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A Comparative Study on the Structural and Functional Features of Four-Word Bundles Used by English Native and Non-Native Upper-Level Students in the Economics Research Papers

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Abstract: Four-word lexical bundles are crucial in assessing English proficiency in academic writing. This study aims to examine similarities and differences in four-word lexical bundles' structural and functional use by native and non-native English-speaking students in economics papers from the MICUSP database, exploring reasons for these differences related to second language acquisition and teaching, and suggests improvements. Corpora were first cleaned and analyzed using AntConc, then categorized by Biber et al.'s structural taxonomy[1] and Hyland's functional taxonomy[2]. Results found that Native students favored noun/prepositional phrases and research-oriented patterns, while non-natives used more varied verb phrases and text-oriented patterns. The study discussed causes like L1 transfer in L2 acquisition and text focus in L2 teaching, aiming to inform future ESL pedagogy.

1. Introduction

English has become the established lingua franca of academia [3][4], with a growing number of scholarly publications authored by non-native English speakers [3]. This trend underscores the need to examine the linguistic challenges faced by these writers in the global academic landscape.

Lexical bundles—recurrent word sequences—are recognized as fundamental to academic prose and reflective of writing proficiency [1][2][5]. Comparative analyses of their structural and functional use by native and non-native writers can shed light on academic discourse conventions, informing both writing practices and pedagogical approaches [1][2][4]. The central role of lexical bundles has thus drawn sustained scholarly attention [6][7].

While prior research has explored lexical bundles in specific disciplines such as chemistry, history, and biology, there remains a notable gap in the field of economics. [8] Moreover, few studies have compared native and non-native writers using corpora of student-authored academic texts.

This study addresses these gaps by analyzing the structural and functional characteristics of four-word lexical bundles in economics research papers written by native and non-native English-speaking students. [12] The findings aim to support non-native writers in aligning their work

with academic English conventions, thereby contributing to improved scholarly writing in an English-dominated academic environment.

2. Literature review

2.1 Lexical bundles

Biber et al. first introduced the term “lexical bundles”, defining them as recurrent sequences of words, irrespective of idiomaticity or grammatical structure [1]. Their research highlighted the pervasiveness of these bundles in both academic and conversational contexts, emphasizing their central role in shaping coherent discourse.

Since the early 21st century, lexical bundle research has increasingly focused on academic discourse, with particular attention to variation across disciplines and linguistic backgrounds [9][10][11]. Four-word bundles have become a standard unit of analysis. Adel and Erman [13] observed that many three-word bundles are subsumed within four-word ones. Similarly, Biber et al. [9] found that five-word bundles often overlap with four-word sequences, making the latter a more efficient analytic unit. Chen and Baker [5] further supported this view, noting that four-word bundles are both prevalent and manageable in scope.

Collectively, these findings establish four-word lexical bundles as a practical and informative focus, offering valuable insights into the structural patterns that underpin academic writing.

2.2 Native/non-native English writers’ usage of lexical bundles

A substantial body of empirical research has compared the use of four-word lexical bundles in academic writing by native (L1) and non-native (L2) English writers. Notably, Güngör and Uysal [6] analyzed research articles in educational sciences authored by native English speakers and Turkish L2 writers, indicating greater syntactic versatility and rhetorical sophistication.

This pattern is echoed in other comparative studies across various academic domains. Non-native writers generally show a higher reliance on VP-based bundles and discourse markers, with less variety and lower complexity in bundle usage. Even advanced L2 learners often struggle to acquire certain bundles through exposure alone [5][13][14]. In contrast, native writers demonstrate more nuanced use of structures involving this-phrases, existential there, modifiers, and passive voice, reflecting both functional diversity and syntactic control [5][13][15].

Despite these insights, research on lexical bundles in economics remains scarce. Few studies have examined academic writing by native and non-native upper-level students within this discipline, highlighting a gap this study seeks to address.

2.3 Structural taxonomy and functional taxonomy

Biber et al’s structural taxonomy[1] was adopted by the researcher as it was the first and only taxonomy developed by Biber et al in the book called ‘Longman Grammar of Spoken and Written English’. It includes 12 categories in academic prose (shown in Table 1), which can serve as basic classification criteria of the four-word lexical bundles.

Hyland developed the functional classification[2] reflecting the concerns of academic writing and classified each lexical bundle into one of the three categories: (1) research-oriented bundles, dealing with ideational function; (2) text-oriented bundles, concerned with textual function; (3) participant-oriented bundles, serving an interpersonal function. Each category has been divided into several subcategories as listed in Table 2.

In the current study, the lexical bundles were categorized functionally depending on these three

functions, and when necessary, concordance lines were controlled in order to find out the functions of lexical bundles.

Table 1 Structural taxonomy of lexical bundles by Biber et al. (1999, pp. 1014-1024)

	Structure	Examples
1.	Noun phrase with of- phrase fragment	the beginning of the, the shape of the
2.	Noun phrase with other post-modifier fragments	the way in which, the extent to which
3.	Prepositional phrase with embedded of-phrase	as a result of, in the case of fragment
4.	Other prepositional phrase (fragment)	at the same time, on the other hand
5.	Anticipatory it + verb / adjective phrase	it is possible to, it should be noted that
6.	Passive verb+prepositional phrase fragment	is shown in figure, is based on the
7.	Copula be + noun / adjective phrase	is one of the, is part of the, is due to the
8.	(Verb phrase+) that- clause fragment	has been shown that, that there is no
9.	(Verb/ adjective +) to-clause fragment	are likely to be, has been shown to
10.	Adverbial clause fragment	as we have seen, if there is a
11.	Pronoun/ noun phrase+ be (+…)	this is not the, there was no significant
12.	Other expressions	as well as the, than that of the

Table 2 Functional taxonomy of lexical bundles by Hyland (2008a)

	Sub-category	Example
Research-oriented bundles	Location	in the area of
	Procedure	the purpose of the
	Quantification	to each of the
	Description	the development of the
	Topic	native speakers of English
Text-oriented bundles	Transition signals	on the other hand
	Resultative signals	it is found that
	Structuring signals	are shown in table
	Framing signals	on the basis of
Participant-oriented bundles	Stance features	are more likely to
	Engagement features	as can be seen

The current study aims to compare the structural and functional features of the four-word lexical-bundles' usage in native and non-native economics' research papers. The results of the study are expected to enhance the quality of academic English writing among non-native student writers.

(1) How do the overall frequencies of four-word bundles usage differ between native and non-native English student writers when writing research papers in the field of economics?

(2) What are the structural and functional similarities and differences in the four-word bundles used by native and non-native English student writers?

(3) What are the reasons for the similarities and differences in the structure and function of the four-word lexical bundles used by native and non-native English student writers?

3. Method

The current study adopts the corpus linguistics as a methodology which in fact is "concerned primarily with the description and explanation of the nature, structure and use of language and languages and with particular matters such as language acquisition, variation and change" [16].

Based on a corpus-driven analysis, the current study aims to determine the shared and distinct uses of lexical bundles by native and non-native English writers in the research papers in Economics.

3.1 Data collection

The data for this study was collected from the Michigan Corpus of Upper-level Student Papers (MICUSP, https://micusp.elicorpora.info/main), an academic corpus meticulously compiled by researchers and students at the University of Michigan English Language Institute (ELI). The MICUSP serves as a rich repository of written academic discourse, offering a comprehensive snapshot of student writing across various disciplines.

After setting the constraints to: 1) Nativeness: Both native and non-native English learners; 2) Discipline: Economics; 3) Paper type: Research paper. A total of 11 relevant papers were obtained, including 6 articles from native English writers (27186 tokens) and 5 articles from non-native English writers (25364 tokens). The corpus statistics are presented in Table 3.

Table 3 Corpus statistics

	Native	Non-native
The number of articles	6	5
Word tokens	27186	25364
Word types	3375	2301

3.2 Procedure

The cleaned data was analyzed using both qualitative and quantitative methods. AntConc 3.5.8 was used to extract four-word lexical bundles from texts by native and non-native English writers, with an N-gram size of four and a minimum frequency of four. This produced two lists for comparative frequency analysis.

Next, the bundles were categorized structurally using Biber et al.'s taxonomy, and functionally using a refined version of Hyland's taxonomy, suited to research writing. Classification results are presented in tables to highlight structural and functional similarities and differences between the two groups.

Finally, based on frequency, structure, and function, a qualitative analysis explores the findings through the lens of second language acquisition and teaching.

4. Results

4.1 Overall frequencies of four-word lexical bundles

First of all, the overall number of lexical bundles in native and non-native writing was identified. Table 4 has demonstrated the overall frequencies of four-word lexical bundles in the academically published economics papers by native and non-native upper-level students. Furthermore, bundle types' percentage and bundles tokens' per-million-word frequency were also calculated in order to compare the standardized findings between the two groups.

Table 4 Overall frequencies of four-word lexical bundles

	Native	Non-native
Bundle Types	58	45
Bundle Tokens	299	360
Per-million-word frequency	10998	14193

As can be seen in Table 4, non-native students' using of lexical bundles employed lower types (n= 45) but higher tokens (n= 1060) than that of native students' types (n= 58) and tokens (n= 299). Upon calculating the per-million-word frequency of lexical bundles using the token method ($f = \frac{1000000}{\text{corpus size}} \times bundles\ \ tokens$) for both the native and non-native groups (f_{native}=10998,$f_{non-native}$ =14193), it was found that, non-native students exhibited a higher frequency of four-word lexical bundles in their economics papers, indicating an extensive—though not necessarily diverse—use of recurrent linguistic patterns in academic discourse. While they employed more bundles in total, their range was narrower compared to native students.

Table 5 presents the most frequent four-word lexical bundles found in the writing of both native and non-native students.

Table 5 The most frequent four-word lexical bundles in the corpora

Native's Bundle Type	Bundle Frequency	Bundle Rank	Non-native's Bundle Type	Bundle Frequency	Bundle Rank
the size of the	18	1	the number of the	27	1
are more likely to	10	2	are more likely to	20	2
it is clear that	9	3	likely to be the	11	3
are less likely to	8	4	the evolution of the	9	4
as a result of	8	5	as can be seen	7	5
i am going to	5	6	at the time of	7	6
the number of the	5	7	the reason for the	5	7

As shown in Table 5, the most frequent four-word lexical bundle among native students was 'the size of the' (18 occurrences), while 'the number of the' was most common in non-native texts (27 occurrences). Notably, 'are more likely to' ranked second in both corpora, representing a shared usage pattern. With the exception of 'as well as', most high-frequency bundles appeared more often in Turkish non-native texts than in those of native students, indicating a heavier reliance on certain recurrent phrases.

4.2 Comparison of structural features of four-word lexical bundles

Table 6 Distribution of structural subcategories

Structural subcategories		Native		Non-native	
NP-based	Noun phrase with of-phrase fragment	20 (51%)	59%	7 (18%)	18%
	Noun-phrase with other post-modifier fragment	3 (8%)		-	
PP-based	Prepositional phrase with embedded of-phrase fragment	7 (18%)	33%	2 (5%)	25%
	Other prepositional phrase (fragment)	4 (10%)		2 (5%)	
	Copula be + noun phrase/adjective phrase	-		5 (13%)	
	Anticipatory it + verb phrase/adjective phrase	1 (3%)		-	
	(Verb phrase +) that-clause fragment	1 (3%)		1 (3%)	
VP-based	(Verb/adjective +) to-clause fragment	2 (5%)	8%	7 (18%)	57%
	Passive verb + prepositional phrase fragment	-		5 (13%)	
	Adverbial clause fragment	-		1 (3%)	
	Pronoun/noun phrase + be (+…)	-		-	
	Other expressions	1 (3%)		10 (25%)	
Total		39		40	

In this section, by employing the structural model proposed by Biber et al., the four-word lexical

bundles identified in the usage of both native and non-native students, as retrieved above, were correspondingly categorized as shown in Table 6. After the comparative analysis, similarities and differences were summarized below.

4.2.1 Comparison of different structural features of four-word lexical bundles

As shown in Table 6, clear structural differences emerge between the two groups. Native students predominantly employed 'noun phrase-based' and 'prepositional phrase-based' structures (59% and 33%, respectively), with limited use of 'verb phrase-based bundles' (8%) (see Examples 1–3). In contrast, non-native students relied more heavily on 'verb phrase structures' (57%), with lower usage of 'noun phrase-based' (18%) and 'prepositional phrase-based bundles' (25%) (see Examples 4–6).

The most striking divergence lies in the use of noun phrases with of-phrase fragments, which accounted for 51% of bundles in native texts but only 18% in non-native texts. Conversely, non-native students showed a substantially higher use of other verb phrase expressions (25% vs. 3%). These differences highlight distinct structural preferences and linguistic patterns in the academic writing of native and non-native students.

Example 1: "In order to demonstrate the size of the domestic agriculture sector..." (Native, Rank 4, Freq. 9)

Example 2: "As a result of these rights, manufacturer was receiving freight-rates on transported goods of 18-30% of their value." (Native, Rank 25, Freq. 4)

Example 3: "...it is clear that these organizations prefer to..."(Native, Rank 11, Freq. 6)

Example 4: "As can be seen, there are changing relationships between educational and fertility levels longitudinally." (Non-native, Rank 57, Freq. 5)

Example 5: "...the number of the aged 41-64 on their educational levels will be ..." (Non-native, Rank 18, Freq. 10)

Example 6: "...they completed their fertility at the time of the policy and thus..." (Non-native, Rank 58, Freq. 5)

4.2.2 Comparison of similar structural features of four-word lexical bundles

Despite notable differences, certain structural similarities are also evident. The use of prepositional phrase-based bundles is relatively comparable between native and non-native students, accounting for 33% and 25% respectively. Similarly, both groups exhibited equal—albeit low—use of '(verb phrase +) that-clause fragments' (see Examples 7 and 8). Notably, neither group employed 'the pronoun/noun phrase + be (+…)' structure, with both showing zero occurrences.

These patterns suggest a shared tendency to favor prepositional phrases for postmodifying nouns and to use that-clauses to introduce actions or ideas. The absence of simpler constructions like 'there be' may reflect an effort by both groups to adopt more formal, discipline-appropriate academic language.

Example 7: "It has been shown that schooling adds another dimension to this relationship." (Native, Rank 31, Freq. 4)

Example 8: "Also, it should be emphasized that the coefficient of negative abnormal earnings is..." (Non-native, Rank 40, Freq. 4)

4.3 Comparison of functional features of four-word lexical bundles

In this section, by employing the functional model proposed by Hyland, the four-word lexical bundles identified in the usage of both native and non-native students, as retrieved above, were correspondingly categorized as shown in Table 7. After the comparative analysis, similarities and differences were summarized below.

Table 7 Distribution of functional subcategories

Functional subcategories		Native		Non-native	
Research-oriented bundles	Location	1 (3%)	20 (69%)	-	8 (24%)
	Procedure	1 (3%)		3 (8%)	
	Quantification	-		-	
	Description	14 (48%)		5 (14%)	
	Topic	4 (14%)		-	
Text-oriented bundles	Transition signals	1 (3%)	6 (21%)	3 (8%)	26 (70%)
	Resultative signals	2 (7%)		12 (32%)	
	Structuring signals	2 (7%)		6 (16%)	
	Framing signals	1 (3%)		5(14%)	
Participant-oriented bundles	Stance features	3 (10%)	3 (10%)	1(3%)	3 (6%)
	Engagement features	-		2 (5%)	
Total		29		37	

4.3.1 Comparison of different functional features of four-word lexical bundles

As shown in Table 7, native and non-native students display distinct functional preferences in their use of lexical bundles. Native students predominantly employed ‘research-oriented bundles’ (69%), with a particularly high frequency of ‘description bundles’ (48% vs. 14% in non-native texts; see Examples 9 and 10). This suggests a strategic emphasis on empirical grounding and detailed exposition in native students’ writing.

In contrast, non-native students relied more heavily on ‘text-oriented bundles’, which comprised 70% of their total usage. Notably, their use of ‘resultative signals’ was significantly higher (32% vs. 7% in native texts; see Examples 11 and 12), reflecting a stronger focus on textual cohesion and organization.

Example 9: "For example, the coefficient on the number of siblings in 2000 means that..." (Native, Rank 8, Freq. 8)

Example 10: "Specifically, for the older cohorts, the negative relationship is..." (Non-native, Rank 46, Freq. 6)

Example 11: "Thus in this model screening is obtained endogenously as a result of strategic agent behavior..." (Non-native, Rank 3, Freq. 15)

Example 12: "...fertility policy might be the reason for the evolution of the relationship." (Non-native, Rank 39, Freq. 4)

4.3.2 Comparison of similar functional features of four-word lexical bundles

Despite clear differences, both groups also exhibit functional similarities in their use of lexical bundles. ‘Participant-oriented bundles’ were used infrequently by both native (10%) and non-native (6%) students—likely reflecting the formal and impersonal nature of academic writing, which discourages personal stance. Notably, both groups employed ‘are more likely to’ to cautiously express authorial stance (see Examples 13 and 14).

Additionally, neither group utilized Quantification bundles within the research-oriented category. Instead, numerical data were presented through objective phrases such as ‘the number of the’, without employing bundles that explicitly convey magnitude (see Examples 15 and 16). This shared absence suggests a common tendency to avoid constructions that may be perceived as less formal or less precise in academic discourse.

Example 13: "...zero or 100 are more likely to reflect confusion than information about held

beliefs." (Native, Stance features, Rank 5, Freq. 8)

Example 14: "Namely, many industries are more likely to have larger stock price ..." (Non-native, Stance features, Rank 28, Freq. 7)

Example 15: "I also conducted analyses,...and the number of the employees in these firms." (Native, Research-oriented, Freq. 3)

Example 16: "Furthermore, both the number of children ever born..." (Non-native, Quantification, Rank 18, Freq. 10)

5. Discussion

Building on the data presented, this section explores the structural and functional similarities and differences in four-word lexical bundle use between native and non-native students. Since English is a second language for non-native writers, targeted instruction is essential to support their language acquisition. Here, ‘instruction’ refers to language teaching, while ‘mastery’ denotes acquisition. Thus, the observed patterns in academic writing reflect underlying processes in second language acquisition and pedagogical practices.

5.1 Reasons for the differences of structural features

5.1.1 Inherent syntactic familiarity

Native speakers exhibit an intuitive command of English syntax, which inclines them towards the utilization of complex noun and prepositional phrases (e.g., ‘the ways in which’). This proficiency indicates a sophisticated understanding of the efficient conveyance of information within these structural contexts.

In contrast, non-native speaker (NNS) students, who may have a less robust internalized grammatical repertoire and a limited lexical resource, tend to focus on verb phrases and passive constructions that offer greater ease of variation (e.g., ‘As the table shows that’). This tendency could stem from the relative simplicity and flexibility of these structures in comparison to the more intricate noun and prepositional phrases commonly favored by native speakers.

5.1.2 L1 transfer

Non-native speakers often import sentence structures from their first language (L1), which can lead to a preference for verb phrases and passive constructions that are more prevalent or straightforward in their L1. For instance, in Chinese, the subject, typically the agent of the action, is commonly placed at the beginning of a sentence.

In contrast, English often prioritizes the object of the action at the onset of a sentence. When describing outcomes presented in a table, a Chinese speaker might initially think to express it as ‘The table shows the results that...’ which reflects the L1 influence of starting with the agent. However, in English, the equivalent expression might be structured as ‘Results shown in the table indicated that...,’ which demonstrates a preference for noun phrases and passive voice, aligning with the syntactic conventions of English academic writing.

5.1.3 Lack of systematic academic writing pedagogy

Through the investigation, it can discovered that even high-level non-native English students struggle to accurately and variably employ four-word lexical bundles that meet the demands of academic discourse. These students often possess a rich vocabulary reserve; however, they are not adept at utilizing more specialized and scholarly syntax for writing academic texts. This observation

can be fundamentally attributed to the insufficient provision of systematic and standardized academic writing instruction, especially in the context of English serving as the primary lingua franca for international academic exchange.

5.2 Reasons for the differences of functional features

5.2.1 Academic rhetorical conventions

Native students' utilization of research-oriented bundles, particularly the descriptive subtype (e.g., 'The scale of'), is in harmony with the conventions of English academic writing, which prioritize thorough exposition and precision. As native speakers, they transition more fluidly between everyday language and the specialized discourse required in academic contexts, possessing a clearer understanding of how to deploy specific lexical bundles to fulfill academic functions.

Conversely, learners of English as a second language often encounter a more homogenous landscape during the acquisition process, with limited opportunities to apply language within academic settings. This constrained exposure results in a less intimate familiarity with the relevant conventions and the nuanced use of lexical bundles that are pivotal in scholarly communication.

5.2.2 Strategic clarity in writing

Non-native speakers' predilection for text-oriented bundles, particularly resultative signals, likely reflects a deliberate strategy aimed at ensuring the clarity and logical progression of their writing. In situations where they are not fully acquainted with a second language, they tend to focus on whether the meaning of the text is clearly conveyed and whether the wording is appropriate.

In contrast, native speakers, owing to their adeptness with language expression, often do not need to exert extensive effort in crafting their texts. Their familiarity with linguistic nuances allows for a more effortless construction of sentences and paragraphs that adhere to the stylistic and rhetorical expectations of academic writing.

5.2.3 Pedagogical focus on coherence

The emphasis in second language teaching on clarity and structure might lead non-native speakers to utilize framing bundles that enhance the coherence of their texts. Whereas non-native speakers might be more influenced by teaching that prioritizes clarity and structure over depth, leading to a greater use of text-oriented bundles.

In conclusion, the structural and functional preferences in the use of 4-word lexical bundles by native and non-native speakers are shaped by a complex interplay of L1 influence, SLA processes, and SLT practices. To bridge these gaps, SLT should aim to enhance the understanding of varied syntactic structures and the nuanced use of functional categories in academic writing.

6. Conclusion

This study compared the structural and functional features of four-word lexical bundles in economics research papers by native and non-native English-speaking upper-level students. Native students favored noun and prepositional phrase structures, reflecting a nuanced command of academic prose. In contrast, non-native students preferred verb-phrase structures and text-oriented bundles, using more bundles overall but with less variety. The findings highlight the need for targeted language instruction addressing these distinct preferences to improve non-native students' academic writing.

While offering valuable insights, this study is limited by its corpus size and focus on a single

discipline. Future research should expand across disciplines and examine cultural and educational influences on lexical bundle use. Longitudinal studies could also track changes in non-native writers' patterns and assess the impact of pedagogical interventions.

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