of “sample” “expert” text stage, joint construction stage, and individual construction stage (Martin, 2009) may prove promising in genre-based teaching of writing whereby learners can enhance their knowledge of text types in terms of language and text features.

In addition to language pedagogy, the findings of the present study may benefit syllabus designers and curriculum developers. As our study showed, two disciplines of clinical medicine and applied linguistics deployed different patterns of lexico-grammatical resources for complexifying academic texts. As Hyland (2002) pointed out, common-core features of academic prose differ considerably in frequency, expression, and function across disciplines. This highlights the importance of designing discipline-specific academic writing courses (writing in disciplines) rather than general EAP courses for undergraduate/high school students.
This study explored the distribution of noun phrase modifiers across IMRD sections of RAs in applied linguistics and clinical medicine. However, IMRD is only one format for investigating text-intrinsic language features (those features which are attributed to macro-structures of the texts) of RAs. Future studies may employ other formats (see Mondal et al., 2019) that accurately capture the macrostructures of RAs. The present study investigated only one dimension of language complexity (phrasal complexity). It might be an interesting area of research for future studies to examine other dimensions such as morphological complexity, collocational complexity, etc. and compare them across text-intrinsic sections of RAs across disciplines.

**Abbreviations**

MA = Master of Arts  
RA = Research Article  
EAP = English for Academic Purposes  
ANOVA = Analysis of Variance  
IMRD = Introduction, Methods, Results, Discussion  
CM = Clinical Medicine  
AL = Applied Linguistics  
NLP = Neuro-linguistic programming  
POS = Part of Speech

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**Authors’ contributions**

The first author conceived of the study and decided on research questions, types of participants, instrumentation, data collection procedure, and data analysis. The first author also supervised the data collection and analysis procedures and helped draft and finalize the manuscript. The second author collected and analyzed the data and drafted the manuscript. Both authors read and approved the final manuscript.

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**Figures**
Figure 1

Normalized Mean Frequency of Distribution of Total Noun Phrase Modifiers in Two Groups of Writers

Figure 2

Normalized Mean Frequency Distribution of Attributive Adjectives in Two Groups of Writers
Figure 3

Normalized Mean Score of Distribution of Relative Clauses in Two Groups of Writers

Figure 4

Normalized Mean Score of Distribution of Noun Pre-Modifiers in Clinical Medicine Group.
**Figure 5**

Normalized Mean Score of Distribution of Prepositional Phrases in Clinical Medicine Group.