

Comparative Rhetorical Analysis of Discussion Sections in Chinese and English Research Articles Across Disciplines

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Article information	
Abstract	This study examines cross-disciplinary and cross-linguistic variations in rhetorical moves and move patterns within the Discussion sections of Chinese and English research articles across four fields: Education, Linguistics, Physics, and Engineering. Using a corpus of 200 Discussion sections from top-tiered journals (100 each in Chinese and English), the analysis employed a combined move framework derived from existing frameworks. The findings revealed that English articles used significantly more rhetorical moves overall compared to Chinese articles. Both languages shared common patterns, such as M1-M2-M4-M5 and M2-M4, but English articles exhibited greater complexity and diversity in move patterns, including M7-M8 sequence to conclude. Chinese articles favored simpler sequences and relied heavily on M8 (Deductions) for conclusions. Soft sciences displayed greater cyclicity and a higher frequency of moves like commenting on results (M4) and reporting results (M2), while hard sciences focused more on background information (M1). These results highlight the influence of disciplinary conventions and linguistic contexts on academic writing. This study offers pedagogical insights into academic article writing instruction and underscores the need to consider cultural and disciplinary nuances in academic communication.
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1. Introduction

The Discussion section is crucial for manuscript acceptance (Peacock, 2002; Swales & Feak, 2004), as it involves interpreting results, evaluating results, comparing them with related studies (Yang & Allison, 2003; Lim, 2010), and highlighting the significance and contributions of the study (Mohammad & Iman, 2019; Zahra, Helen & Ain, 2017), while ensuring the

reliability of the findings through existing literature and argumentation (Basturkmen, 2012). However, it is challenging for L2 learners and novice writers (Flowerdew, 1999, 2001). Nevertheless, success can be fulfilled with the deployment of effective strategies like rhetorical moves (Liu & Buckingham, 2018).

To reveal the rhetorical moves, numerous studies have investigated the move structures in research articles (RAs). Some examined the whole section of RAs (e.g., Kanoksilapatham, 2015), some explored the consecutive or related sections, such as Results and Discussion, Introduction and Discussion (e.g., Nguyen & Pramoolsook, 2015b; Zahra, Helen & Ain, 2017), and others concentrated on the separate sections of RAs, such as Introduction (Kanoksilapatham, 2011, 2012; Nguyen & Pramoolsook, 2014;), Method (Chuang & Chen, 2021; Nguyen & Pramoolsook, 2015a;), Results (Lim, 2010; Zahra, Helen & Ain, 2017), and Discussion (Gao & Pramoolsook, 2022; Hilmi, Toyyibah & Afifi, 2021).

Focusing on the Discussion section, some studies explored rhetorical moves in specific disciplines. Amnuai (2017) found frequent use of background information (M1), reporting results (M2), commenting on results (M4), the common sequence M1-M2-M4-M2-M4 + other moves, and a typical limitation-suggestion sequence by examining 20 English Discussion sections of accounting RAs. In applied linguistics, Liu and Buckingham (2018) analyzed 20 RAs in Applied Linguistics, yielding similar results but noting the notable absence of critical moves (summarizing the study, drawing pedagogical implications). These findings indicate potential discipline-specific rhetoric.

Other studies examined cross-discipline comparisons. Soodmand, Doosti, and Movassagh (2018) comparatively analyzed 104 RAs in Applied Linguistics and Chemistry, showing summarizing results, commenting on results, evaluating the study, and implications for further research were more prevalent in Applied Linguistics. Zahra, Helen, and Ain (2017) similarly found M2 and M4 most frequent, with limitations and suggestions rarely used, and hard sciences favoring prior study references and claim-making over soft sciences. However, these studies only compared two disciplines, neglecting nuanced differences among Biglan's (1973) four academic clusters ((hard-pure (HP), soft-pure (SP), hard-applied (HA), and soft-applied (SA)).

Scholars also investigated cross-cultural/cross-contextual differences. Gao and Pramoolsook (2022) analyzed 24 English electrical engineering Discussion sections by Chinese and Thai scholars and found Chinese writers tended to summarize results more, with both groups showing highly cyclical patterns due to multiple results reporting. Yassaman and Elham (2019) compared Iranian and native MA theses using Yang & Allison's (2003) framework and reported Iranian learners used fewer M2 and M4 than native writers. Mohammad (2012) obtained similar results by comparing Iranian EFL and non-Iranian MA theses. Further, Amnuai and Wannaruk (2012) compared 30 applied linguistics RAs in Thai and international journals and demonstrated: 1) Thai RAs used more implications; 2) Thai writers favored M2 to start Discussions while international authors had a preference for M1; 3) social science scholars employed more suggestions for future research than hard sciences. Yet, most of these studies only focused on cross-cultural differences within a single discipline.

Additionally, scarce studies examined L1-written RAs. For example, Safnil (2013) found Indonesian RAs used limited prior study references. Collectively, previous studies have explored rhetorical moves in specific disciplines or languages (Liu & Buckingham, 2018; Safnil, 2013), contributing to our understanding of Discussion sections. However, limited

attention has been given to how disciplinary conventions and linguistic contexts interact in shaping rhetorical practices. Most research focuses on single disciplines (Soodmand et al., 2018) or cross-cultural comparisons within a single field (Gao & Pramoolsook, 2022), while cross-disciplinary (HP, SP, HA, SA) and cross-linguistic variations, particularly in non-English RAs such as Chinese, remain underexplored. Addressing these gaps is crucial for non-native English speakers' writing instruction and multilingual academic communities, and findings will advance genre theory by integrating cross-disciplinary and cross-linguistic perspectives. Thus, this study aims to fill these gaps by analyzing rhetorical moves in Chinese and English RAs from Education (SA), Linguistics (SP), Physics (HP), and Engineering (HA).

This study is novel in its cross-disciplinary and cross-linguistic approach, using a corpus of 200 articles written in Chinese and English from four distinct disciplines. By applying an integrative framework, the study not only identifies rhetorical moves but also investigates patterns of cyclicity and recurrence, which goes beyond static move identification to uncover how writers recycle and integrate moves to reinforce claims, create coherence and achieve persuasive communication. This is conducive to developing publishable writing among novice writers and informing pedagogy in academic writing instruction. To fill the gaps of insufficient cross-disciplinary and cross-linguistic exploration, this study examines rhetorical moves and their patterns across Chinese and English research articles from diverse disciplines, focusing on cross-linguistic and cross-disciplinary variations. Accordingly, the study aims to answer the following research questions:

RQ1: What are the cross-disciplinary and cross-linguistic similarities and differences in terms of the move frequency in the Discussion section of Chinese and English articles of Education, Linguistics, Physics and Engineering?

RQ2: What are the cross-disciplinary and cross-linguistic similarities and differences in terms of the move patterns in the Discussion section of Chinese and English articles of Education, Linguistics, Physics and Engineering?

2. Literature Review

Rhetorical move analysis has been a pivotal approach in examining the structural and functional elements of academic writing, particularly in Discussion sections of RAs. Moves are defined as functional units that fulfill certain communicative purposes within a text, and their systematic analysis provides insights into the construction of scholarly argumentation. Two foundational frameworks have guided much of this research: the models proposed by Hopkins and Dudley-Evans (1988) and Yang and Allison (2003). These frameworks have significantly contributed to understanding rhetorical moves but also present limitations that necessitate further refinement.

As a trailblazer, Hopkins and Dudley-Evans developed an influential framework based on their analysis of Discussion sections in dissertations and research articles from hard sciences. Their model consists of eleven distinct moves, including Background Information, Statement of Results, Explanation of Results, and Deductions, etc. The framework provides detailed categorization of moves specific to hard sciences, offering a robust tool for analyzing results-driven disciplines. However, it lacks applicability to soft sciences and does not incorporate finer-grained subcategories (steps) within moves, reducing its flexibility for diverse disciplines.

As a milestone of the transformation from one-level move-analysis (Hopkins & Dudley-Evans, 1988; Holmes, 1997) to two-level move-step analysis, Yang and Allison proposed a tiered (move-step) framework tailored to applied linguistics RAs. Their framework includes seven core moves, such as Background Information, Reporting Results, Commenting on Results, Evaluation and Deductions, with additional steps for some moves (e.g., M4, M7). The inclusion of steps provides a granular understanding of rhetorical functions, making it particularly useful for analyzing soft science disciplines. This framework has been widely utilized in move analysis of Discussion section (Hilmi et al., 2021; Ulya, 2022; Yassaman & Elham, 2019). However, since the framework is primarily based on soft sciences, it lacks components relevant to hard sciences, such as unexpected outcomes or hypothesis testing.

Academic disciplines are not uniform in their rhetorical practices. They differ in epistemologies, communication norms and community expectations. According to Becher and Trowler (2001), disciplines can be conceptualized as tribes inhabiting distinct territories; each has its own rhetorical landscape. Complementing this view, Hyland (2000) emphasizes that disciplinary writing reflects social interactions between writer and reader, with variations in voice, stance and engagement.

While both frameworks have significantly advanced move analysis, their limitations highlight the need for a comprehensive framework that accommodates the rhetorical practices of both hard and soft sciences. Hopkins and Dudley-Evans excel in addressing the needs of hard sciences but overlook the nuanced and iterative structures found in soft sciences. Conversely, Yang and Allison provide a detailed analysis of soft sciences but do not sufficiently address the rhetorical conventions of hard sciences. Additionally, neither framework explicitly considers the cross-linguistic and cross-disciplinary variations that are important in global academic writing. This study bridges these gaps by integrating the core elements of both frameworks into a new combined framework. The rationale for this integration is rooted in the need to address the disciplinary variations between hard and soft sciences, incorporate both single-level moves and finer-grained steps for flexibility, and enable cross-linguistic comparisons by adapting components to reflect differences in rhetorical preferences across English and Chinese academic writing.

As demonstrated in Table 1, both similarities and differences can be observed from the two frameworks. Therefore, the combined framework proposed in this study merges elements from Hopkins and Dudley-Evans and Yang and Allison to create an inclusive model that captures the rhetorical diversity of Discussion sections across disciplines and languages. Key features of the framework include the retention of Yang and Allison's step-level analysis to provide granularity, the integration of Hopkins and Dudley-Evans' moves, such as Unexpected Outcomes and Hypotheses, to address the needs of hard sciences, and consolidation of similar moves from both frameworks for coherence (e.g., merging Suggesting Future Research and Recommending Further Research). According to a pilot study, Justification is hardly used, so this move is excluded.

Based on the combined framework, this study employed contrastive analysis to systematically compare rhetorical moves across disciplines and linguistic backgrounds, which allows for the identification of both universal patterns and discipline- and/or linguistic-specific variations in Discussion sections. This approach strengthened the reliability of the analysis and provides a nuanced understanding of how writers organize, reinforce and evaluate their arguments.

Table 1

Comparison of Hopkins & Dudley-Evans' Framework (F1) and Yang & Allison's Framework (F2)

Move	Steps	Notes (Similarities and Differences)
Move 1: Background Information		Common across both frameworks
Move 2: Reporting Results		Matches "Statement of Results" in F1
Expected outcomes		Unique to F1
Unexpected		Unique to F1
Move 3: Summarizing Results		Unique to F2
Move 4: Commenting on Results	Step 1: Interpreting results Step 2: Comparing with literature Step 3: Accounting for results Step 4: Evaluating results	Covers "References to Previous Research" and "Explanation of Unsatisfactory Results" in F1
Hypothesis/Making Claims		
Move 5: Summarizing the Study		Unique to F2
Move 6: Evaluating the Study	Step 1: Indicating limitations Step 2: Indicating significance Step 3: Evaluating methodology	Unique to F2
Move 7: Deductions from Research	Step 1: Making suggestions Step 2: Recommending further research Step 3: Drawing pedagogical implications	Similar to " <i>Deduction</i> ", and "Recommendation" in F1
Move 8: Justification		Unique to F1

3. Methodology

3.1 Corpus

The study used two self-built sub-corpora: the English Research Article Discussion Corpus (EN-RAD) and the Chinese Research Article Discussion Corpus (CH-RAD). Each corpus consisted of 100 articles, 25 from Education, Linguistics, Physics, and Engineering respectively, as they can be representatives of SA, SP, HP and HA disciplines (Biglan, 1973). According to Biglan's (1973) typology (continuum), the distance of a discipline from the coordinate center can be used to indicate the distinctiveness or representativeness of its characteristics. Disciplines that are located farther from the center exhibit more typical or extreme features. Based on this principle, Education, Linguistics, Physics and Engineering

were selected in the present study because each occupies a prototypical position in the Hard/Soft $\times$ Pure/Applied continuum.

Articles were randomly selected from five top-tiered journals domestically (in China) and internationally, i.e., Q1 journals in Scopus and Core Journals in CNKI, as these journals are all peer-reviewed and of high impact factors. CNKI, as the largest dataset in China, provides access to full-text journals, conference papers, dissertations and other scholarly publications. It is widely used for literature searches and bibliometric studies. In this study, it served as a key source for identifying relevant Chinese-language research articles. Eventually, the total word count was 151,892 for CH-RAD and 181,841 for EN-RAD. Although there is a difference of approximately 16.5%, as both corpora exceed 150,000 words, they are sufficiently large to allow reliable pattern detection (McEnery & Hardie, 2012). Within the sub-corpora, running words ranged from 27,674 to 40,253 for EN-RAD and 32964 to 54831 for CH-RAD (see Table 2).

Table 2

Running Words in the Corpus

	CH-RAD				EN-RAD			
	SA	SP	HP	HA	SA	SP	HP	HA
Word count	34,383	37,515	27,674	40,253	54831	54514	32964	39532
Total	151,892				181,841			

In terms of article selection, four criteria were followed. First, open-access articles published between 2022 and 2023 were selected to reflect the recent rhetorical practices, as academic writing may present different features over time (Biber, Ulla, & Thomas, 2007; Jalilifar, Hayati, & Namdari, 2012). Second, Chinese articles are authored solely by Chinese researchers, while English articles could be written by international researchers for the articles have been published in the international peer-reviewed journals and can be regarded as expert research articles (e.g., Kustyasari, Basthomi & Anugerahwati, 2021). Third, the articles had to be empirical in nature and adhere to the IMRD (Introduction-Methods-Results-Discussion) structure to ensure structural comparability across studies (Soodmand et al., 2018). This criterion was adopted because previous research has shown that variations in research methods can lead to differences in move use in academic writing (e.g., Kargar, Ghashami & Jafary, 2025; Maporn, Chaiyasuk & Nattheeraphong, 2023). Fourth, only explicitly labeled Discussion were included, excluding conflated headings like Results and Discussion (Ahmadi, 2022; Loi et al., 2016).

3.2 Instrument

Given that Hopkins and Dudley-Evans' (1988) framework originated from articles in hard sciences and Yang and Allison's (2003) framework focused on soft sciences, a new comprehensive framework was developed to accommodate both disciplinary domains. This integrative framework combines elements from both models to create an inclusive tool for analyzing Discussion sections across diverse fields.

The new framework retains the core components of Yang and Allison's model while incorporating specific moves from Hopkins and Dudley-Evans' framework to enhance its applicability. For instance, [M3] Unexpected Outcomes was reclassified as [M2S1] Expected

Results and [M2S2] Unexpected Results under the broader category of [M2] Reporting Results. Similarly, [M8] Hypothesis was reclassified as [M5] Making Claims to align with its rhetorical function. Additionally, [M7S1] Making Suggestions and [M7S2] Recommending Further Research were consolidated into [M8S1] Making Suggestions for Further Study, as these steps convey similar meanings.

The final framework includes eight moves, with four moves featuring constituent steps. These include [M2] Reporting Results, [M4] Commenting on Results, [M7] Evaluating the Study, and [M8] Deductions from the Research. The other moves are [M1] Background Information, [M3] Summarizing Results, [M5] Making Claims and [M6] Summarizing the Study. See Table 3 for the full framework.

3.3 Procedure

The PDF versions of articles were downloaded and the Discussion sections were extracted into Microsoft Word. Then, they were reviewed for the second-time qualification check. Any typos and abnormal spaces were corrected and tables and figures were cleaned to ensure consistent quality for analysis. The 25 Discussions in each discipline was ordered from 1 to 25 (i.e., ED1-25, LI1-25, PH1-25, and EN1-25) and assigned a unique coding name via the combination of the field, journal name and publication time (e.g., EAE202298 for an Engineering article in the Applied Ergonomics Journal, 98th issue of 2022) for easy reference.

According to the combined framework, move analysis was subsequently performed by identifying boundaries using linguistic evidence, formal cues and text comprehension, with clauses as the analytical unit to accommodate instances where one sentence may embody multiple moves. This study employed an open coding system that integrated both deductive and inductive approaches, allowing for the addition of new moves as needed. Then the move frequency and patterns were calculated and tabulated. Chi-square test, a statistical test to determine significant association between categorical variables, was used to see if there are significant differences across disciplines or languages. Since the minimum expected count for several cells was less than five, the Monte Carlo method was used to compute the Fisher's exact test value. Concurrently, pairwise comparisons were also carried out to capture the items that showed significant differences by running *z* test, with *p* value adjusted (Bonferroni method). All statistical analyses were conducted using SPSS version 27.

3.4 Reliability Measurement

To ensure the reliability of the coding process, both inter-rater and intra-rater reliability were systematically assessed. Prior to coding, the first author and a second coder, who is a Ph.D. student in Applied Linguistics, native in Chinese and fluent in English, underwent a comprehensive training session. During the training session, the two coders practiced using a detailed coding scheme and annotated examples from previous studies. Discrepancies were discussed until consensus was reached. Subsequently, the coders independently coded 30% of the dataset (Mackey & Gass, 2022), and the consistency was assessed using agreement rates. The inter-rater reliability reached 90.46% for the Chinese corpus and 92.38% for the English corpus, indicating a strong level of agreement between the coders. Intra-rater reliability was also conducted, with results of 95.89% for Chinese and 96.24% for English. Both of them

indicated high consistency within individual coding. After establishing reliable coding procedures, the first author independently analyzed the remaining RADs.

Table 3

Coding Scheme for Move Analysis in Discussion Section

Coding moves	Coding steps	Moves & Steps	Description	Example
M1		Move 1: Background information	State research purpose, questions, methodology or theoretical framework of the research	The purpose of our study is; the first research question is...
M2		M2: Reporting results	Report the results of study	The results showed, we found
	M2S1	Move 2 Step 1: Expected results	Demonstrate the expected results, which directly answer the research questions	It is expected
	M2S2	Move 2 Step 2: Unexpected results	Indicate the unexpected results, which do (not) target at the research questions directly	Which is beyond our expectation
M3		Move 3: Summarizing the results	Summarize results by integrating the specific results into one sentence	In summary, these results showed
M4		Move 4: Commenting on the results	Demonstrate the meanings and significance of the results	
	M4S1	Move 4 Step 1: interpreting results	Interpret one of the results	This finding suggests
	M4S2	Move 4 Step 2: Comparing results with previous studies	Compare result with those in previous literature	In line with, contrast with
	M4S3	Move 4 Step 3: Explaining results	Provide explanations of the results (use previous	This is because, it may be caused by

		literature to support explanation)	
M4S4	Move 4 Step 4: Evaluating results	Indicate evaluation of the results	It is an important finding
M5	M5: Making claims	Draw a general claim from the results	It can be concluded that
M6	M6: Summarizing the study	Offer a brief summary of the study	This study investigated
M7	M7: Evaluating the study	Critically evaluate the research	
M7S1	Move 7 Step 1: Indicating the limitation of the study	Indicate limitations of the research	There are some limitations
M7S2	Move 7 Step 2: Indicating the significance of the study	Elucidate importance of the study	This study further enriched previous study by
M7S3	Move 7 Step 3: Evaluating generalizability	Make comments on the generalizability of the result	The results cannot be generalized to
M8	M8: Deducting from the study	Make comments on the implications of the research	
M8S1	Move 8 Step 1: Making suggestions for further study	Indicate suggestions for further research	Future study can
M8S2	Move 8 Step 2: Drawing (pedagogic) implications	Clarify implications for relevant stakeholders	Theoretical/practical implications

4. Results

4.1 Move Frequency

Table 4

Move Frequency in Chinese and English Articles

	CH-RAD					EN-RAD				
	ED	LI	PH	EN	Total	ED	LI	PH	EN	Total
M1	22 ^a	21 ^a	34 ^b	21 ^{a, b}	98	34 ^a	33 ^a	45 ^b	49 ^{a, b}	161
M2	147	147	84	70	448	151	148	116	143	558
M3	3	4	0	4	11	6	0	1	0	7
M4	250	216	102	90	658	250 ^a	231 ^{a, b}	117 ^c	195 ^{b, c}	793
M5	26	33	18	17	94	40	37	42	38	157
M6	4	0	2	2	8	1 ^a	5 ^{a, b}	9 ^b	5 ^{a, b}	20
M7	17 ^a	2 ^b	5 ^{a, b}	8 ^a	32	26 ^{a, b}	25 ^{a, b}	10 ^b	41 ^a	102
M8	35	14	10	15	74	28 ^{a, b}	28 ^{a, b}	14 ^b	47 ^a	117
Total	504	437	255	227	1423	536	507	354	518	1915

Note: Each subscript letter denotes a subset of Disciplines categories whose column proportions do not differ significantly from each other at the .05 level. ED=Education, LI=Linguistics, PH=Physics, EN=Engineering.

As is shown in Table 4, both sets of articles used almost all the moves, except M3 (Chinese Physics and English Engineering) or M6 (Chinese Linguistics). They seemed to follow the similar order of move frequency. M4 and M2 occurred with the highest frequency across disciplines and languages, M1, M5, M8 and M7 were moderately employed, while M3 and M6 appeared least frequently.

Disciplinarily, it can also be observed that M4 and M2 were more popular in Education and Linguistics than Physics and Engineering across languages. In contrast, hard science used more M1, especially in English Physics (45) and Engineering (49), which also occurred frequently in the Chinese Physics (34). Noticeably, the English Engineering significantly deployed more M7 (10 vs. 41) and M8 (14 vs. 47) than Physics.

Linguistically, we found that English articles used more moves (1915) than Chinese articles (1423). In particular, Chinese articles showed a less tendency to employ M5 (94), M7 (32) and M8 (74) while the English article presented a higher frequency of them (157, 102 and 117). Obviously, English Physics and Engineering employed M5 more frequently than Chinese articles.

Statistically, significant differences were detected across disciplines in both languages ($\chi^2=62.96, p < .05$ for Chinese articles and $\chi^2=75.51, p < .05$ for English articles) while there was no significant difference between languages, except Linguistics ($\chi^2=33.43, p < .05$). These results indicate disciplines can exert great influence on rhetorical moves and that language/culture is also a potential factor that may affect the use of rhetorical moves.

4.2 Move Patterns

In terms of move organization, it was revealed that the Discussion sections presented both similarities and differences across disciplines and languages. The main findings are illustrated bellow.

4.2.1 Sub-headings

From a macro level, Education and Linguistics articles in both Chinese and English showed a higher tendency to use sub-headings (40%-72%) compared to Physics and Engineering (16%-40%). Notably, Chinese authors in Education (18) and Linguistics (18)

showed a stronger preference for sub-headings than their English counterparts (11 and 10) (see Table 5). Careful observation indicated sub-headings fall into two categories: Research Question (RQ)-oriented and Topic-oriented. RQ-oriented sub-headings directly address specific research questions in the study (e.g., Muscle activity, Development of multitasking), while Topic-oriented sub-headings refer to the broader content to be discussed (e.g., Limitations, Implications).

Table 5

Frequency of Articles with Sub-headings

	CHI-RADS Corpus	EN-RADS Corpus
ED	18(72%)	11 (44%)
LI	18 (72%)	10 (40%)
PH	4 (16%)	5 (20%)
EN	10 (40%)	6 (24%)

Note: ED=Education, LI=Linguistics, PH=Physics, EN=Engineering

4.2.2 Beginning Move

Although both Chinese and English articles tend to start the Discussion section with M1 or M2, English articles showed a preference for M1 than M2 (76 vs. 21 instances), whereas Chinese articles displayed a similar rate to use them (57 vs. 42). For example, the English excerpt employed M1 (research objective) as the beginning move. Similarly, Chinese excerpt 2 started with M1 (design and purpose), while excerpt 3 selected M2 (report result). Noteworthy, Chinese SA articles frequently used M1 to initiate the Discussion section (17 out of 25 instances).

Example 1: **This study had two objectives:** to ascertain the efficacy of an intervention based on task-oriented reading strategy instruction and to analyze students' use of the instructional components and resources and their relationship to the students' task-oriented reading outcomes. (SA3) → [M1]

Example 2: **本研究采用 2（图像线索 vs.文本线索）×2（预测提示 vs. 反省提示）**被试间实验设计，**检验了**线索类型与自我解释策略对视频动画学习效果的影响. (SA1) → [M1]

Example 3: **首先，本研究发现**思辨能力与综合型口语测试表现显著相关. (SP3) → [M2]

4.2.3 Similarities and Differences of Patterns

As illustrated in Table 6, the common patterns between Chinese and English articles across disciplines were M1-M2-M4-M5 (15 occurrences in Chinese and 18 occurrences in English), M1-M2-M4-M8 (9 and 7 instances) and M2-M4-M1-M2-M4+other moves (8 and 7 instances). These patterns indicate the common preference between Chinese and English writers for the combination of background information, statement of and commenting on results, as well as claims or implications.

Although shared patterns were observed, Chinese and English articles also displayed specific preference for certain patterns. For example, Table 6 demonstrated Chinese articles favor the patterns of M1-M2-M4 (10 instances), M2-M4-M5 (9 instances) and M2-M4 (8 instances), compared to English articles (4, 2 and 4 respectively). In addition, the patterns of M2-M4-M5-M8 (6 instances) and M2-M4-M8 (4 instances) also appeared among Chinese articles while they failed to occur in English articles as most of them selected M1 as the beginning move. Preferably, the English articles presented a higher tendency to use the M1-M2-M4-M5-M7-M8 pattern across disciplines (9 instances).

From table 6, it can also be discovered that there were disciplinary divergences concerning rhetorical organization. For instance, the patterns of M1-M2-M4, M2-M4, M2-M4-M5-M8 and M2-M4-M8 failed to appear in Chinese Physics, Education, Engineering and Physics articles respectively. Similarly, the English Engineering and Linguistics articles did not employ the patterns of M1-M2-M4-M8 and M2-M4-M1-M2-M4+other moves.

Table 6
Popular Patterns in Chinese and English Articles

Pattern	Frequency	CH-RADs	Frequency	EN-RADs
M1-M2-M4-M5	15	ED18, ED20, LI7, LI8, LI1, LI13, LI21, PH1, PH4, PH6, PH9, PH12, PH23, EN14, EN25	18	ED3, ED9, ED18, ED19, A21, ED24, LI4, PH3, PH6, PH7, PH8, PH13, PH16, PH23, EN8, EN10, A13, EN14
M1-M2-M4-M8	9	ED1, ED5, ED23, LI18, LI20, LI2, LI16, ED22, EN24	7	ED11, ED12, ED13, ED16, ED23, LI2, LI9, LI13, PH24, PH18
M2-M4-M1-M2-M4+other moves	8	ED8, LI9, LI10, PH19, PH21, PH24, EN4, EN6	7	ED5, ED25, EN12, EN22, PH14, PH18, PH20
M1-M2-M4	10	ED2, ED3, ED4, ED16, LI5, LI23, LI25, LI11, EN11, EN19	4	ED22, LI7, LI8, LI10
M2-M4-M5	9	ED10, ED19, ED24, LI14, PH15, PH25, EN2, EN12, EN20	2	LI1, PH19
M2-M4	8	LI2, LI7, PH5, PH7, PH10, EN3, EN5, EN13	4	LI5, LI6, PH2, PH12
M2-M4-M5-M8	6	ED6, ED7, LI12, PH1, PH8, PH22		
M2-M4-M8	4	ED25, LI3, LI4, EN16		

M1-M2-M4-M5- M7-M8	2	PH17, PH20	9	ED2, ED4, ED8, LI19, LI23, PH5, EN3, EN5, EN7
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Note: ED=Education, LI=Linguistics, PH=Physics, EN=Engineering

4.2.4 Recurrence and cyclicity

The Discussion section produced by Chinese and English scholars were highly recursive and cyclical. Main recursive moves pointed to M4, M7, M8 and the M2-M4 sequence. Closer observation indicated their recurrences were closely associated with their constituent elements, as there are two/three steps for these moves. When writers finish one facet of these moves, they may proceed with next move and then reverse to another facet of these moves, which naturally triggers the recursive appearance of these moves. The following excerpts display the recurrence of M8, indicated by the sequence of implication-limitation-suggestion.

Example 4: **We recommend** performing the consistency test once per year for CT systems employed in diagnosis and every 6 months for CTsystems... [M8S2]
 As a **limitation** of our study, no pre-processing was applied before metrics calculation and it may be of interest **to define the effect** that image pre-processing could have in metrics reproducibility. (SP9) [M7S1]
 Example 5: **教学实践**除直接激发学习动机外, 还可以考虑从外显数学板印象的角度, 对初中女生的数学学习坚持性进行干预, 在课堂上增强学生的领域归属感...**研究不足之处**在于仅选用了初一学生作为被试, 并且采用了横断设计, 无法得出明确的因果关系...**未来的研究**可以从以下角度继续展开: (1) 对中学生开展纵向考查... (ED 11) [M8S1]

The major cyclical structure found in both sets of data turned out to be M2-M4, M2-M4-M5 and M7-M8. Additionally, Chinese writers also showed a tendency to cyclically employ the M2-M4-M8. Importantly, circles of M7-M8 earns great popularity in the English HA articles, while it is overshadowed in the HP articles. Together, these recursive and cyclical patterns manifest the way how scholars deal with lengthy and multi-faceted information.

4.2.5 Intensity of cyclicity

Although majorities of the articles are cyclical, the intensity of M2-M4 cycles presented some differences. Since M2–M4 constitute the backbone of the Discussion section, and nearly all cycles revolve around these moves, the cyclic sequences of M2–M4 were calculated to reflect the intensity of cyclicity. As is illustrated in Table 7, Chinese articles of Education and Linguistics showed an obviously higher degree of cyclicity (5.56 and 5.67) than PH and EN (2.88 and 2.68). In terms of English articles, Education and Linguistics included the most cycles of M2-M4 (5.68 and 5.36), followed by Engineering (5.28), and then Physics (3.28). Differently, Chinese articles of Physics and Engineering were both low-cyclicity-oriented (2.88, 2.68) while English articles of Engineering were of higher intensity of cycles than Physics (5.28 vs. 3.28). Linguistically, English articles of Engineering intensively deployed M2-M4 cycles than Chinese articles of Engineering (5.28 vs. 2.68). Instead, about half of the

Chinese articles of Engineering (EN3, EN8, EN9, EN11, EN12, EN16, EN17, EN21, EN22, EN24, EN25, 11 instances in total) turned out to be linearly organized.

Table 7

Intensity of M2-M4 Cycles

	CH-RAD				EN-RAD			
	ED	LI	PH	EN	ED	LI	PH	EN
Frequency	139	144	72	67	142	134	82	132
Fre/article	5.56	5.76	2.88	2.68	5.68	5.36	3.28	5.28

Note: ED=Education, LI=Linguistics, PH=Physics, EN=Engineering

4.2.6 Ending Move/Sequence

From Table 8, we can see that sole M8 consistently appeared to end the Discussion section across languages and disciplines. Yet, it was more prevalent in Chinese articles, indicated by the total frequency of 31 instances (especially Education, 12 instances), compared to English articles (15 instance). Differently, when M7-M8 were employed together to stop the Discussion section, it seemed that they earned a popularity in English articles (32), Education (10) and Engineering (12) in particular, whereas they occurred in Chinese articles with a lower frequency (12 instances), even without appearance in Linguistics. For example, Excerpt 6 signaled both the importance of the study and implications for lectures, whereas the Chinese excerpt merely indicated pedagogical implications. Even though some Chinese articles exclusively selected M7, it merely presented 7 occurrences (i.e., EN15, EN16, PH16, PH17, PH18, PH 20 and LI21).

Table 8

Ending-move Patterns in the Discussion Section

	CH-RAD				EN-RAD			
	ED	LI	PH	EN	ED	LI	PH	EN
Patterns	ED1	LI 1	PH1	EN7	ED5	LI2	PH15	EN2
with M8	ED2	LI 3	PH2	EN8	ED15	LI9	PH21	EN4
	ED5	LI 4	PH8	EN9	ED23	LI15		EN6
	ED6	LI12	PH13	EN10		LI22		EN11
	ED7	LI 18	PH14	EN16				EN19
	ED9		PH22	EN18				EN25
	ED11			EN22				
	ED12			EN24				
	ED15							
	ED21							
	ED23							
	ED 25							
Frequency	12	5	6	8	3	4	2	6
TOTAL	31				15			

Patterns	ED11	PH16	EN9	ED2	LI14	PH4	EN1
with M7-	ED12	PH17	EN17	ED4	LI16	PH5	EN3
M8	ED14	PH18	EN18	ED6	LI17	PH9	EN5
	ED15	PH20	EN23	ED7	LI18	PH17	EN9
				ED8	LI19		EN15
				ED10	LI20		EN16
					LI21		EN17
					LI23		EN20
					LI24		EN21
					LI25		EN22
							EN23
							EN24
Frequency	4	4	4	6	10	4	12
TOTAL	12			32			

Note: ED=Education, LI=Linguistics, PH=Physics, EN=Engineering

Example 6: **The most important contribution** of this study to practice and research is that the effect of online social interaction appears to extend beyond promoting online classroom engagement...**Thus, lecturers should** become more aware that how they structure their classes may influence students' learning behavior outside the classroom... (SP4)

Example 7: 因此，在英语阅读教学中，培养基本的转喻能力是有必要的不仅有利于培养学生解读转喻词汇的基本能力，而且可升华到从宏观与微观之间的关系解读语篇的能力。(ED 18)

Moreover, we found four articles were organized with the combination of M6, M7 and M8. They were M7-M8 in English EN23, M6-M7-M8 in English PH17 and EN25 and M6-M8-M7 in English PH15. However, only one Chinese article used such a structure (M6-M7-M8 in EN9). These results may indicate that the articles of Physics and Engineering show a likelihood to make a simple conclusion in the Discussion section.

Interestingly, two occurrences of reverse moves were observed in the English Linguistics articles (LI22, LI25). They presented a sequence of M1-M7-M2-M4-M5-M8 and M7-M2-M4-M5-M7-M8 respectively. Nevertheless, such a phenomenon failed to appear in the Chinese articles.

4.2.7 General Pattern

Based on the observation, a general pattern used in both datasets may be started with the background information and the general statement of the results. Subsequently, a subsection heading introduces a specific research question, whose fundamental content is then presented, followed by result reporting and interpretation. With these prerequisites, a claim or implication is proposed. Then, a new cycle of these moves reoccurs, triggered by a subsection heading or sequencer. Within each circle, the sequence of M2-M4 is heavily repeated. Alternatively, M2-M4-M5 (or M2-M4-M5-M8 specifically in Chinese article) can be repeated. At last, the study is evaluated and deductions are drawn. When it comes to limitations, they usually co-occur

with suggestions in a cyclical fashion. Of course, the Discussion section can be flexibly organized with a reasonable arrangement of the rhetorical moves recognized by the speech community to convey the writers' autonomy. The freedom of writing can also be indicated by within-discipline variation, as many move patterns were identified with slight differences in one discipline.

In summary, English articles used more claims, evaluations of and implications from the study, especially the English Engineering articles. Within Chinese articles, Education showed a tendency to employ more implications than other disciplines. Soft sciences displayed a higher degree of cyclicity of M2-M4 sequence than hard sciences in both languages. However, English Engineering presented more cycles of M2-M4 than English Physics disciplinarily and Chinese Engineering linguistically. Additionally, both shared and preferable patterns were found across disciplines and languages.

5. Discussion

5.1 Cross-disciplinary Differences

First, the frequent use of commenting on and reporting of results and the consistent co-occurrence of them across disciplines and languages corroborates the findings of previous studies (e.g., Liu & Buckingham, 2018; Nguyen & Pramoolsook, 2015b), mapping the major functions of the Discussion section, namely, to report and comment on the results (Yang & Allison, 2003).

However, more occurrences of them and higher cyclicity of M2-M4 sequence were found in Education and Linguistics than Physics and Engineering. In addition, it was revealed that the Education and Linguistics articles tend to use more sub-headings than Physics and Engineering. Together, these results indicate that rhetorical moves can be influenced by disciplinary features. According to Soodmand et al (2018), researchers in soft science usually deal with many research questions and report various relevant findings. Statement of and commentary on results are thus frequently used and cycled to tackle diverse findings. This disciplinary convention shapes the frequent use of sub-headings by writers in soft science. On the contrary, scholars in hard science may cope with a novel experiment that has not been performed previously and they do not need to compare the results with previous studies (Soodmand et al., 2018). This specific feature may also contribute to the conclusion-oriented structure found in the articles of Physics and Engineering.

Moreover, we found that English Engineering showed an obvious preference for evaluation of and implication from the study than English Physics. This hints that the English HA writers attach great importance to evaluating the study and drawing implications for related stakeholders, compared to their Physics counterparts. Further, Chinese Education are likely to indicate the implications from the study than other disciplines, showing the writers' emphasis on pedagogical implications for instructors or learners. These results suggest the disciplinary divergence in terms of rhetorical choices in the Discussion section. The common higher frequency of implication in English Engineering and Chinese Education may indicate that researchers in soft science display a tendency to highlight the practical implications or suggestions for future studies. These results further substantiated Amnuai and Wannaruk's (2012) findings that implications are popular in the Discussion section of Applied Linguistics.

5.2 Cross-linguistic Variations

Linguistically, no significant differences were found between the Chinese and English articles of Education, Physics and Engineering in terms of the overall deployment of rhetorical moves. Perhaps, this is related to the commonly high quality of the articles under investigation, as they are indexed from Q1 journals of Scopus and Core Journals of CNKI. Thus, Chinese scholars have a good understanding of the rhetorical conventions as their international counterparts do (Ulya, 2022). Moreover, this result may be attributed to the small size of the corpus. Given that the corpus contains only 333,733 running words, it may not be large enough to reveal statistically significant differences. Future studies can extend the analysis using a larger corpus.

Nevertheless, we found there were significant differences between the Chinese and English articles of Linguistics, similar to the results gained by Mohammad (2012), who reported significant differences between Iranian and Non-Iranian novice writers. Especially, the English Linguistics articles used more claims, evaluation of and deductions from the study. Additionally, it was revealed that English writers attach equal importance to the evaluation of and implications from the study, whereas Chinese scholars showed an overemphasis on implications. Possibly, this is because collective cultures care “face” and cherish harmony, humbleness and indirectness as a priority. Thus, the Chinese writers are not willing to explicitly make claims, praise themselves and highlight the significance of their studies (Greenlee & Stück, 2004; Li & Andersen, 2017). On the contrary, English writers are individualism-oriented; freedom and confidence are valued, so they usually feel free and confident to make claims and highlight the significance of their studies. These results suggest move organization can be influenced by cultural elements. Thus, Chinese scholars can be explicitly guided to make proper claims and to use evaluation of and implication from the study with balance so as to successfully publish RAs in the international journals.

Contradictorily, now that Chinese people have faith in collectivism and value humble virtue, it should be a prevalent practice to acknowledge the limitations of the study. However, careful examination showed that such practices rarely occurred. It seemed that they failed to give due attention to the evaluative move. Possible reason is this move is included in the Conclusion section (Liu & Buckingham, 2018; Zahra et al., 2017). Yet, some articles offered a slight evaluation of the study, so they are not likely to repeat this move in the Conclusion section. Perhaps, the length restriction of the articles can explain this phenomenon. As journals usually guide writers to organize the manuscripts within a specific word count (Gao & Pramoolsook, 2022), they may try to shorten the evaluative move or just skip it. This tells us that when constructing the Discussion section, we should endeavor to incorporate essential moves with effective arrangement of necessary information.

Additionally, the discovery that most articles presented cyclical nature is in harmony with previous studies (e.g., Liu & Buckingham, 2018; Zahra et al., 2017), as they reported the Discussion section are commonly realized cyclically. The cyclicity of [M7]-[M8] and M2-M4-M8 consolidate the findings of Amnuai and Wannaruk (2012) and Amnuai (2017), who found [M8] usually recurred with [M7] or [M4]. Importantly, we found that almost half of Chinese Engineering articles are linearly organized while English Engineering articles were highly cyclical. This result indicates that the cyclicity of Discussion section can be influenced by both disciplinary and linguistic features. Overall, these findings echo the findings obtained by Hilmi,

Toyyibah and Afifi (2021) and Holmes (1997), as they maintained the Discussion section can be repetitive or structured organization.

On top of that, the within-discipline variation, reversal of moves and the conclusion-oriented structure were also detected. These findings hint that although the Discussion section, as a sub-genre of RAs, usually conforms to certain norms recognized by the specific discourse community, it can also be organized relatively flexibly to convey the writers' freedom and autonomy (Amnuai & Wannaruk, 2012).

6. Limitations and Recommendations

While this study offers valuable insights into cross-disciplinary and cross-linguistic variations in rhetorical moves within the Discussion sections of Chinese and English research articles, several limitations should be acknowledged. First, the relatively small size of the corpus (200 articles) may constrain the generalizability of the findings. Expanding the dataset to include more articles could provide a more comprehensive understanding of rhetorical practices and allow for a more robust statistical analysis. Second, this study focused on four specific disciplines to represent the broader categories of hard and soft sciences. However, these fields may not fully capture the diversity of academic writing styles across other disciplines. Future research should incorporate a wider range of fields, including interdisciplinary studies to enhance the applicability of the findings. Third, this study analyzed rhetorical moves solely in Discussion sections. Since rhetorical strategies often interact across different sections of research articles (e.g., Introduction and Discussion), future research could explore move patterns holistically by examining how rhetorical moves in one section relate to and influence other sections. Lastly, the study primarily focused on print-based research articles and excluded newer forms of academic communication, such as digital publications, blogs, or open peer-reviewed articles. Investigating these emerging platforms could reveal how rhetorical practices evolve in response to changing academic and technological landscapes.

7. Conclusion

This study examined cross-disciplinary and cross-linguistic differences in rhetorical moves in the Discussion sections of Chinese and English articles across Education, Linguistics, Physics, and Engineering. It proposed a new combined framework integrating Hopkins and Dudley-Evans (1988) and Yang and Allison (2003). This is a significant advancement that addresses existing framework limitations and enables the study of cross-linguistic/cross-disciplinary rhetorical practices. Applying this framework to Chinese and English RAs, the present study contributes to academic writing research and offers insights into the interplay of linguistic, cultural, and disciplinary conventions. It also enriches the English-centric research landscape by incorporating Chinese articles and promotes linguistic diversity, and encourages reviewers to prioritize cultural conventions over sole English-community standards to mitigate linguistic hegemony.

Pedagogically, ESP teachers can guide learners to effectively make claims and balance study evaluation and implications, avoiding overemphasis on the latter. Material developers can list discipline-specific move structures with captions (e.g., more M2-M4 cycles in soft vs. hard sciences). Practically, learners aiming for international publication can compare Chinese and English authors' writings to improve strategies. Instructors can design targeted exercises on discipline/linguistic-specific rhetoric. And editors can enhance awareness of such

differences; however, generalization is cautioned, as manuscript acceptance depends on multiple factors beyond rhetorical moves. Conclusively, the study illuminates the interplay of linguistic, cultural, and disciplinary conventions in academic writing, deepening understanding of global scholarly communication and fostering inclusivity in research dissemination.

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9. Declaration of AI Use

The authors declare that GPT was used only for spelling checking, grammar correction and text reduction; no other purposes were served.

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