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RESEARCH ARTICLE

Metadiscourse in English Academic Writing across Disciplines: A Systematic Review

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ARTICLE INFO	ABSTRACT
	Metadiscourse plays a crucial role in academic writing by enabling writers to express their stance, negotiate knowledge claims, and engage with their audience. It is intricately embedded within contexts where it occurs, shaped by the norms and conventions of specific cultural and professional communities. Previous reviews center around cross-linguistic or cross-cultural analyses of metadiscourse strategies, while there is a lack of comprehensive studies on cross-disciplinary use in academic writing. This systematic review synthesizes empirical studies from 1983 to 2023 investigating metadiscourse markers across different disciplines. Following the PRISMA 2020 guidelines, Web of Science, Scopus, and Google Scholar databases are searched, yielding 47 studies spanning soft and hard science. The selection criteria focused on contrastive analysis of metadiscourse in academic writing across various fields. The findings reveal applied linguistics is often used to compare with other disciplines in academic writing, particularly in research articles and that significant disciplinary variations exist in the use of interactional metadiscourse. Hyland's interpersonal framework is widely adopted due to its practicality and ease of study comparability. Additionally, disciplines show similar subtype use in certain genres, for example the introductory textbook. These differences reflect distinct disciplinary norms and conventions in academic discourse. This review highlights the significance of metadiscourse analysis across disciplines to enhance writer-reader communication in academic contexts. It suggests the need for discipline-specific metadiscourse instruction in academic writing courses and calls for further research on the diachronic analysis of metadiscourse use within specific disciplines over time and the impact of digital technologies on these practices.

INTRODUCTION

In today's global academic landscape, English has become the dominant language of scientific communication, making English-medium publications essential for academic success across disciplines (Matusiak, 2019). As a prerequisite for academic recognition and career advancement, this dominance is particularly evident in the publish or perish culture (Lee, 2014). This underscores the need for understanding the rhetorical and interactive features of English academic writing, such as metadiscourse, which facilitate academic writers to effectively convey their findings and engage with an international audience (Hyland, 2005; Dörnyei & Taguchi, 2009).

Metadiscourse, as a powerful analytical tool, attracts much attention in academic field, particularly in the study of academic writing which involves not only reporting research discoveries objectively but conveying the interaction between writers and readers to achieve the persuasive function (Hyland & Jiang, 2022). This interaction is crucial for building a connection with the audience. Academic communication plays a vital role in the production and understanding of knowledge by readers (Hyland, 1998). As Harris (1991) states, academic writers try to "weave discourse into fabrics that others perceive as true", ensuring their arguments are articulate and persuasive.

Despite the lack of consensus on the concept of metadiscourse, various scholars have proposed diverse definitions and interpretations. Williams (1981) is the first one to use the term in applied linguistics, describing it as "writing about writing", while it is defined as "discourse about discourse" or "text about text" by Ädel (2010) and Hyland (1998). Hyland (2005a, p.37) further refines the concept, viewing metadiscourse as "the cover term for the self-reflexive expressions used to negotiate interactional meanings in a text, assisting the writer (or) speaker to express a viewpoint and engage with readers as members of a particular community". While definitions may vary, the key features of metadiscousre (multifunctionality and context-dependency) remain widely accepted (Ädel, 2006; Cristmore, 1989; Hyland, 2005b; Mauranen, 1993). As Mauranen (1993) observes, context is particularly critical in distinguishing metadiscourse from other textual elements. Moreover, metadiscourse reflects writer's stance towards the text or reader, serving as a medium for interaction and persuasion (Hyland, 2000). It also facilitates to engage the audience and reveal the writers' attitudes, significantly contributing to the high quality of academic writing and enhancing the relationship between the writers and the readers (Zarei, 2011).

When it comes to the classification of metadiscourse, it divides writing into two levels: writing that guides the reader to interpret or classify the topic and writing that provides information about the content of the topic (Williams, 1981). It is divided into two categories: textual and interpersonal (Vande Kopple, 1985). Text connectives assist readers realize the organization of texts and the ways of different parts to connect with each other functionally or semantically (e.g. first, next, however, but). Ädel's (2006) reflexive model presents the metadiscourse is classified into metatext and writer-reader interaction. Text, writer and reader compose a reflexive triangle. Text has the metalinguistic function, while writer has the expressive function and reader has the directive function. This reflexive model outlines the boundaries of basic concepts and has several advantages (Salas, 2015). However, while this model clarifies conceptual boundaries and offers advantages in smaller-scale studies (Salas, 2015), it excludes important dimensions such as stance and is less suitable for large-scale corpus analyses. Hyland's (2005a) framework, which distinguishes metadiscourse into interactive and interactional categories, has become widely influential due to its practicality and relevance for corpus-based research. The former illustrate "the writer's awareness of a participating audience and the ways he or she seeks to accommodate its probable knowledge, interests, rhetorical expectations and processing abilities" (Hyland, 2005a, 49), act as a guide to the reader through the text, helping "to organize propositional information in ways that a projected target audience is likely to find coherent and convincing" (Hyland, 2005a, 50). While the latter aim to involve the reader in the argument, referring to the ways a writer communicates with readers. This approach allows the writer to express themselves through a textual 'voice' or community-recognized persona, enabling them to convey judgments clearly and foster a strong connection with the readers.

Over the past four decades, there has been a growing interest investigating metadiscourse usage in academic writing. Extensive studies have been dedicated to the contrastive analysis, particularly comparing the metadiscourse elements of native and non-native English speakers, as well as novice and expert scholars. These studies predominantly draw attention to linguistic items, such as metadiscourse strategies, exploring their application across various writer groups (Aull & Lancaster, 2014; Hu and Cao, 2011; Lee and Casal, 2014; Lee & Deakin, 2016; MurDueñas, 2011). Most studies are carried out on different sections of English research articles, including abstracts, introductions, discussions and conclusions to demystify patterns of metadiscourse resources across specific textual structures (Khedri, Heng & Ebrahimi 2013; Kashiha & Marandi 2019).

Fostering writers' awareness of disciplinary variation holds significant value in enhancing their academic writing proficiency. Disciplines represent institutional conveniences, channels of communication, systems of values, and methods of investigation. Hyland lays emphasis on the significance of metadiscourse in persuasive academic writing, emphasizing that "This study is only a first step in examining the effects of disciplinary context on metadiscourse and the results need to be confirmed in different disciplines and genres" (Hyland, 1998). As academic writing is widely regarded as the disciplinary-based practice, numerous studies have examined disciplinary differences in the manipulation of metadiscourse strategies. Genre community and disciplinary community complete each other by way of offering a schema for developing meanings in academic contexts (Hyland, 2005).

Members in the disciplinary community need conform to certain conventions of the exact discipline to compose and interpret the academic texts effectively. Cross-disciplinary analyses have revealed substantial differences in how individual members of academic communities employ metadiscourse in their writing (Charles, 2006; Harwood, 2005a; Hewings & Hewings, 2001; Swales et al., 1998). Such differences are evident not only in research articles (McGrath & Kuteeva, 2012; Hu and Cao, 2015; Jiang & Hyland, 2018; Jiang, 2017; Bruce, 2014, 2016), but also in undergraduate essays (Jiang, 2015; Noble, 2010). In the meantime, they can be found in postgraduate dissertations (Charles, 2006) and academic book reviews (Tse & Hyland, 2006). The findings indicate that writers use interactive metadiscourse more than interactional metadiscourse in English research articles in applied linguistics than that of in engineering disciplines (Pooresfahani, Khajavy & Vahidnia 2012). This is not in line with Hyland and Tse's (2004) finding in eight disciplines that interactive features are less common than interpersonal features. Hence, the further studies are imperative to disclose the disciplinary similarities and differences of metadiscourse use in academic writing across disciplines.

It is obvious that there are a few attempts to conduct a study of the systematic literature review (SLR) on cross-disciplinary analysis of metadiscourse markers in academic writing in spite of a preponderance of such studies. There are several exceptions. Avon Crismore & Esmaeel Abdollehzadeh (2010) review the metadiscourse studies in Iranian context, while Khedri et al. (2013) perform a brief review of the metadiscourse in academic writing from the cross-disciplinary and cross-linguistic perspectives. Besides, there are relevant reviews consisting of Wei et al.'s (2016) study on metadiscourse since 3rd millennium, Hyland and Jiang's (2022) examination of metadiscourse across languages and genres, Abdelhamid and Xiao Zhang's (2023) review of literature of students' voice in L2 English writing which focuses on the voice markers, Pearson and Abdollshzadeh's (2023) comprehensive review of metadiscourse in academic writing which investigates the conceptual frameworks, the research design and methodological features of empirical studies. Previous reviews have deepened our understanding of metadiscourse elements in academic writing. However, these reviews do not provide a systematic and nuanced analysis of cross-disciplinary aspect of metadiscourse in academic writing and the cross-disciplinary studies. This research gap underscores the need for further research to shed some light on the relationship between the metadiscourse and disciplines. The differences of the previous review studies are summarized in Table 1.

Table 1. Summary of the differences among previous review studies

References	Time	Review scope
Avon Crismore & Esmaeel Abdollehzadeh	2010	Iranian context
Khedri et al.	2013	Timeframe of the sample: before 2013
Wei et al.	2016	Timeframe of the sample: 2001-2015
Hyland et al.	2022	Metadiscourse across languages and genres
Abdelhamid M. Ahmed & Xiao Zhang	2023	Sample size: 59 studies Timeframe of the sample: 1985-2022

William S. Pearson & Esmaeel Abdollshzadeh	2023	Sample size:370 studies Timeframe of the sample: 1990-2021
Jinzu Zhang	2023	Sample scope: stance markers Sample size: 34 studies Timeframe of the sample: before April 1st in 2023
Masliza Mat Zali et al.	2023	Sample size: 26 studies Timeframe of the sample: January in 2018-December in 2022

The present study aims to compare the results available in other research works and simply focuses on the cross-disciplinary aspect. Therefore, this review is expected to answer the following research questions:

RQ1: What conceptual frameworks are adopted in the cross-disciplinary analysis of metadiscourse research in English academic writing?

RQ2：What data sources are employed in the cross-disciplinary analysis of metadiscourse research in English academic writing?

RQ3: What research methodologies are used in the cross-disciplinary analysis of metadiscourse research in English academic writing?

In answering these questions, research gaps in the existing literature body will be pinpointed. The following provides an overview of the study. Section two details the methodology adopted in this review, including the inclusion and exclusion criteria for the searched literature, while section three outlines the selected literature, with an analysis of the disciplines compared across the studies. Section four presents a discussion of the findings, providing insights into the trends and gaps identified in the literature. Finally, it is the conclusion drawn from this review by summarizing the key findings, acknowledging the study's limitations, and offering suggestions for future research.

2. METHODS

2.1 Identifying relevant studies

In this study, three databases were utilized, namely Web of Science, Scopus, and Google Scholar. Both Web of Science and Scopus are widely recognized as dominant databases for information retrieval (Singh, Karmakar, Leta, & Mayr, 2021). Despite notable differences in the number of results retrieved for the same query between Web of Science and Scopus, their retrieval relevance exhibits minimal disparity, albeit with a slight advantage observed for Scopus (Singh et al., 2023). Additionally, Scopus's citation analysis is noted for its speed and comprehensive coverage of articles compared to Web of Science (Falagas, Pitsouni, Malietzis, & Pappas, 2008). On the other hand, Google Scholar, as an inclusive database, boasts superior coverage of highly-cited documents across various fields, surpassing both Web of Science and Scopus in areas such as Humanities, Literature & Arts, Social Sciences, Engineering & Computer Science, and Economics & Management (Martín-Martín et al., 2018). Overall, while each database has its strengths and weaknesses, the combined use of all three is anticipated to provide a comprehensive overview of the relevant literature, allowing for a more nuanced understanding of the topic under investigation.

The initial step in the search strategy is to determine the appropriate search strings. Based on previous studies, similar search strings and those related to metadiscourse and academic writing were repeatedly reviewed and refined iteratively for utilization. This query, applied to the titles, abstracts, and keywords, resulted in 713 documents from WoS and 182 documents from Scopus. Due to the large volume of results from Google Scholar, the analysis was limited to the first 200 hits to ensure manageability. In total, 1,095 documents were collected for further analysis. Notably, no specific exclusion criteria were applied in this initial stage of document identification. The finalized search strings are provided in Table 2.

Table 2. The search strings

Database	Search Strings
Web of Science	((TS= ('metadisc*' OR 'interactive' OR 'interactional') AND TS= ('markers' OR 'resources') AND TS= ('academic writing' OR 'research writing' OR 'graduate writing' OR 'argumentative writing' OR 'persuasive writing' OR 'student writing' OR 'argumentative essay')).
Scopus	TITLE-ABS-KEY("metadisc*" OR "interactive" OR "interactional") AND ("markers" OR "resources") AND ("academic writing" OR "research writing" OR "graduate writing" OR "argumentative writing" OR "persuasive writing" OR "student writing" OR "argumentative essay")
Google Scholar	((TS= ('metadisc*' OR 'interactive' OR 'interactional') AND TS= ('markers' OR 'resources') AND TS= ('academic writing' OR 'research writing' OR 'graduate writing' OR 'argumentative writing' OR 'persuasive writing' OR 'student writing' OR 'argumentative essay')).

2.2 Inclusion and exclusion criteria

Six rigorous inclusion and exclusion criteria were implemented during the screening process to ascertain the comparability of the selected sample. First, the timeframe for the existing literature spans from 1983 to 2023. The year 1983 was chosen as the starting point because it marks the introduction of the first metadiscourse model by Vande Kopple. The cutoff date of 2023 aligns with the search process conducted in March 2024, thereby excluding any studies published thereafter. Second, inclusion criteria stipulate that selected literature must be in English, as the authors are proficient only in this language. Third, the research focus had to concentrate on metadiscourse, with any records not unrelated to this topic being excluded. Fourth, only peer-reviewed journal articles were considered, excluding doctoral dissertations, master's theses, books, book chapters, and conference proceedings. Fifth, the research scope must involve cross-disciplinary analysis in academic writing; records failing to meet this criterion are removed. Sixth, only empirical studies are included, as non-empirical studies lack accurate data sources or employ inappropriate methods, primarily consisting of reviews. Finally, records that did not meet the cross-disciplinary criterion were omitted, as the primary objective of this review is to conduct a comprehensive cross-disciplinary analysis of metadiscourse in academic writing. The full inclusion and exclusion criteria are presented in Table 3.

Table 3. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
1.Publication timeframe	1983-2023	No exclusion
2.Language	English	Not English
3.Research focus	Metadiscourse markers or resources	Not about metadiscourse markers or rescourses
4.Document type	Journal articles	Doctoral dissertations or masters' theses Books Book chapters Conference proceedings
5.Research scope	Cross-disciplinary in academic writing	Non-academic writing
6.Research type	Empirical study	Review articles

2.3 Study selection, retrieval and filtering

To ensure that the SLR provides significant value to its users, authors must offer clear, comprehensive, and precise reporting regarding the rationale behind the review, the methodologies employed, and the findings obtained (Page et al., 2021). In this study, we adhere to a rigorous standard procedure for conducting the SLR, following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline, which is widely recognized as an appropriate and

reliable framework for conducting and reporting systematic reviews. The findings of this review are visually represented in a PRISMA flow diagram, enhancing transparency and clarity in the study selection process. This approach makes certain that readers can easily follow the review process, fostering trust in the validity and reliability of the findings presented.

All documents have been organized using the literature management software Zotero. Figure 1 illustrates the four distinct stages of the SLR: identification, screening, eligibility, and inclusion. Initially, a total of 1,095 records were extracted from three databases, with 152 duplicate records efficiently removed using Zotero's duplicate integration feature and manual filtering, leaving 943 unique records remained for screening. In the initial screening phase, 891 records were excluded based on title, abstract, and keywords, adhering to predefined inclusion and exclusion criteria. Notably, 23 records were published after 2023, 1 record was not in English, and 523 records did not focus on metadiscourse. Additionally, 15 records were excluded due to being the wrong document type, such as books or doctoral dissertations. A further 319 records were removed based on their research scope, with an additional 10 records not meeting the criteria for empirical studies. This process resulted in 52 records eligible for full texts retrieval, of which only two could not be obtained, leaving 50 reports for further assessment. Subsequent assessment led to the exclusion of 11 reports deemed irrelevant to the topic, resulting in 39 studies included for subsequent analysis. During citation searching, 36 additional articles were identified, of which 8 articles were excluded due to the inability to retrieve full-text versions, leaving 28 articles for eligibility assessment. Finally, 20 articles were excluded as they fail to meet the criteria for cross-disciplinary analysis of metadiscourse markers in academic writing. The remaining 47 articles were subjected to the final analysis, the results of which are described chronologically in Appendix. Moreover, the detailed data filtering process is illustrated in figure 1.
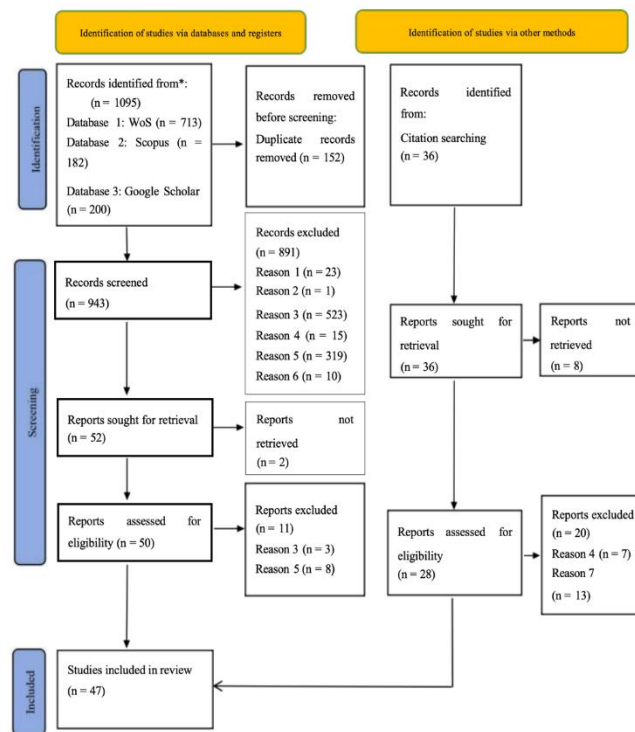

Fig. 1 PRISMA diagram

3. RESULTS

3.1 Overview of the sample

Table 4 showcases a comprehensive summary of the existing literature that was retrieved. It is apparent nearly 94% of the articles included in the analysis are published after 2004. This trend echoes the findings of bibliometric research conducted by Hyland and Jiang (2022), providing additional support to their conclusions. With the publication of Hyland's (2004 2005) interpersonal metadiscourse model, there is an obvious increase of metadiscourse studies in academic writing.

The publication English for Specific Purposes comprises nearly 13% of scholarly publications, with the Journal of Pragmatics and Journal of English for Academics following closely at 8.51% and 6.38%, respectively. These statistics underscore the significant interest among expert researchers in metadiscourse studies, indicating concerted efforts to demonstrate the value of cross-disciplinary analysis within academic writing.

Table 4. Features of the sample

Variable	Value	N	%
Decade of publication	1983-1993	0	0
	1994-2003	3	6.38%
	2004-2013	14	29.79%
	2014-2023	30	63.83%
Top-4 most common publication venues	English for Specific Purposes	6	12.77%
	Journal of Pragmatics	4	8.51%
	Journal of English for Academic Purpose	3	6.38%
	Discourse Studies	2	4.26%

3.2 Conceptual framework

Table 5 illustrates the metadiscourse characteristics under investigation alongside the adopted frameworks. It's evident that over 55% of the articles explore interactive and interactional metadiscourse concurrently, indicating a prevalent interest in understanding the dynamics of both types. Conversely, a minority of studies focus solely on either interactive or interactional metadiscourse. Additionally, several investigations narrow their scope to a specific metadiscourse marker, as exemplified by Jiang and Hyland (2015), who delve into the analysis of stance nouns. This diversity in research focus underscores the multifaceted nature of metadiscourse analysis within scholarly discourse.

The prevalence of the Hyland (2005) interpersonal model in metadiscourse taxonomy adoption surpasses 50%, indicating its significant influence and widespread acceptance within academia. Its accessibility and practicality make it a favored choice among researchers for conducting contrastive analyses across various disciplines. However, many studies adhere to this model without modification, highlighting its enduring impact on scholarly discourse analysis. Moreover, a subset of research ventures into utilizing multiple metadiscourse taxonomies. For instance, Noble (2010) integrates Mauranen (1993) and Ädel's (2003) models, while Keshmirshekan and Atai (2022) incorporate Hyland and Tse's (2004) alongside Hyland's (2005) framework. This diverse utilization highlights the nuanced approaches to understanding and analyzing metadiscourse phenomena within academic literature.

Table 5. Metadiscourse characteristics investigated and framework adopted

Variable	Value	N	%
Metadiscourse characteristics investigated	Interactive and Interactional metadiscourse	26	55.32%
	Interactive metadiscourse	8	17.02%
	Interactional metadiscourse	13	27.66%

Taxonomy of metadiscourse adopted	Hyland (2005)	24	51.06%
	Hyland & Tse (2004)	3	6.38%
	Thompson (2001)	2	4.26%
	Mauranen (1993) & Ädel (2003)	2	4.26%
	Ädel (2006)	1	2.13%
	Crismore et al. (1993)	1	2.13%
	Jiang and Hyland (2016)	1	2.13%
	Hyland (2019)	1	2.13%
	Vande Kopple (1985)	1	2.13%

3.3 Research design and research context

3.3.1 Research design

As can be seen from the table 6, more than 90% studies concentrate on synchronic analysis, in comparison to only 6.38% diachronic studies. We speculate that to some extent, the diachronic study is not the best choice for the limited length of journal articles. When it comes to the study approaches, most research is concerned with cross-disciplinary analysis. Conversely, only 6.38% studies focus on the cross-linguistic and cross-disciplinary examination. Regarding the analysis methods, most research adopts the quantitative method. Only 4.26% studies deploy the qualitative analysis. We speculate such studies need much data to analyze the linguistic phenomena across disciplines. Therefore, the corpus analysis can facilitate the understanding of metadiscourse markers in academic writing.

Table 6. Research design

Variable	Value	N	%
Study types	Synchronic studies	44	93.62%
	Diachronic studies	3	6.38%
Approaches	Cross-linguistic and cross-disciplinary	3	6.38%
	Cross-disciplinary	44	93.62%
Methods	Qualitative	2	4.26%
	Quantitative	22	46.81%
	Mix methods	10	21.28%
Statistical software	Spss	8	17.02%
	Nvivo	1	2.13%

3.3.2 Research context

Academic research articles constitute a pivotal genre for knowledge dissemination and scholarly communication within academic discourse communities (Hyland, 2009; Swales, 1990). These articles, diverse across disciplines, not only convey research findings but also reflect target audiences and prevailing social assumptions (Bruce, 2005; Hyland, 1999). Remarkably over 70% of studies delve into comprehensive research articles, examining them in their entirety. However, a mere 4.26% of studies focus specifically on the introductions within research articles, indicating a relative scarcity of attention in this area. Furthermore, a modest 6.38% of studies are dedicated to analyzing university students' essays, showcasing a narrower focus within the broader landscape of academic discourse analysis.

Table 7. Textual registers

Variable		N	%
Research article	Full RA	21	44.68%
	Abstracts	3	6.38%

	Introductions	2	4.26%
	Discussions	1	2.13%
	Conclusions	1	2.13%
	Introductions & conclusions	1	2.13%
	Introductions, results & discussion	1	2.13%
	Results, discussion & conclusions	1	2.13%
	Discussions & conclusions	1	2.13%
	Results & discussion	2	4.26%
University students' Essay		3	6.38%
Postgraduate writing		5	10.64%
BA these abstracts		1	2.13%
University textbooks		1	2.13%
Book review		3	6.38%

In terms of disciplinary contexts, most articles engage in comparative analyses between two or four disciplines, comprising 42.55% and 29.79%, respectively. This suggests that researchers find it convenient to conduct contrastive analyses, particularly for peer review purposes. Comparing too many disciplines may make it difficult for researchers to manage.

Table 8. Disciplinary contexts

Variable	Value	N	%
Disciplinary numbers	2 disciplines	20	42.55%
	3 disciplines	8	17.02%
	4 disciplines	14	29.79%
	6 disciplines	1	2.13%
	8 disciplines	3	6.38%
	16 disciplines	1	2.13%
Top-14 disciplinary contexts	Applied linguistics	28	16.87%
	Biology (cell biology)	12	7.23%
	Sociology	9	5.425
	Economics	8	4.82%
	Psychology	7	4.22%
	Computer science	5	3.01%
	Electrical engineering	5	3.01%
	Marketing	5	3.01%
	Physics	5	3.01%
	Chemistry	4	2.41%
	Education	4	2.41%
	Medicine	4	2.41%
	Mechanical engineering	4	2.41%
	Philosophy	4	2.41%

Among the top disciplines utilized for analysis, applied linguistics, biology, and sociology emerge as the most prominent. This trend underscores the significance of interdisciplinary approaches in understanding and contextualizing metadiscourse phenomena across various academic domains. The word cloud of disciplines is shown in the following figure.
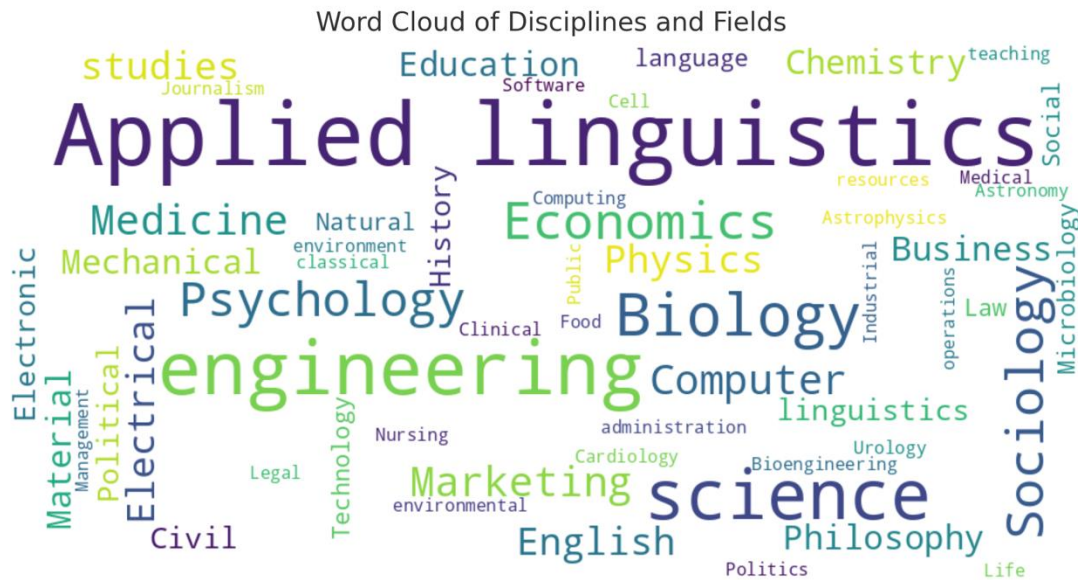

Figure 2 Word cloud of disciplines

3.4 RESEARCH METHODOLOGY

Bruce (2010) employs the BAWE corpus, whereas Yoon and Roemer (2020) utilize the MICPSP corpus. However, nearly 96% of studies rely on self-built corpora, indicating their flexibility and ability to cater to researchers' specific needs. In terms of corpus languages, 74.47% of studies made no distinction between native (Ns) and non-native (NNs) speakers. Among the remaining studies, Iranian (8.51%), L2 English (4.26%), Chinese (4.26%), and other languages such as Persian, Pakistani, Arab and Anglophone, Lithuanian, and Spanish were represented in small percentages (2.13% each).

The corpus size is analyzed in terms of both the number of texts and the number of words. For the number of texts, 51–100 texts were 27.66%, followed by 11–30 texts. Texts numbering 1–10, >500, and unreported data appeared less frequently. As for the number of words, corpora exceeding 1,000,000 words were 27.66%, followed by corpora with 10,000–100,000 words. Unreported word counts and corpora with fewer than 10,000 words accounted for 8.51% and 2.13%, respectively.

Regarding software tools, AntConc was the most frequently used tool (27.66%), followed by WordSmith Tools, MonoConc Pro, and UAM CorpusTool (each 6.38%). MicroConcord was used in 2.13% of the studies, while a significant proportion of studies (51.06%) did not report the software tools they employed. Table 9 displays the findings in detail.

Table 9. Corpora features and study contexts

Corpora features	Study context	N	%
Corpus types	Existing/extant corpus	2	4.26%
	Self-built corpus	45	95.74%
Corpus languages	No difference between Ns and NNs	35	74.47%
	Iranian	4	8.51%
	L2 English	2	4.26%
	Chinese	2	4.26%
	Persian	1	2.13%
	Pakistani	1	2.13%

	Arab and Anglophone	1	2.13%
	Lithuanian	1	2.13%
	Spanish	1	2.13%
Corpus Size	Quantity of texts		
	1-10	1	2.13%
	11-30	11	23.4%
	31-50	4	8.51%
	51-100	13	27.66%
	101-200	8	17.02%
	201-500	8	17.025
	>500	1	2.135
	Unreported	1	2.13%
	Number of words		
	<10000	1	2.13%
	10000-100000	11	23.4%
	100001-300000	9	19.15%
	300001-500000	4	8.51%
	500001-1000000	5	10.64%
	>1000000	13	27.66%
	Unreported	4	8.51%
Corpus software tools used	AntConc	13	27.66%
	WordSmith tools (2004)	3	6.38%
	MonoConc Pro	3	6.38%
	UAM CorpusTool	3	6.38%
	MicroConcord	1	2.13%
	Unreported	24	51.06%

4. DISCUSSION

This study presents a comprehensive systematic review of metadiscourse markers in academic writing, incorporating cross-disciplinary analyses. Following the PRISMA (2020) guidelines for identification and screening, 47 articles were selected for inclusion in the final analysis. The review delves into the conceptual framework, research design, and contextual factors, followed by an examination of the research methodology employed.

In response to research question 1, 'broad' conceptions of metadiscourse, Hyland's interpersonal model in specific, prominently dominate contrastive analyses within academic writing, reflecting its widespread applicability and methodological feasibility. The reference list of metadiscourse markes offer a profitable framework for the corpus analysis of metadiscourse elements. However, few researchers make adaptations to the list. This can be attributed to the inborn fuzzy and polypragmatic nature of metadiscourse, which complicates the identification of its functions within the specific context. Nevertheless, relying only on such list without adaptation is considered as a lazy behaviour (Hyland 2019). Therefore, the manual check is imperative to enhance the validity and precision of future research findings.

In responding to research question 2, research articles stand out as a most extensively analyzed genre, with studies on various sections sections including abstracts, introductions, discussions, and conclusions. This is in line with the findings with Hyland and Jiang (2017). However, the effect of intrageneric variation on the use of metadiscourse in research articles is underexplored (Qiu et al. 2024). Consequently, there is a lack of the detailed metadiscourse profiles across disciplines in the English for Academic pedagogy.

Applied linguistics emerges as a prominent discipline in contrastive analyses across various fields. Research articles in this field are often authored by language specialists who possess an in-depth understanding of the linguistic and rhetorical aspects of this genre (Kawase 2015). While it is more valuable to explore the language use of research articles in this discipline, Harwood (2006) argues that "distinguishing between writing practices only at the disciplinary level is an oversimplification"

(p. 443). Applied linguistics encompass a range of sub-disciplines, each of which may exhibit different patterns of metadiscourse use. This difference is also the same with other disciplines. For instance, the studies by Cao and Hu (2014, 2015) focus on the science learning and instruction in applied linguistics, highlighting the interdisciplinary nature of the field. The paradigmatic difference is examined in this study as well. Based on their findings, the authors suggest that discipline- and paradigmatic-tailored writing courses in metadiscourse could enhance students' effective academic writing.

In response to the research question 3, all studies are corpus studies and AntConc is a frequently utilized tool as it is free and power for corpus analysis. Due to its practicability and publication limitation, most studies adopt the quantitative analysis instead of qualitative analysis, reflecting the frequency and distribution patterns of metadiscourse markers in research articles across disciplines. In addition, numerous studies focus on the comparison of native and non-native English language writers. However, this perspectvie does not align with the understanding proposed by World Englishes, which claims that native English language may not be the only benchmark in the academia (Canagarajah, 2006).

The reviewed studies demonstrate remarkable disciplinary and genre-specific variations in the use of metadiscourse. For instance, Kashiha & Marandi (2019) examine the research articles introduction in terms of interactive metadiscourse markers while Kashiha (2021) conducts the similar study in terms of interactional metadiscourse markers. Both studies choose the disciplines: Applied Linguistics and Chemistry. Researchers adopt the CARS model (Swales, 1990) and explore the differences among different moves. Findings reveal that marked similarities and discipline-specific variations in the frequency and function of metadiscourse markers in the main moves of research article introductions.

The findings of several studies indicate that there is no significant statistical difference across the disciplines. For example, Estaji & Vafaeimehr (2015) observed there is no statistically significant difference in the use, type and frequency of interactional metadiscourse markers in the introductions and conclusions of research articles across two disciplines: Mechanical and Electrical Engineering, which can be attributed to the close nature of these fields. This highlights that disciplines with similar epistemological and methodological foundations may exhibit comparable metadiscourse practices.

In addition, some studies present different findings. For instance, contrary to Khedri et al. (2014), who claimed that hedging devices were rarely employed in hard science disciplines, the findings showcased that authors in Physics and Cardiology actively adopted hedging devices to evaluate arguments and engage with their audience (Keshmirshekan & Atai, 2022). This suggests that the use of hedging devices may vary not only across disciplinary boundaries but also within subfields of the same discipline, reflecting the nuanced nature of academic communication.

Academic writers in various disciplines face challenges in utilizing metadiscourse effectively and demonstrate notable variations in its use. Despite these advancements, some studies are constrained in the corpus size due to the eyewatering task or the limited length of publishing.

5. CONCLUSION

This current study aspires to examine the metadiscourse use in academic writing across disciplines to obtain a comprehensive understanding of the conceptual framework and methodology utilized. These results underscore the nuanced and context-specific nature of academic communication, highlighting the need for discipline- and genre-tailored approaches to teaching and analyzing metadiscourse. Future research should address underexplored areas, such as intradisciplinary variations and the integration of qualitative methods, to develop a more comprehensive understanding of metadiscourse practices.

5.1 Enhancing methodological rigor in metadiscourse research

During the process of conducting this SLR, the researcher was confronted with several obstacles in synthesizing the selected studies. Incorporating with the research findings, the following recommendations are proposed to guide future high-quality metadiscourse research.

Firstly, it is advisable to explicitly specify the metadiscourse model utilized and provide a comprehensive list of markers in the appendix for clarity and transparency. This practice ensures transparency and enables other researchers to replicate or build on their findings. Additionally, a detailed discussion of the distinctions between various models would enhance readers' understanding.

Secondly, researchers can explicitly outline their categorization of disciplines and provide rationale for their selection of specific disciplines. A clear and systematic classification – ideally presented in a table - would facilitate to understand the disciplinary focuses. The elaboration on why certain disciplines were prioritized can also provide valuable and critical context for the study.

Thirdly, enhancing the replicability of studies can be achieved by increasing transparency in both the analysis data and procedures (Qiu et al., 2024). Researchers are encouraged to providing detailed descriptions of their methodologies, including the clear illustrations of statistical software and corpus tools used. Sharing datasets and analysis scripts openly would further improve reproducibility and foster collaboration within the academic community. Such studies can check the generality of existing literature (Cao and Hu, 2014). Reporting corpus design and corpus data also need to be improved to provide the full context of the research and persuade readers with interpretability and reliability (Ahmed & Zhang 2023).

5.2 Exploring emerging trends and areas in metadiscourse research

Several perspectives for future metadiscourse research are suggested as follows:

First, when the differences in metadiscourse use across disciplines are identified, researchers could conduct qualitative analysis and investigate the underlying causes through interviews with writers or surveys with readers.

Second, with the rapid emergence of new fields, such as data science, there is a need to examine their unique linguistics features. Further studies could investigate how writers in these disciplines communicate with readers through metadiscourse in their academic writing.

Third, while most metadiscourse studies focus on English academic writing, examining research articles written in other languages would provide valuable insights into cultural and linguistic influence on metadiscourse (Pearson & Abdollahzadeh 2023).

Finally, further studies could explore postgraduate theses or other genres to investigate their persuasiveness and analyze the usage of metadiscourse markers across various disciplines. Such research endeavors would enhance writing skills in academic contexts, potentially enabling students to produce journal articles for publication. By delving into the metadiscourse strategies employed in these academic works, researchers can gain valuable insights into effective communication within scholarly writing, thus advancing the quality and impact of academic publications.

5.3 Limitations

This study provides valuable insights into the use of metadiscourse in academic writing across disciplines, contributing to a better understanding of the conceptual frameworks and methodologies employed. However, this study is subject to several limitations. Firstly, it does not categorize disciplines into soft or hard disciplines, potentially overlooking important distinctions in academic writing conventions. Future research should consider employing frameworks like Becher's (1989) typology for greater analytical precision. Secondly, certain articles focus solely on individual metadiscourse markers, such as interactive or interactional markers, without contextualizing them within broader categories. This study aggregates specific markers into larger categories, which might

oversimplify the analysis. Thirdly, certain articles lack clarity regarding the methodological approaches - whether qualitative, quantitative, or mixed methods. The reliance on statistical software or corpus tools utilized may have obscured the nuances of methodological approach employed.

Despite these limitations, this study sets the stage for further contrastive cross-disciplinary analysis of metadiscourse strategies. By addressing the aforementioned challenges, future research can contribute to in-depth understanding of metadiscourse resources in academic writing and foster the development of more effective practice across disciplines.

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