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| RESEARCH ARTICLE

## The Functional Features of Chunks in Journal Articles of Aquaculture

Jiumei Xu<sup>1</sup> and Fei Guo<sup>2</sup> ✉

<sup>1,2</sup>*School of International Languages, Shanghai Ocean University, Shanghai, China*

**Corresponding Author:** Fei Guo, **E-mail:** [fguo@shou.edu.cn](mailto:fguo@shou.edu.cn)

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| ABSTRACT

This study investigates the functional similarities and differences of four-word chunks in the academic discourse of aquaculture by Chinese and international scholars based on Hyland's functional classification method within a corpus-driven approach. The findings reveal that, compared to their international counterparts, Chinese scholars significantly utilize more four-word chunks. Functionally, Chinese scholars frequently employ quantification, structure, framing, and engagement chunks, underscoring the importance they assign to the logic of discourse and the interaction between authors and readers. The infrequent use of description chunks suggests that it is essential for Chinese scholars to fully appreciate the significance of describing research objects, methods, and results in order to convey the foundational and experimental nature of hard science research. Furthermore, the structures of chunks used by Chinese and international scholars to express the same discourse functions differ. The expression of data indication among Chinese scholars appears more solidified. These research results can offer valuable references for academic writing.

| KEYWORDS

Four-word Chunks; Function; Academic Discourse; Aquaculture; Corpus.

| ARTICLE INFORMATION

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### 1. Introduction

Lexical bundles are word combinations that recur most commonly in a given register, which are distributed in a certain number of texts (Biber et al., 1999) and are stored and used as a whole (Wray, 2002). Different scholars describe this phenomenon of lexical bundles using various terms based on their theoretical frameworks, research objectives, and methodologies. For instance, terms such as 'chunks' (Sinclair, 1991), 'prefabs' (Nattinger & DeCarrico, 1992), 'lexical bundles' (Biber et al., 1999; Cortes, 2004), 'formulaic sequences' (Wray, 2002), 'word clusters' (Hyland, 2008a), and 'n-grams' (Stubbs, 2007) are commonly employed. In this study, the term 'chunks' is selected for analysis.

High-frequency words combine to form chunks, thereby influencing the immediate processing of sentences. Their prevalence signifies that these chunks have become integral to the language used within academic discourse communities (Schmitt & Carter, 2002; Wang, 2020). As the basic unit of discourse construction, chunks play an important textual function in language production, especially in academic writing, helping to shape the meaning of the text and highlight the author's identity as an "expert" in a language community (Hyland, 2008a). Consequently, authors who master the characteristic chunks of a specific field can enhance their effective communication with members of that discipline. This paper compares the functional features of chunks in academic articles published by Chinese and international scholars in aquaculture journals, aiming to identify similarities and differences that can contribute to the improvement of scholars' communication, academic writing, and teaching proficiency.

**2. Literature Review**

**2.1 Functional classification of chunks**

Currently, there are primarily two methods for classifying the functions of chunks.

Biber et al. (2004), when studying chunk usage in college university classroom teaching and textbooks, divided chunks into three categories: referential expressions, stance expressions, and discourse organizers, each of which serves different functions depending on the contexts. Referential bundles make direct reference to physical or abstract entities or to the textual context itself, either to identify the entity or to single out some particular attribute of the entity as especially important. For example, “in the context of” “a wide range of”. Stance bundles express attitudes or assessments of certainty that frame some other proposition. For example, “seems to have been,” “it is necessary to.” Discourse organizers reflect relationships between prior and coming discourse. For example, “on the other hand,” “that is due to.”

Hyland (2008a) classifies chunks into three broad categories for academic English discourse: research-oriented, text-oriented, and participant-oriented, and each category can be divided into several sub-categories. This classification corresponds to the three meta-functions of systemic functional linguistics (SFL): ideational function, interpersonal function, and textual function. Research-oriented chunks help authors construct activities and experiences in the real world, that is, express research content and results, such as “in the present study” and “the purpose of the”. Discourse-oriented chunks are used to organize the discourse, that is, to organize information or arguments according to meaning, such as “in addition to the,” “it was found that.” Participant-oriented chunks focus on the author or the reader of the text, including stance chunks that express the author’s attitude and evaluation and engagement chunks that directly interact with the reader, such as “it is possible that,” “as can be seen,” etc.

The former classification method facilitates an effective comparison of the stylistic differences between spoken and written English. This study specifically focuses on academic English discourse, thus adopting Hyland’s (2008a) method. Detailed information regarding the functional categories is presented in Table 1.

Functional Category	Functional Subcategory	Instance
Research-oriented	Location	at the beginning of, at the same time, in the present study
	Procedure	the use of the, the role of the, the purpose of the, the operation of the
	Quantification	the magnitude of the a wide range of one of the most
	Description	the structure of the, the size of the
	Topic	in the Hong Kong, the currency board system
Text-oriented	Transition signals	on the other hand, in addition to the, in contrast to the
	Resultative signals	as a result of, it was found that these results suggest that
	Structuring signals	in the present study, in the next section, as shown in fig
	Framing signals	in the case of, with respect to the, on the basis of, in the presence of, with the exception of
Participant-oriented	Stance features	are likely to be, may be due to it is possible that
	Engagement features	it should be noted that, as can be seen

Table 1 Functional Classification of Chunks

**2.2 Reviews of research on chunks**

Considered a fundamental linguistic construct in academic papers, chunks play a crucial role in enhancing the coherence and persuasiveness of texts. These statistically linked combinations are familiar to writers and readers who frequently use a particular genre and so come to signal competent participation in a given community of users. The absence of such chunks might reveal the lack of fluency of a novice or newcomer to that community (Hyland, 2008; Li & Jiang, 2023). The frequency, structure, and pragmatic function of chunks in academic discourse varies across different registers, genres, and disciplines. Biber et al. discovered through a comparison of classroom and textbook corpora that nouns and prepositional phrases are frequently employed in the academic writing of various disciplines to convey referential functions and organize texts, with less than 5% of these phrases being structurally intact. The research results indicate the extent to which different academic discourses rely on different repertoires of chunks (Biber, 2006; Biber et al., 2004; Perez-Llantada, 2014; Durrant, 2017; Shirazizadeh & Amirfazlian, 2021; Wang & Wang, 2015). Furthermore, chunks utilized by learners from diverse language backgrounds or proficiency levels exhibit different distributional characteristics in terms of structure and function. Hyland (2008b) found that hard disciplines (such as biology and electrical engineering) tend to

use research-oriented chunks to construct the real world, while soft disciplines (such as business and applied linguistics) tend to use text-oriented chunks that reflect more evaluative modes of argument.

Currently, the study of chunks in academic English either emphasizes the overall structure and function of these chunks or integrates chunk analysis with move analysis. The subjects of research include both Chinese and international scholars (Lou & Wang, 2021; Pan, 2016), Chinese and international students, Chinese and international students and scholars (Xu, 2012), as well as English learners at various proficiency levels (Jiang, Kang & Xiao, 2024). Research content encompasses comprehensive analyses of three-, four-, and five-word chunks in the whole texts and in the abstracts, introductions, and conclusions of academic journal articles and dissertations from both Chinese and international contexts, utilizing corpus-based methodologies. Additionally, there are more specialized studies focusing on chunks with specific functions and their subcategories, such as stance expressions (Wang & Liu, 2013) and text-oriented chunks. There are also investigations into non-adjacent chunks, thereby broadening the scope of research.

It has been observed that the study of lexical chunks in academic English predominantly spans disciplines such as geography, history, chemistry, biology, and linguistics. However, there is a notable lack of research and corpora concerning academic English chunks in aquaculture sciences. Furthermore, corpus-driven studies on chunks are grounded in authentic data, employing frequency as a foundational criterion (Zhang, 2014), which enhances their scientific rigor. Thus, this study aims to extract chunks using data-driven methods by comparing a self-constructed corpus of English papers from aquaculture journals in China and abroad. It will investigate the functional features of chunks utilized by both Chinese and international scholars in journal articles, comparing their similarities and differences while exploring the underlying causes. This research seeks to provide insights for academic English writing and foster communication among aquaculture scholars.

### 3. Methodology

#### 3.1 Research questions

This study investigates the functional distribution characteristics of four-word chunks in academic English texts, utilizing a self-constructed corpus of Chinese and international aquaculture journal papers. It aims to address three primary questions:

1. What are the functional features of English chunks employed by Chinese scholars in academic papers on aquaculture?
2. What are the functional features of English chunks utilized by international scholars in academic papers on aquaculture?
3. What are the similarities and differences in the functional features of four-word chunks used across the two corpora, and what are the underlying causes?

#### 3.2 Corpus introduction

This research is based on two self-constructed academic English corpora: the Chinese Aquaculture Article Corpus (CAAC) and the International Aquaculture Article Corpus (IAAC). The CAAC comprises 30 English papers published by Chinese scholars between 2022 and 2023 in the first English journal *Aquaculture and Fisheries* published in China, totaling 99,071 words, with an average of 3,302 words per paper. The IAAC includes 30 papers published in 2022-2023 by authors from four native English-speaking countries—namely the UK, the US, Australia, and New Zealand—in the internationally recognized journal *Aquaculture*, which has a significant impact factor. This corpus totals 171,800 words, with an average of 5,727 words per paper. All titles, abstracts, references, diagrams and formulas, footnotes, and author information have been removed, leaving only the body of the texts.

#### 3.3 Research steps

(1) Research object determination.

Four-word chunks are chosen as the research object because they are far more common than 5-word strings and offer a clearer range of structures and functions than 3-word bundles (Biber et al., 2004; Cortes, 2004; Hyland, 2008a).

(2) Four-word chunks extraction and statistics

AntConc 4.2.3 was used to generate 4-word chunk lists. The cut-off frequency was in accordance with Hyland's (2008a) standard, setting a minimum frequency of 20 times per million words and an occurrence in at least 5 of texts, which means the four-word chunks with the minimum frequency of 2 in CAAC and of 4 in IAAC that occur in at least five different texts are extracted and studied.

(3) Four-word chunks classification and comparative analysis.

According to the classification framework of Hyland (2008a), the retrieved chunks are classified functionally. The difference between frequencies is compared, and the functional features of chunks are analyzed. In the present study, Likelihood and Chi-square Calculator 1.0 were used to calculate LL and P values to observe the frequency difference of each functional chunk. The functional classification of chunks is shown in Table 2.

4. Results and Discussion

In total, 43 types of four-word chunks were extracted from IAAC and 40 from CAAC. A statistical difference was observed in the number of four-word chunks utilized by Chinese and international scholars (LL = -4.667, P = 0.031 < 0.05). Chinese scholars employed a greater number of four-word chunks in their academic papers on aquaculture. The functional features of research-oriented, text-oriented, and participant-oriented chunks will be analyzed separately in the following sections.

Functional Category	Functional Subcategory	IAAC (Raw frequency /Standard frequency)	CAAC (Raw frequency /Standard frequency)	LL	P
Research-oriented	Location	the end of the (36/210) in the current study (33/192) in the present study (25/146) in the control group (7/41) at the time of (6/35)	in the present study (28/283) at the same time (12/121) in our previous study (9/91) the early stages of (8/81)	<b>0.236</b>	<b>0.627</b>
	Subtotal	<b>107</b>	<b>57</b>		
	Procedure	used in this study (12/70) was added to each (8/47) was used to compare (8/47) was used to determine (8/47) were exposed to a (7/41) was used to calculate (6/35) statistical analyses were conducted (5/29) was used to identify (5/29) were removed from the (5/29)	were obtained from the (10/101) total rna was extracted (9/91) followed by cycles of (7/71) by agarose gel electrophoresis (6/61) software was used to (6/61) was extracted from the (4/40) was used to detect (5/50) have been reported in (5/50)	<b>-3.317</b>	<b>0.069</b>
	Subtotal	<b>64</b>	<b>52</b>		
	Quantification	the total number of (14/81) one of the most (11/64) for each of the (5/29)	higher than that of/in (12/121) one of the most (10/101) a large number of (8/81) a wide range of (5/50) for the first time (5/50) in the range of (5/50)	<b>-16.889</b>	<b>0.000</b>
	Subtotal	<b>30</b>	<b>45</b>		
	Description	there were/was no significant (31/180) the duration of the (13/76) the mean of the (9/52) there was no difference (9/52) were not significantly different (9/52) at a concentration of (7/41) have the potential to (5/29) in the form of (5/29)	there was no significant (9/91) were significantly enriched in (8/81) one way analysis of (7/71)	<b>12.028</b>	<b>0.001</b>
	Subtotal	<b>88</b>	<b>24</b>		
	Topic	atlantic salmon salmo salar (8/47) rainbow trout oncorhynchus mykiss (7/41)	animal care and use (7/71)	<b>0.219</b>	<b>0.640</b>

	Subtotal	<b>15</b>	<b>7</b>		
<b>SUM</b>		<b>304</b>	<b>196</b>	<b>-1.471</b>	<b>0.225</b>
Text-Oriented	Transition	compared to the control (12/70) with the exception of (11/64) in addition to the (6/35) as well as the (5/29)	on the other hand (8/81) were consistent with the (7/71) in accordance with the (5/50)	<b>-0.005</b>	<b>0.944</b>
	Subtotal	<b>34</b>	<b>20</b>		
	Resultative signals	has been shown to (10) have been shown to (8/47) were found to be (8/47) as a result of (7/41) the results of this (5/29)	the results showed that (19/192) we found that the (5/50)	<b>-0.121</b>	<b>0.728</b>
	Subtotal	<b>38</b>	<b>24</b>		
	Structuring signals	in this study, we (8/47) in this study the (5/29) in this study was (5/29)	in this study, we (18/182) in this study, the (12/121) are shown in table (8/81) as shown in fig (8/81)	<b>-32.877</b>	<b>0.000</b>
	Subtotal	<b>18</b>	<b>46</b>		
	Framing signals	/	according to the manufacturer (9/91) be related to the (9/91) on the basis of (8/81) as an internal reference (5/50)	<b>-62.360</b>	<b>0.000</b>
	Subtotal	<b>0</b>	<b>31</b>		
<b>SUM</b>		<b>90</b>	<b>121</b>	<b>-37.424</b>	<b>0.000</b>
Participant-oriented	Stance	it is possible that (14/81) can be used to (7/41) it is likely that (6/35)	may be due to (10/101) can be used to (6/61)	<b>-0.007</b>	<b>0.931</b>
	Subtotal	<b>27</b>	<b>40</b>		
	Engagement	it is important to (12/70)	it is necessary to (11/111) play an important role (7/71) a key role in (6/61)	<b>-13.377</b>	<b>0.000</b>
	Subtotal	<b>12</b>	<b>24</b>		
<b>SUM</b>		<b>39</b>	<b>64</b>	<b>-27.598</b>	<b>0.000</b>
<b>CHUNKS TOTAL SUM</b>		<b>43</b>	<b>40</b>	<b>-4.667</b>	<b>0.031</b>

Table 2. The Functional Classification, Frequency, LL Value, and P Value of Four-word Chunks in IAAC and CAAC  
Note:  $p < 0.001$  (extremely significant difference),  $p < 0.01$  (significant difference),  $p < 0.05$  (statistical difference)

#### **4.1 Analysis of functional features of research-oriented chunks**

Research-oriented chunks are the most frequently used among the three types of chunks, with a total occurrence of 304 times in IAAC and 196 times in CAAC. There is no significant difference in the frequency of research-oriented chunks between Chinese and international scholars ( $LL = -1.471, P = 0.225 > 0.05$ ), likely due to the tendency of academic texts to employ these chunks for emphasizing information presentation. However, the two corpora exhibit differences in the preference for specific functional subcategories of chunks, particularly in the frequency of quantification and description chunks.

Chinese scholars predominantly employed quantification chunks with various expressions ( $LL = -16.889, P = 0.000 < 0.001$ ) to convey the range of studies (e.g., "a wide range of," "in the range of"), frequency (e.g., "for the first time"), magnitude (e.g., "higher than that of/in," "a large number of"), and importance (e.g., "one of the most important"). In contrast, international scholars utilize these chunks to indicate total counts (e.g., "for each of the") and importance (e.g., "one of the most").

International scholars often utilize descriptive chunks ( $LL = 12.028, P = 0.001$ ) primarily to articulate research methods (e.g., "the mean of the," "at a concentration of"), research results (e.g., "there were/was no significant," "the duration of the," "there was no difference," "were not significantly different"), or research objects (e.g., "have the potential to," "in the form of"). In contrast, Chinese scholars rarely employ descriptive chunks, which are mainly used to describe research results (e.g., "there was no significant"), research objects (e.g., "were significantly enriched in"), and research methods (e.g., "one way analysis of"). This disparity suggests that Chinese scholars need to fully recognize the importance of articulating research objects, methods, and results to effectively convey the fundamental and experimental aspects of hard subject research.

The CAAC contains four location chunks, while the IAAC includes five. To convey the effective range of research or research data, varied expressions were utilized. Chinese scholars employed the chunk "in our present study," whereas international scholars used "in the current study." Similar chunks were identified to denote time, such as "at the time of" and "at the same time," as well as to indicate research steps, including "the end of the," "in the control group," and "the early stages of."

Procedure chunks appeared 8 and 9 times in CAAC and IAAC, respectively, with the most commonly used structure being the passive construction 'be done to do.' This structure is primarily employed to present the research process and methodology in an objective manner. Examples from IAAC include chunks such as 'used in this study,' 'was added to each,' 'was used to compare,' 'was used to determine,' 'were exposed to a,' 'was used to calculate,' 'statistical analyses were conducted,' 'was used to identify,' and 'were removed from the'. Examples from CAAC include chunks such as similar phrases include 'were obtained from the,' 'total RNA was extracted,' 'followed by cycles of,' 'by agarose gel electrophoresis,' 'software was used to,' 'was extracted from the,' 'was used to detect,' and 'have been reported in.'

Topic chunks are infrequently utilized and will not be discussed further.

#### **4.2 Analysis of functional features of text-oriented chunks**

Chinese and international scholars exhibit significant differences in the frequency of text-oriented chunks ( $LL = -37.424, P = 0.000 < 0.001$ ). The CAAC group demonstrates a higher frequency of text-oriented chunks, suggesting that Chinese scholars possess a strong awareness of text organization and place greater emphasis on the layout of academic texts and the logical construction of propositions.

A significant difference was observed in the frequency of structuring and framing chunks, with Chinese scholars utilizing more structuring word chunks ( $LL = -32.877, p = 0.000 < 0.001$ ). Common structuring chunks are primarily employed to introduce the text structure, suggesting the content to be presented later (for example, "in this study we/the/was"). Furthermore, it was found that Chinese scholars also use the "passive verb + prepositional phrase" structure to reference graphs, such as in the chunks "as shown in table" and "as shown in fig." Two possible explanations may account for this phenomenon: 1. International scholars may not use the expression "as shown in + graph" to indicate where the data is located. This could suggest that the data presentation style of Chinese scholars is predominantly characterized by a stylized structure, lacking sufficient diversity. These expressions tend to be consistently present in the input as a whole, exhibiting low productivity and a lack of variation, making them easy to remember and extract. 2. The absence of this expression may be attributed to the small corpus size.

In the self-constructed corpus of this study, a highly significant difference exists in the frequency of framing chunks utilized by Chinese and international scholars ( $LL = -62.360, P = 0.000 < 0.001$ ). While the frequency of frame word chunks in the International Academic Article Corpus (IAAC) is 0, it is 31(4 types) in the Chinese Academic Article Corpus (CAAC). These framing chunks are primarily employed to express restrictions (e.g., "on the basis of," "according to the manufacturer"), describe the research (e.g., "as an internal reference"), and highlight relationships (e.g., "be related to"). This indicates that Chinese scholars tend to elaborate on

and summarize the preconditions of their theses for readers by employing framing chunks, thereby making their arguments through clearly defined restrictions.

International scholars employ four transition phrases to indicate parataxis: "as well as the/in," "in addition to the," and "compared to the control." In contrast, Chinese scholars utilize only three transition chunks, which convey transition relations with "on the other hand" and comparative relations with "were consistent with the" and "in accordance with the."

Chinese and international scholars utilize 2 and 5 resultative chunks, respectively, yet there is no significant difference in their standard frequency. International scholars employ resultative signals to elucidate reasons (e.g., "as a result of"), present research findings and discoveries (e.g., "the result of this," "were found to be," "have/has been shown to," "it has been shown"), and similar functions. In contrast, Chinese scholars use active, structured chunks to achieve comparable objectives (e.g., "the results showed that", "we found that"). These two types of chunks correspond to the Chinese expressions "结果发现" and "我们发现," respectively. This suggests that Chinese scholars may be influenced by language transfer from Chinese and exhibit a lack of diversity in their use of resultative chunks.

#### **4.3 Functional features analysis of participant-oriented chunks**

Among the three types of chunks, participant-oriented chunks are the least frequently utilized by both Chinese and international scholars. This may be attributed to the nature of aquaculture articles, which primarily focus on making objective statements regarding research findings and seldom convey attitudes or evaluations. A significant difference in the frequency of participant-oriented chunks was observed between the two groups (LL = -27.598,  $P = 0.000 < 0.001$ ).

In contrast, no significant difference was found in the frequency of stance chunks. Stance chunks serve as linguistic tools through which the writer conveys their attitude towards a proposition or viewpoint, makes judgments, and establishes an appropriate relationship with readers (Hyland, 2005). It is evident that both groups express the author's evaluation of propositions by employing hedges such as "possible," "likely," and "may" (e.g., "it is possible that," "can be used to," "it is likely that," "may be due to"). This approach allows authors to adjust the certainty of their propositions, mitigate risks associated with overly assertive claims, and enhance propositional integrity and academic rigor, thereby facilitating space for academic discourse.

Engagement chunks can facilitate academic interaction between the author and the reader, guiding the latter to interpret the text as intended by the author. Among the selected four-word chunks, the frequency of engagement chunk usage by Chinese scholars was significantly higher than that of international scholars (LL = -13.377,  $P = 0.000 < 0.001$ ). Specifically, three types of engagement chunks were identified in Chinese academic articles (CAAC) compared to only one type in international academic articles (IAAC). Chinese scholars predominantly employ these chunks to convey necessity (e.g., "it is necessary to") and importance (e.g., "play an important role," "a key role in"), whereas international scholars primarily use them to express importance alone (e.g., "it is important to"). Therefore, the available data suggest that Chinese scholars have recognized the significance of interpersonal interaction in academic discourse and used a greater variety of engagement chunks to guide readers in understanding their perspectives.

## **5. Conclusion**

This study aims to explore the functional similarities and differences of four-word chunks in the academic discourse of aquaculture by Chinese and international scholars based on Hyland's functional classification method within a corpus-driven approach. The findings are as follows:

1. Overall, due to the rigorous nature of the aquaculture discipline, both Chinese and international scholars frequently employ research-oriented chunks in their articles, followed by text-oriented chunks, with participant chunks being the least utilized. This pattern aims to facilitate a more objective presentation of the research process and findings.

2. Notably, there are differences in the frequency of text-oriented and participant-oriented chunks between Chinese Academic Aquaculture Articles (CAAC) and International Academic Aquaculture Articles (IAAC). The frequency of these two categories of chunks is higher among Chinese scholars compared to their international counterparts, indicating a greater emphasis on the logical structure of the article and interaction with readers. Significant difference also exists in the frequency of quantification and description function subcategories under research-oriented chunks, as well as in the structuring and framing function subcategories under text-oriented chunks and the engagement subcategories under participant-oriented chunks. Chinese scholars tend to utilize more quantification, structuring, framing, and engagement chunks, whereas international scholars favor description chunks.

In summary, by prioritizing the use of description chunks and detailing research objects, methods, and results, Chinese scholars can effectively convey the foundational and experimental aspects of hard science research and thus enhance their writing.

Considering the limitations of corpus size and source, this study cannot comprehensively summarize the characteristics of chunk usage among Chinese and international scholars. The analysis focused solely on four-word chunks. Future research could broaden the corpus sample and investigate the usage characteristics of chunks of varying lengths, such as three-word and five-word chunks, to explore chunk usage rules more thoroughly and in depth.

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