

Lexical Bundles in the Abstract and Conclusion Sections: The Case of Applied Linguistics and Information Technology

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Abstract: The study of lexical bundles, known as fixed phrases, chunks, clusters, and multi-word expressions, has attracted considerable attention. While there has been much research on lexical bundles across different registers and a number of disciplines, their deployment in some special sections of research articles as the most high-stakes genre has not yet been well explored. Accordingly, the present study aimed at identifying 4-word lexical bundles by analyzing the data obtained from a collection of the abstract and conclusion sections of 1000 English research articles written by L1-Persian and L1-English writers in AL¹ and IT², as published between 2015 and 2019. The researchers used Antconc software to analyze the data composed of about 600,000 words; then, the functional analysis was carried out based on Hyland's (2008a,b) framework. Overall, the analysis revealed that AL writers outweighed their IT counterparts in their use of lexical bundles. Also, L1-Persian writers used more lexical bundles in the abstract section. Despite this, both writers used the same number of bundles in the conclusion section. In addition, both AL and IT writers had similar use of the three main functional categories; however, there were substantial differences and similarities in regard to these two parts of research articles. The findings of this study can help writing instructors improve students' academic writing. They can also enhance their abilities better comprehend the role of lexical bundles in different genres and sub-genres.

Keywords: Applied Linguistics, Information Technology, Lexical bundles, Corpus, Function.

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Introduction

Lexical bundles play an important role in acquiring communicative competence. As we gain more control of these expressions, we will experience fluent linguistic utterances. There is also the apparent importance of these expressions in English for Specific Purposes (ESP). In other words, using discipline-specific frequent expressions shows the difference between the expert disciplinary writing and the novice one (Hyland, 2008a). Jespersen (1924) and Firth (1951, 1957) could be regarded as the initial developers of the idea of word combinations, popularizing collocation as a technical term. More recently, Biber, Conrad, Reppen, and Leech (1999) stated that lexical bundles could be considered as word combinations that are regularly employed in different registers. They defined lexical bundles as "recurrent word expressions, regardless of their idiomaticity and regardless of their structural status" (p. 990).

Bamberg (1983) and McCulley (1985) held the view that using these fixed expressions could be indicative of the proficient language use in a particular register; this includes academic writing as well. As mentioned, lexical bundles are, for the most part, not idiomatic in meaning. In other words, we can understand the meaning of lexical bundles by their components, but idioms are opaque in meaning. Thus, lexical bundles are commonly transparent in terms of meaning (Conrad & Biber, 2005). Moreover, lexical bundles, unlike idioms, are not complete in regard to their structure. Furthermore, as idioms are rarely used in academic prose, they are not as frequent as lexical bundles. Biber et al. (2004) also grouped lexical bundles in regard to their function into three categories: stance bundles, discourse-organizing, and referential bundles. Stance bundles refer to the words that present feelings, attitudes, and judgments (e.g., *it is important to*). Discourse-organizing bundles represent links between different discursive stretches (e.g., *on the other hand*). Finally, referential bundles are related to the expression of particular attributes of an entity (e.g., *results of this study*).

Biber (2006) also categorized lexical bundles into three groups in terms of structure: verb fragment, verb phrase, and question fragment. The first type is a verb phrase adding to a subject pronoun (e.g., *the findings revealed that*). The second one involves a complementizer or a subordinator following the main clause. This type contains a verb phrase without a pronoun, known as dependent clause fragments (e.g., *based on the result*). The third category refers to discourse markers followed by a verb phrase (e.g., *you know it was*) or a prepositional phrase with modifiers (e.g., *at the end of*).

Despite the previous research, not many works have addressed the use of lexical bundles in different sections of research articles in different disciplines; therefore, this study attempted to make

a comparison of research articles in the abstract and conclusion sections in order to find possible differences and similarities in the use of lexical bundles in these two important parts of research articles.

The present study was, therefore, launched to look into the abstract and conclusion sections of research articles in regard to their use of lexical bundles, both structurally and functionally. More specifically, this study compared the use of four-word lexical bundles of research articles sub-sections in AL and IT research articles, as written by L1-English and L1-Persian published writers. We focused on four-word bundles as "they are far more common than 5-word strings and offer a clear range of structures and functions than 3-word bundles" (Hyland 2008a, p. 8). As we attempted to shed light on the considerable differences and similarities of different disciplines, we chose to collect two corpora in two fields: information technology (IT), representing a hard science, and applied linguistics (AL), reflecting a field in soft sciences. Furthermore, AL can represent a wide range of academic territories. Likewise, IT interfaces a perspective of an academic multi-disciplinary field. More specifically, the similarities and differences between these two sub-sections of research articles in terms of range, frequency, and functions of bundles were highlighted.

The abstract and conclusion sections were the focus of the present research for two reasons. First, there is a scarcity of research analyzing lexical bundles in different sections of research articles and in different disciplines. Second, the abstract is an important sub-genre representing an accurate and readable summary of the paper, thus allowing them to decide whether a piece of work is of use and relevant. The conclusion part, on the other hand, is also one of the most important parts of research articles since it restates the original argument and convinces by summarizing the most important points. Also, writing a conclusion as an important part of research articles needs much expertise and disciplinary knowledge. Meanwhile, exploring these sub-sections of research articles in two different disciplines could serve as a good contribution to a better understanding of lexical bundles. Therefore, this study addressed the following questions:

1. What are the most frequent four-word lexical bundles in the abstract section of AL and IT research articles?
2. What are the most frequent four-word lexical bundles in the conclusion section of AL and IT research articles?
3. What are the similarities and/or differences between the abstract sections of IT and AL research articles in terms of the function of lexical bundles used?

4. What are the similarities and/or differences between the conclusion sections of AL and IT research articles in terms of the function of lexical bundles used?

Review of the Literature

Recently, some studies have investigated the use of lexical bundles as the ability to control these multiword expressions as part of communicative competence in a given genre or register (Hyland, 2012). There are some frameworks used by scholars in most of these studies. The first framework is a comparison between native and non-native writers (Pan, Reppen & Biber, 2016; Adel & Erman, 2012; Kim, 2009, Rafiee, Tavakoli, & Amirian, 2011; Amirian, 2013; Alipour, Jalilifar & Zarea, 2013). The other one is concerned with disciplinary variations (Kashiha & Chan, 2013; Biber, 2006; Cortes, 2004; Hyland, 2008a; Omidian, Shahriari, Siyanova-Chanturia, 2018; Farvardin, Afghari, & Koosha, 2012). On the other hand, there are a good number of studies in relation to registers (Biber, 2006; Biber & Barbieri, 2007; Herbel-Eisenmann & Wagner, 2010; Nesi & Basturkmen, 2006; Shirazizadeh, & Amirfazlian, 2021). Finally, the analysis of academic genres is one other main line of research done on lexical bundles (Chen & Baker 2011; Hyland, 2008b; Qin, 2014; Wei & Lei, 2011; Razmjoo & Montasseri, 2018; Rahimi Azad & Modarres Khiabani, 2018). All these mentioned frameworks are related to the studies addressing lexical bundles in regard to frequency and structure, as well as function. Romer (2009), for instance, focused on how word sequences were used by native speakers and their advanced non-native counterparts. The results revealed no evidence showing the proficient use of lexical bundles, whether the writers were native speakers or not. It was concluded that acquiring academic writing conventions could be more important than background language.

Alipour, Jalilifar, and Zarea (2013) also zoomed in on the frequencies of three- and four-word lexical bundles in three disciplines: applied linguistics, computer engineering, and physics. They also aimed to compare L1 English and Persian writers. The research revealed that lexical bundles behaved differently across different disciplines. Furthermore, non-native writers employed more lexical bundles in their writing. Subsequently, the study analyzed three- and four-word bundles, both structurally and functionally, to fill the gap in the study of bundles and improve writing in different texts.

In another study, Esfandiari and Barbary (2017) examined how four-, five-, and six-word lexical bundles were used structurally and functionally by English and Persian writers in psychology research articles. The important merit of this study was analyzing longer lexical

bundles. While most previous studies have only concentrated on four-word lexical bundles (Adel & Erman, 2012; Chen & Baker, 2010; Cortes, 2013), other longer lexical bundles have not been considered by researchers. This can be important as there may be differences in the use of such larger lexical bundles. Framing signals were found to be the most frequent bundles in EC¹ and transition signals in PC². The reason behind this may be Persian writers' L1 transfer (Paquot, 2013). Surprisingly, Persian writers used six-word lexical bundles more frequently than their English counterparts did.

Further, Durrant (2017) evaluated four-word lexical bundles in the writing of students by drawing on the corpus of British Academic Written English (BAWE). In this large-scale study, 24 different fields were included. Similar to Hyland (2008a,b), this study revealed that science and technology writers employed lexical bundles more frequently, relative to others. Science and technology writers made extensive use of bundles for showing physical location, while humanities and social sciences writers drew on bundles for locating events. Qin (2014) also examined how lexical bundles were used by non-native English graduate students of AL at different levels of study in their published articles. A comparison was made between 136 research articles written by 20 non-native graduate students and 11 native English speakers. It was concluded that differences between the two genres outweighed those between natives and non-natives. Frequency analysis also showed that students at PhD level used considerably more target bundles. The reason might be the similarity of the writing tasks studied at that level (Qin, 2014; see also Cortes, 2004).

Alipour, Jalilifar and Zarea (2013), for example, compared the structure and function of three- and four-word lexical bundles in the research articles of three disciplines: physics, computer engineering and applied linguistics. There were significant differences between both in terms of the structure and function of lexical bundles. This study revealed how writers of different disciplines should become aware of different conventions governing each particular discipline.

In a study done by Ahmadi, Ghonsooly, and Fatemi (2013), 200 research article abstracts written by Iranian and native English-speaking authors in the field of applied linguistics were analyzed. The results revealed that Iranian authors employed more four-word bundles when compared to their native speaker counterparts. Interestingly, Iranian authors used more clausal

¹ English corpus

² Persian corpus

elements and subordination, while native speakers used more bundles that were phrasal in nature. The researchers also employed the N-gram function of AntConc 3.3.0 to identify the bundles in the corpora. The study highlighted that lexical bundles played an important role in supporting writing teachers working in English for Academic Purposes (EAP).

Kashiha (2015) also evaluated how native and Iranian non-native writers used lexical bundles in two different corpora consisting of 200 research articles conclusions. The findings demonstrated that native writers were generally more inclined to use lexical bundles in writing the conclusion. However, Iranian writers employed some bundles more. Generally, scholars believe that lexical bundles used by native speakers can help L2 learners to learn them efficiently. The study also encouraged scholars to do cross-disciplinary investigations on the use of lexical bundles in different sections of research articles.

To summarize, previous studies of lexical bundles have well demonstrated that different disciplines exploit different language use patterns (e.g., Hyland, 2008a, 2008b; Biber et al., 2004). So, language learners should be exposed to these fixed expressions and their discipline specificities (e.g., Biber, Conrad, & Cortes, 2004; Hyland, 2008a). Studies in which research articles' sections are evaluated could be of value as the previous research on lexical bundles has well attested that different disciplines may behave differently and in dissimilar ways in regard to these word combinations. So, this study was designed to address the possible differences between the abstract and conclusion sections of research articles in two disciplines of AL and IT.

Method

Corpora

One-thousand research articles published between 2015 and 2019 in Iran were selected. The random sampling technique was used as the size of the data was small. Therefore, the best results could be obtained according to the goals of the study. Out of these research articles, 500 were written by native writers and the same number of articles had been developed by L1-Persian writers. Overall, four corpora, each consisting of 250 texts, were applied in this study. To prepare the corpora, other sections of the research articles were removed. Tables 1 and 2 show the details of the four corpora applied in this study.

Table 1. Corpora Word Count

Corpora	Number of texts	Number of words
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Native corpus of AL	250	163204
Native corpus of IT	250	130653
Non-native corpus of AL	250	165706
Non-native corpus of IT	250	105840

Table 2. *Information about Journals*

No	Native corpus of AL/Journals	Number of article	No	Native corpus of IT/Journals	Number of articles
1	Applied Linguistics	50	1	Information Systems	50
2	English for Academic Purposes	50	2	Information Science	50
3	English for Specific Purposes	50	3	Future Generation Computer Systems	50
4	Language Learning	50	4	Data and Knowledge Engineering	50
5	Language Teaching Research	50	5	Computational Science	50
	Non-native corpus of AL			Non-native corpus of IT	
1	English for Academic Purposes	50	1	Information and Communication Technology Research	50
2	Language Teaching research	50	2	Information Science and Management	50
3	Applied Language Studies	50	3	Information Systems	50
4	Teaching Language Skills	50	4	Artificial Intelligence and Data Mining	50
5	Applied Linguistics	50	5	Operation Research	50

Instruments

Antconc 3.5.8. was used in this study. This software, created by Anthony (2018), helps the researchers to identify lexical bundles. This software was used to produce four-word lexical bundles lists from the corpora. In order to ascertain the reliability of this software, it is important to mention that there have been 19 releases of the program constantly since it was launched in 2002. A pilot testing of 100 abstract sections of research articles was also done by the researchers to examine the reliability and validity of the research.

The process of finding four-word lexical bundles can be done by few corpus analysis programs including Antconc. This software not only made it possible to quantize the results but also provided the information necessary for the more qualitative interpretation of the results as one of the purposes of this study. Overall, all bundles were analyzed in their respective contexts of use to determine their patterns of functions. The image of this computer software is displayed in Figure 1.

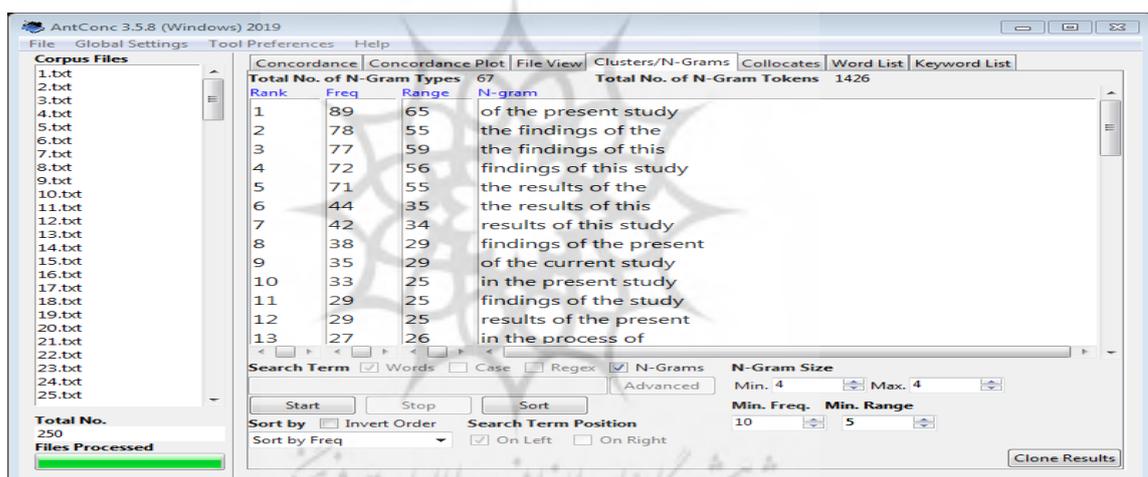


Figure 1.

Procedure

First, lexical bundles were identified in different corpora. There were some criteria in this phase of research: frequency, dispersion, and length of lexical bundles. While some studies have selected the frequency of 20-40 (Hyland, 2008b; Biber et al., 2004), some others, dealing with small size corpora, have chosen the frequency of 1-10 (e.g. Altenberg, 1998; De Cock, 1998). Therefore, given the size of the corpora used, the frequency of five was chosen for the abstract sections of both disciplines because the number of words in AL corpus was 49,452 and that of IT was 45,551 words. On the other hand, the frequency of 10 was chosen for the conclusion sections of both disciplines. The number of words in the AL conclusion corpus was 114,113,

while IT contained 60,289 words.

Dispersion is another criterion showing how bundles are used in a wide variety of texts. In other words, it shows in how many texts lexical bundles are used. In the previous studies, dispersion varies from 3 to 5 texts (Biber & Barbieri, 2007; Cortes, 2004). This depends on the number of texts, so different corpora have different dispersion rates (Hyland, 2008a,b). In the present study, the number of five texts was selected for both sections of research articles. The last criterion concerned the length of lexical bundles, ranging from 2, 3, 4, 5, to 6 words. This study focused on four-word bundles as they are the most frequent in writing (Chen & Baker, 2010). The next phase of the research was to functionally classify lexical bundles according to Hyland's (2008a) functional taxonomy, as described below.

Data Analysis.

Firstly, the researchers coded the data. The inter-judge agreement technique was performed in order to measure the reliability of the data. In other words, the agreement between two persons was made to determine the inter-rater reliability and one hundred percent agreement was obtained. This method was used to check the consistency of the coding. Secondly, lexical bundles were extracted from the Antconc. Hyland (2008a) functionally grouped lexical bundles using three broad functional categories: text-oriented, research-oriented, and participant-oriented. For each of these, some sub-categories reflecting specific uses have been proposed. While there are some other functional taxonomies of bundles (Biber et al, 2004; Hewings and Hewings, 2002), this was more appropriate for the purpose of this investigation to probe into the functions of lexical bundles in academic writing. Here, we describe this taxonomy in more detail:

Research-oriented: Describing time, place, and research procedure, this category includes:

- **Location:** Indicating time and place (e.g., *at the end of, at the university of*).
- **Procedure:** Indicating methodology (e.g., *the purpose of this, the use of the*).
- **Quantification:** Describing the number and quantity (e.g., *is one of the*)
- **Description:** Focusing on qualities or properties of the material (e.g., *in the control group, the structure of the*).
- **Topic:** Focusing on the topic of research (e.g., *as a second language*).

Text-oriented: Reflecting the organization of the text, this includes:

- **Transition Signals:** Representing a link between contrastive or additive elements (e.g., *on the other hand, in contrast to the, in line with the*).
- **Resultative Signals:** Indicating causative or referential relationship between elements (e.g., *the results of the, the findings revealed that*).
- **Structuring Signals:** Using reflexive markers to refer to other parts of the text (e.g., *as shown in figure*).
- **Framing Signals:** Describing arguments by recognizing restricted conditions (e.g., *in the presence of, on the basis of*).

Participant-oriented: Concentrating on the reader or writer of the text as the audience, this includes:

- **Stance Features:** Indicating the writer's attitude (e.g., *were more likely to*)
- **Engagement features:** Address reader's attention directly (e.g., *it should be noted*).

Then, the use of all identified lexical bundles in their respective corpora was analyzed in terms of frequency and function based on the functional taxonomy of Hyland (2008a). So, the present study attempted to explore the extent to which phraseology could contribute to academic writing. The identified lexical bundles were compared in the two sections of the research articles in two fields: AL and IT. The results obtained are described in the next section.

Results

As for the two sub-genres investigated, in the analysis of the abstract section, the identified bundles had to meet the cut-off frequency of 5. 59 lexical bundles found in AL and 39 in IT, for the two corpora reflecting L1-English writing. As illustrated (see appendix A), there were fifty-nine different bundles in the corpus of AL abstracts. The results of the was the most frequent bundle with the frequency of 28; the number of texts, representing the dispersion rate, was 21 for this bundle. Meanwhile, there were thirty-nine different lexical bundles in the corpus of abstracts in IT (see Appendix B). So, compared to AL corpus, fewer bundles were used in IT. In the field of was the most frequent bundle, with the frequency of 20 and the dispersion rate of 15 texts. It should be noted that bold bundles in the appendix section represent the shared ones, as shown in table 3 here.

Table 3. *Shared Lexical Bundles in the Two Corpora*

Numbers	Lexical bundles	AL frequency/IT frequency	AL range/IT range
1	<i>The results of the</i>	28/7	21/6
2	<i>In the field of</i>	14/20	14/15
3	<i>On the other hand</i>	6/8	6/8
4	<i>The results showed that</i>	10/6	10/6

The common bundle used in all corpora was the results of the. Two corpora only had four bundles in common: in the field of, the results of the, on the other hand, and the results showed that. The total frequency in AL and IT was 452 and 322, respectively. The most frequent bundles in the former were the results of the (28), as a foreign language (21) and the findings of this (15). The three top frequent bundles in the latter had similar frequencies: in the field of (20), is one of the (19) and show that the proposed (17). Among these frequent bundles, in both corpora, two bundles were also common: the results of the and in the field of.

Forty lexical bundles were found in the AL corpus research abstracts written by L1-English writers (see Appendix C). On the other hand was the most frequent bundle in this corpus. Meanwhile, the results of the was the most frequent lexical bundle in the L1-Persian corpus. Moreover, the number of lexical bundles in the native corpus was less than that by the L1-Persian corpus. As can be seen in Appendix D, the part of the was the most frequent bundle in this corpus. However, in the field of was the most frequent lexical bundle in the L1-Persian corpus, with both being noun-phrases. The findings of the and the extent to which were the least frequent bundles in this corpus, while their frequencies were more than those of the least frequent bundles in the L1-Persian corpus. Shared lexical bundles in the abstract corpora of AL and IT, as written by L1 English writers, are displayed in table 4 below. In the native corpus, the shared lexical bundles were on the other hand and the results of the, which were different from those in the L-Persian corpus.

Table 4. *Shared Lexical Bundles in the two Corpora*

Rank	Lexical bundles	AL frequency/IT frequency	AL range/IT range
1	<i>The results of the</i>	27/19	24/14
2	<i>On the other hand</i>	30/18	25/14
3	<i>One of the most</i>	25/19	22/15
4	<i>In the present study</i>	25/12	20/11
5	<i>Is based on the</i>	23/12	20/11
6	<i>In terms of the</i>	20/14	18/12
7	<i>In the case of</i>	20/17	18/14
8	<i>At the end of</i>	20/18	18/17
9	<i>As a result of</i>	19/18	18/18
10	<i>A the beginning of</i>	19/13	14/12
11	<i>As well as the</i>	18/16	14/14
12	<i>On the one hand</i>	18/14	14/14
13	<i>On the part of</i>	16/13	11/11
14	<i>With regard to the</i>	15/18	11/11
15	<i>The extent to which</i>	10/10	9/9

Thirty seven lexical bundles were found in the conclusion section of AL (see Appendix E). These bundles included 24% of the whole corpus, which was less than that of the abstract section in this discipline and similar to the results of abstract analysis of IT. *Of the present study* was the most frequent bundle with the frequency of 0.89. This frequency was almost eight times more than that of 10, as chosen for this corpus. Also, the range of 65 was six times more than that selected for this corpus. Unlike the highest frequent bundles, *this study can be* was the least frequent bundle, with the minimum frequency of 10, occurring in nine texts. Among these frequent bundles in both corpora, two were shared: *in the field of* and *the findings of this*. The most common bundles in the native corpus were of the text-oriented type, whereas research-oriented bundles were used more frequently, as compared to the other corpora.

There were fifteen bundles in the conclusion section of IT (see Appendix F). In comparison with the abstract section of the AL corpus, this corpus contained the less frequent bundles. *In the field of* was the most frequent bundle with the frequency of 36, occurring in 14 texts. The results, thus, indicated that three bundles including *the findings of this*, *results of this*

study and *the results of the* were used three or four times in AL texts, as compared to IT research articles, while bundles like *in the field of* and *on the other hand* were used in 14 and 18 texts, which were similar in both corpora. Figure 2 demonstrates these bundles.

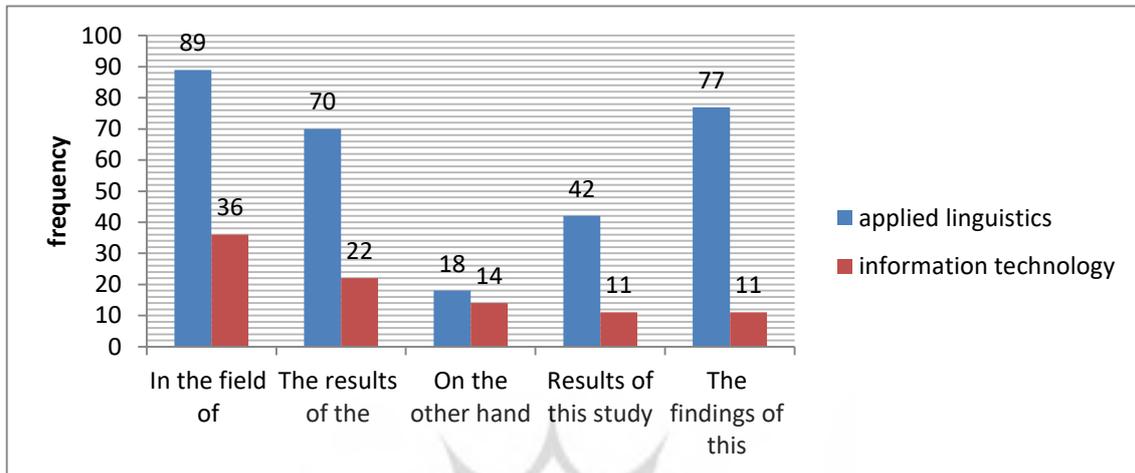


Figure 2. Comparing Shared Lexical Bundles in the Conclusion of both Corpora

Also, thirty-seven lexical bundles were found in the AL corpus of the conclusion section written by L1 English (see Appendix G). Functional analysis of abstract sections showed that generally native writers used all three sub-categories more than their Iranian counterparts did. Research-oriented bundles had the highest rank in all corpora. In the text-oriented category, abstract corpora in both AL and IT, as written by L1-Persian writers, had a similar proportion, being 36.84 % and 32.50%, respectively. Similarly, participant-oriented bundles constituted a similar proportion for the same corpora. Generally, L1 Persian writers of AL used more lexical bundles than their IT counterparts did. In regard to the conclusion section, Iranian writers used more lexical bundles in comparison to their L1-English counterparts; however, native writers used all sub-categories. In the L1-Persian corpus, IT writers drew on a higher proportion of research-oriented bundles, whereas AL writers constituted a part of text-oriented bundles.

About 56.14% of lexical bundles in the AL corpus and 60% of bundles in IT, both in L1-Persian corpus, were research-oriented bundles (see table 5), describing time and the study itself. In the category of text-oriented bundles, both AL and IT corpora of L1-Persian writing constituted a similar proportion. Resultative signals were the most frequent bundles. Participant-oriented bundles had the lowest percentage among all categories of bundles. In fact,

only 7% of bundles were participant-oriented bundles, while writers displayed a heavy use of research-oriented bundles, especially description and study-focusing sub-categories. AL and IT writers used the same number of research-oriented bundles in both L1-Persian and L1-English corpora, but native writers used more text-oriented bundles in comparison to their Iranian counterparts. As can be seen in Table 5, in all corpora, writers did not use participant-oriented bundles as much as other sub-categories, but L1 Persian writers of AL tended to use them more.

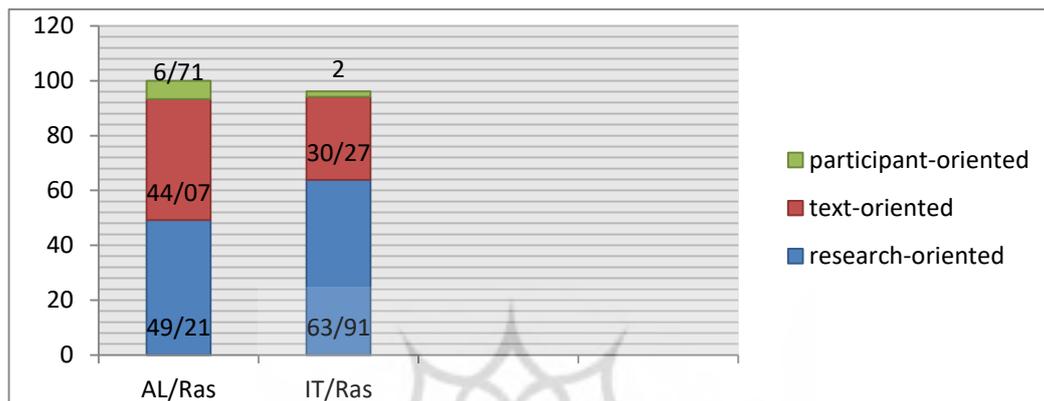


Figure 3. Functional Distribution of Bundles in the Abstract Section (token)

Table 5. Functional Classification of Bundles in AL and IT Abstracts (continued)

Major function	Sub-category	Lexical bundles
Text-oriented bundles	Structuring signals	----
	Framing signals	In the field of (15),the extent to which(8),in terms of the (8),in terms of their(6),in the context of (5),in this regard the (5),investigate the relationship between(6),significant positive correlation between(5), in the field of (20),in the form of (12),is based on the (6).
	Rephrasing signals	----
Participant-oriented	Attitude marker	
	Epistemic certain	Indicated that there was (7), revealed that there was (5)
	Epistemic uncertain	Can be used for (7)
	Intention	Study was an attempt (10), attempt to investigate the (8), in order to increase(5)
	Engagement	Of the most important (7)

Functional analysis of conclusion corpus written by L1 Persian writers indicated that about 65% of lexical bundles in AL corpus were text-oriented bundles, while about 62.5% of lexical bundles in IT were research-oriented bundles. Although both AL and IT corpora used a similar number of lexical research-oriented bundles, AL writers used text-oriented and participant-oriented bundles more than their IT counterparts. The writers in both fields did not use participant-oriented as frequently as the other two categories.

All three subcategories of bundles were used by L1-English writers of AL and IT in the conclusion corpus. Although L1-Persian writers of both AL and IT used lexical bundles frequently, L1-English writers used all categories, particularly participant-oriented bundles, which were rarely used by L1-Persian. Similar to the L1-Persian corpus in which AL writers tend to use more text-oriented bundles, we also discovered that AL writers used more lexical bundles in the L1-English corpus.

Discussion and Conclusion

Lexical bundles can be considered as valuable devices contributing to the comprehension and construction of the unfolding discourse (Biber & Barbieri, 2007, p. 247). Consequently, the analysis of different disciplines can reveal different discipline-specific word combinations (Wray, 2002). As mentioned earlier, the present study concentrated on how bundles were applied in two disciplines by using a corpus-based approach. Overall, the bundles used by L1-Persian writers in both disciplines were more than those used by the native writers. In addition, the most frequent bundles in the corpora were different. The most frequent bundles in this study were also in line with the findings of the study by Adel and Erman (2012), where the writing of Swedish and English native speakers in the field of applied linguistics were compared. Shared lexical bundles were like *on the other hand*, *the results of the* and *in the field of*.

Regarding functional differences, text-oriented bundles were used by L1-English writers more, while the frequency of research-oriented bundles in L1-Persian corpora was found to be more than that of the native corpora. The number of bundles in the native corpus was the same as that in the non-native corpus; however, in the native corpora, IT writers used more bundles than their counterparts in L1-Persian corpora. Some scholars believe that the linguistic background of L2 writers may affect their language choice. So, they use some fixed expressions repeatedly (Kashiha, 2015).

According to the results obtained, noun and prepositional phrases were the most frequent bundles in the conclusion section of both disciplines. Similar to the findings of our study, Alipour, Jalalifar, and Zarea (2013) found that AL writers used more bundles than other disciplines: computer engineering and physics. Moreover, noun phrases and prepositional phrases were the most frequent bundles used by the writers of the two disciplines. Qin (2014) examined 136 academic papers written by 20 non-native students of AL at four levels of study and 15 published articles written by native speakers of the same field. In contrast to the findings of our study, prepositional phrases like *of the present study* and noun phrases like *the findings of this* were not very frequent in that research.

According to the third research question, in the native corpus, both AL and IT writers had similar use of the three main functional categories; however, AL writers used them slightly more frequently than their IT counterparts did. Text-oriented bundles were the largest category in this corpus, while participant-oriented bundles were the least ones. In the abstract corpus belonging to L1-Persian writers, both AL and IT writers had similar use of the three main functional categories. Specifically, research-oriented bundles were the largest category of bundles, accounting for 56.14% in AL and 60% in IT; despite this, participant-oriented bundles were the smallest category, with around 7%. Both corpora had similar proportions of research-oriented bundles. Moreover, in this category, study-focusing and description were the subcategories AL writers used more than their IT counterparts did (3 times more). Meanwhile, both writers displayed a relatively equal use of goal-oriented subcategory, using 4 bundles. Regarding the text-oriented category, there was similarity in both AL and IT, with a higher percentage for AL writers. The higher use of such bundles in the AL corpus represented the AL writers' maturity in writing and their higher ability in using English structures. 44.07% of bundles in AL and 32.27% of bundles in IT corpora were considered in this category. Structuring and rephrasing subcategories were not used by the writers of both corpora. In comparison with IT writers, AL writers used resultative and framing signals with higher frequency (3 times more). The least frequent subcategory was related to transition signals, which were used by AL writers less than their IT counterparts. Interestingly, similar proportions of participant-oriented bundles were found in both corpora in the abstracts written by L1-Persian writers.

The analysis of abstracts also revealed that 43% of the bundles were research-oriented, with the most frequent subcategories being procedure and description and the least one discipline-bound bundles. Also, 59% of the bundles belonged to the text-oriented category.

Interestingly, there was a very smaller use of participant-oriented bundles, with 1% in this research. The results revealed that non-native writers used research-oriented and text-oriented bundles more than native writers did in the conclusion section; however, participant-oriented bundles were used by native writers more. Similar to the non-native corpus, AL writers tend to use all three sub-categories more than their IT counterparts. IT writers did not use them at all. In contrast to the Iranian writers, both AL and IT writers used text-oriented bundles more than the research-oriented ones.

Based on the fourth research question, the analysis of the conclusion section in the non-native corpus revealed significant differences between the two corpora. About 62.50 % of lexical bundles in the IT corpus belonged to the research-oriented category. On the other hand, about 27.93 % of bundles in AL were text-oriented bundles. These differences were found in both types and tokens distributions. Meanwhile, AL writers used only two subcategories of study-focusing and description more frequently. IT writers drew on different subcategories including study-focusing, quantification, procedure, and description.

Another finding of this study was the considerable difference between the two corpora of AL and IT in the conclusions written by L1-Persian writers in terms of text-oriented bundles, with AL writers using them more than IT counterparts (65% in AL and 37.50% in IT). In relation to subcategories, resultative and framing signals constituted the higher frequency, in comparison to transition and structuring signals. The most frequent bundles of AL corpus, *the findings of this* and *findings of this study*, were related to the resultative subcategory. Interestingly, in the AL corpus, less frequent use of structuring signals was found, with only 3 %, whereas in the IT corpus, there was no use of these bundles. Similar to the abstract section, rephrasing signals were not used by the writers of both disciplines. This could be due to the fact that our analysis was limited to the conclusion section and some specific bundles might not be used in all sections. The participant-oriented category was an area where only AL writers used these bundles in their academic writing, with 3.90 %; so, IT writers did not draw on these bundles. The low rate of such bundles as *it is important to* showed that the article's authors intended to elaborate on the significance of the study in other parts of the article, like the introduction (Kashiha, 2015).

To sum it up, this study addressed the use of lexical bundles in the abstract and conclusion sections of research articles in two disciplines of AL and IT. Regarding the differences between native and non-native writers, the latter generally used more lexical bundles in the abstract

section, but both writers used the same number of bundles in the conclusion section. It means that some bundles are specific to some sections of research articles. In relation to the differences between both disciplines, AL writers tended to use more bundles in both native and non-native corpora because they had greater knowledge of lexicon and formulas. AL writers made more frequent use of lexical bundles in both sections. In the analysis of the abstract section, the two different disciplines did not show many differences in the proportions of functional distributions of bundles, in regard to both types and tokens. However, IT writers used fewer text-oriented bundles in comparison to their AL counterparts since they professionally relied on these bundles as a point of departure, showing how good they were in English. This study also demonstrated more differences in terms of analyzing the conclusion section. In regard to the comparison of research-oriented bundles, IT writers used such bundles more than their AL counterparts did; meanwhile, the latter used more text-oriented bundles than the former did. On the other hand, while AL writers used fewer participant-oriented bundles, their IT counterparts did not use any of them. AL writers used bundles frequently in terms of frequency and function in both sections of articles. It seems, therefore, that due to the exposure they had in their academic courses, they used bundles more frequently and drew on all three main subcategories of function in relation to every section of research articles.

Implications

According to the findings, this study could help writing instructors in the field of English for Academic Purposes (EAP). This study may help them to increase the awareness of students toward these chunks in order to have more fluent production. Also, they can familiarize students with the different functions of bundles and show the ways in which lexical bundles have been used by different writers. EAP practitioners can improve the academic writing of learners by representing the bundles used by native writers.

Limitations and Future Directions

This study had two important limitations. The first one was related to the size of the corpora, which might have affected the results of the study. If more studies using larger corpora could be conducted, more revealing results would be obtained. The second limitation concerned the structure of bundles, which was not investigated in this study. Analyzing the structure of bundles along with frequency and function would allow a more precise investigation. In the

future, we also need studies investigating lexical bundles in different moves and steps representing different sections of research articles.

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Appendix A

Lexical bundles in Applied Linguistics Abstracts

Rank	Lexical bundles	Frequency	Range
1	<i>The results of the</i>	28	21
2	<i>As a foreign language</i>	21	21
3	<i>The findings of the</i>	15	15
4	<i>In the field of</i>	14	14
5	<i>There was a significant</i>	13	10
6	<i>Findings of the study</i>	12	12
7	<i>The results indicated that</i>	12	12
8	<i>Participated in the study</i>	10	10
9	<i>Results of the study</i>	10	10
10	<i>Study aimed to investigate</i>	10	10
11	<i>Study was an attempt</i>	10	10
12	<i>The findings revealed that</i>	10	10
13	<i>The present study aimed</i>	10	10
14	<i>The present study was</i>	10	10
15	<i>The results showed that</i>	10	10
16	<i>It was found that</i>	9	9
17	<i>Of the present study</i>	9	9
18	<i>As one of the</i>	8	6
19	<i>Attempt to investigate the</i>	8	7
20	<i>The extent to which</i>	8	8
21	<i>The present study investigated</i>	8	7
22	<i>At the end of</i>	7	7
23	<i>In terms of the</i>	7	7
24	<i>Indicated that there was</i>	7	6
25	<i>Participants of the study</i>	7	7
26	<i>Significant difference between the</i>	7	6
27	<i>The end of the</i>	7	7
28	<i>The findings of this</i>	7	7
29	<i>The results revealed that</i>	7	7
30	<i>Based on the results</i>	6	6
31	<i>Content analysis of the</i>	6	6
32	<i>In terms of their</i>	6	6

33	<i>Investigate the impact of</i>	6	6
34	<i>Investigate the relationship between</i>	6	6
35	<i>Of the study investigated</i>	6	5
36	<i>Of this study was</i>	6	6
37	<i>On the other hand</i>	6	6
38	<i>The findings suggest that</i>	6	5
39	<i>To investigate the impact</i>	6	6
40	<i>Were selected based of</i>	6	6
41	<i>While the control group</i>	6	6
42	<i>A significant positive correlation</i>	5	5
43	<i>And a control group</i>	5	5
44	<i>Data were analyzed through</i>	5	5
45	<i>In the context of</i>	5	5
46	<i>In the control group</i>	5	5
47	<i>No statistically significant difference</i>	5	5
48	<i>Of the current study</i>	5	5
49	<i>Revealed that there was</i>	5	5
50	<i>Significant positive correlation between</i>	5	5
51	<i>Study sought to investigate</i>	5	5
52	<i>The findings suggest that</i>	5	5
53	<i>The content analysis of</i>	5	5
54	<i>The data were analyzed</i>	5	5
55	<i>The study indicated that</i>	5	5
56	<i>This study aimed to</i>	5	5
57	<i>To analyze the data</i>	5	5
58	<i>To investigate the relationship</i>	5	5
59	<i>Was a significant difference</i>	5	5

Appendix B

Lexical Bundles in Information Technology Abstracts

Rank	Lexical bundles	Frequency	Range
1	<i>In the field of</i>	20	15
2	<i>Is one of the</i>	19	18
3	<i>Show that the proposed</i>	17	17
4	<i>The performance of the</i>	17	13
5	<i>state of the art</i>	14	14
6	<i>Of the proposed method</i>	13	11
7	<i>In the form of</i>	12	10
8	<i>In this paper the</i>	12	12
9	<i>The results show that</i>	11	11
10	<i>This paper we propose</i>	9	8
11	<i>One of the most</i>	9	9
12	<i>The proposed method is</i>	8	8
13	<i>On the other hand</i>	8	8
14	<i>The accuracy of the</i>	8	7
15	<i>The proposed algorithm is</i>	8	8
16	<i>The results of the</i>	7	5
17	<i>Can be used for</i>	7	5
18	<i>In comparison with the</i>	7	6
19	<i>Of the most important</i>	7	7
20	<i>Results demonstrate that the</i>	7	7
21	<i>The aim of this</i>	7	7
22	<i>This paper aims to</i>	7	7
23	<i>To find the optimal</i>	7	6
24	<i>Used to evaluate the</i>	6	6
25	<i>Is based on the</i>	6	5
26	<i>Of the proposed algorithm</i>	6	6
27	<i>The effectiveness of the</i>	6	6
28	<i>The efficiency of the</i>	6	6
29	<i>The purpose of this</i>	6	5
30	<i>The results showed that</i>	6	6
31	<i>Examine the impact of</i>	5	5
32	<i>Experimental results show that</i>	5	5
33	<i>For the first time</i>	5	5
34	<i>Improved the importance of</i>	5	5

35	<i>Is compared with the</i>	5	5
36	<i>Simulation results show that</i>	5	5
37	<i>The last two decades</i>	5	5
38	<i>The main objective of</i>	5	5
39	<i>The proposed algorithm has</i>	5	5

Appendix C.

Lexical Bundles in Applied Linguistics Abstracts (written by LI-English writers)

Rank	Lexical bundles	Frequency	Range
1	<i>On the other hand</i>	30	25
2	<i>In the form of</i>	30	24
3	<i>As one of the</i>	29	24
4	<i>The results of the</i>	27	24
5	<i>In the present study</i>	27	24
6	<i>Findings of the study</i>	25	22
7	<i>One of the most</i>	25	22
8	<i>In the present study</i>	25	20
9	<i>Results of the present</i>	24	20
10	<i>Is based on the</i>	23	20
11	<i>In terms of the</i>	20	18
12	<i>In the case of</i>	20	18
13	<i>At the end of</i>	20	17
14	<i>On the basis of</i>	20	17
15	<i>As a result of</i>	19	18
16	<i>At the beginning of</i>	19	14
17	<i>As well as the</i>	18	14
18	<i>In the process of</i>	18	14
19	<i>On the one hand</i>	18	14
20	<i>The fact that the</i>	18	14
21	<i>Based on the findings</i>	17	12
22	<i>The focus of the</i>	17	11
23	<i>A number of studies</i>	17	12
24	<i>On the part of</i>	16	11
25	<i>With regard to the</i>	15	11
26	<i>The analysis of the</i>	15	12
27	<i>In addition to the</i>	15	11
28	<i>For each of the</i>	14	11
29	<i>The purpose of this</i>	14	11
30	<i>In relation to the</i>	13	10
31	<i>This paper reports on</i>	11	10
32	<i>The aim of this</i>	10	10
33	<i>As a foreign language</i>	10	9
34	<i>The extent to which</i>	10	9

35	<i>The ways in which</i>	10	8
36	<i>To the development of</i>	9	9
37	<i>A wide range of</i>	8	8
38	<i>At the same time</i>	7	6
39	<i>It is suggested that</i>	7	5
40	<i>This paper investigate the</i>	5	5

Appendix D

Lexical Bundles in Information Technology Abstracts (Written by LI-English Writers)

Rank	Lexical bundles	Frequency	Range
1	<i>The part of the</i>	20	15
2	<i>The basis of the</i>	20	15
3	<i>In order to make</i>	20	15
4	<i>The results of the</i>	19	14
5	<i>It was found that</i>	19	16
6	<i>The nature of the</i>	19	17
7	<i>One of the most</i>	19	15
8	<i>The content of the</i>	19	14
9	<i>In the use of</i>	18	16
10	<i>As one of the</i>	18	15
11	<i>On the other hand</i>	18	14
12	<i>With regard to the</i>	18	15
13	<i>In the case of</i>	18	17
14	<i>At the end of</i>	18	17
15	<i>The findings of the</i>	18	17
16	<i>As a result of</i>	18	18
17	<i>In terms of the</i>	17	14
18	<i>As well as the</i>	16	14
19	<i>In the process of</i>	15	10
20	<i>On the one hand</i>	14	14
21	<i>In this paper we</i>	14	14
22	<i>State of the art</i>	13	12
23	<i>This paper we propose</i>	13	11
24	<i>At the beginning of</i>	13	12
25	<i>On the part of</i>	13	11

26	<i>The state of the</i>	13	11
27	<i>Of the proposed method</i>	13	12
28	<i>We show that the</i>	12	11
29	<i>Is based on the</i>	12	11
30	<i>In the present study</i>	12	11
31	<i>The ways of the</i>	12	10
32	<i>This paper shows that</i>	10	10
33	<i>To the fact that</i>	10	10
34	<i>The findings of the</i>	10	9
35	<i>The extent to which</i>	10	9

Appendix E

Lexical Bundles in Applied Linguistics Conclusion

Rank	Lexical bundles	Frequency	Range
1	<i>Of the present study</i>	89	65
2	<i>The findings of this</i>	77	59
3	<i>Findings of this study</i>	72	56
4	<i>The results of the</i>	70	54
5	<i>Results of this study</i>	42	34
6	<i>Findings of the present</i>	38	29
7	<i>Of the current study</i>	35	29
8	<i>In the present study</i>	35	29
9	<i>Results of the present</i>	29	25
10	<i>In the process of</i>	29	25
11	<i>The present study was</i>	27	26
12	<i>It can be concluded</i>	21	19
13	<i>In line with the</i>	20	19
14	<i>Can be concluded that</i>	18	17
15	<i>On the other hand</i>	18	18
16	<i>It was found that</i>	17	14
17	<i>As well as the</i>	16	14
18	<i>It was revealed that</i>	15	10
19	<i>In the field of</i>	14	14
20	<i>The fact that the</i>	14	14
21	<i>Based on the findings</i>	13	12
22	<i>Are in line with</i>	13	11
23	<i>Findings of the current</i>	13	12
24	<i>In the context of</i>	12	11
25	<i>It should be noted</i>	12	11
26	<i>Of this study can</i>	12	11
27	<i>Of this study showed</i>	12	10

28	<i>Results of the current</i>	12	11
29	<i>Should be noted that</i>	12	12
30	<i>With respect to the</i>	12	12
31	<i>Be considered as a</i>	12	10
32	<i>In a way that</i>	11	11
33	The findings revealed that	11	10
34	The findings suggest that	11	10
35	It could be concluded	11	11
36	Of this study have	11	10
37	This study can be	10	9

Appendix F

Lexical Bundles in Information Technology Conclusions

Rank	Bundles	Frequency	Range
1	<i>In the field of</i>	36	14
2	<i>Of the proposed method</i>	33	17
3	<i>In this paper we</i>	32	31
4	<i>The results of the</i>	22	19
5	<i>The performance of the</i>	20	16
6	<i>The proposed method is</i>	18	14
7	<i>Performance of the proposed</i>	16	12
8	<i>Of the proposed algorithm</i>	14	12
9	<i>On the other hand</i>	14	12
10	<i>And the number of</i>	12	6
11	<i>Results of this study</i>	11	9
12	<i>That the proposed method</i>	11	9
13	<i>The effectiveness of the</i>	11	9
14	<i>The findings of this</i>	11	11
15	<i>The results showed that</i>	11	10

Appendix G

Lexical Bundles in Applied Linguistics Conclusions (Written by LI-English Writers)

Rank	Lexical bundles	Frequency	Range
1	<i>The results of the</i>	53	33
2	<i>In other words the</i>	50	33
3	<i>Findings of this study</i>	50	30
4	<i>In line with the</i>	45	30
5	<i>It can be concluded</i>	45	29
6	<i>Findings of the present</i>	43	29
7	<i>The results showed that</i>	32	29
8	<i>It should be noted</i>	30	29
9	<i>The fact that the</i>	29	27
10	<i>On the other hand</i>	28	26
11	<i>It was found that</i>	28	26
12	<i>In the use of</i>	20	18
13	<i>Can be seen in</i>	19	15
14	<i>In contrast to the</i>	19	15
15	<i>As well as the</i>	19	15
16	<i>In order to make</i>	18	14
17	<i>Due to the fact</i>	18	14
18	<i>It was revealed that</i>	16	10
19	<i>In the field of</i>	14	14
20	<i>In the case of</i>	14	14
21	<i>Based on the findings</i>	14	14
22	<i>Are in line with</i>	14	11
23	<i>At the same time</i>	13	11
24	<i>It is important to</i>	13	11
25	<i>The extent to which</i>	13	10
26	<i>It is possible that</i>	11	11
27	<i>The use of the</i>	11	10
28	<i>As a result of</i>	10	10
29	<i>Should be noted that</i>	11	9
30	<i>With respect to the</i>	11	9
31	<i>To be able to</i>	11	9
32	<i>In the course of</i>	11	8
33	<i>On the one hand</i>	11	8
34	<i>The ways in which</i>	11	8
35	<i>This study can be</i>	10	5
36	<i>Study was an attempt</i>	10	5
37	<i>The basis of the</i>	10	5