

Metadiscourse in Applied Linguistics and Chemistry Research Article Introductions¹

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Abstract

This study examined disciplinary rhetoric in research articles, focusing on different traditions in structuring text discourses from a metadiscourse-move analytic approach. The corpus consisted of 72 research article Introductions (RAIs): 36 in applied linguistics and 36 in chemistry. Swales' CARS model (1990, 2004) and Hyland's interpersonal model of metadiscourse (2005) were used as analytical frameworks for move and metadiscourse analyses, respectively. Both frequency and functional analyses showed that there were considerable differences between the 2 disciplines in terms of how the writers used metadiscourse in the RAIs and how the metadiscourse markers were mapped to fulfill the rhetorical purposes of Introduction moves. Such discrepancies reflect the susceptibility of metadiscursive features to the sociorhetorical cultures conditioned by the discipline to which the writers belong. Findings have implications for teaching novices, especially nonnative speakers of English, to write research articles and help them create a convincing research space and make appropriate use of metadiscourse.

Keywords: Disciplinary Community; Genre; Metadiscourse; Move; Research Article Introductions (RAIs)

1. Introduction

Academic disciplines vary in how they build and disseminate new knowledge and in what they regard as constituting knowledge within their field (see Becher, 1989). However, what is now common to most disciplines is their preference for producing and disseminating new knowledge among scholars world-wide via research articles. Increasing interest over the last two decades in research articles as a genre has led to the study not only of their overall organization, but also of their

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historical evolution, social construction, and the broad structure of their constituent rhetorical sections (e.g., Brett, 1994; Hirano, 2009; Hyland, 2000; Kanoksilapatham, 2005; Lim, 2006; Loi & Evans, 2010; Ozturk, 2007; Peacock, 2002; Swales, 2004; Williams, 1999). As an often-studied academic genre, research articles have also been used to scrutinize rhetorical options, such as lexical bundles (Cortes, 2013), transitivity structures (Martínez, 2001), citations (Hyland, 1999), reporting verbs (Thompson & Ye, 1991), and metadiscourse markers (Hyland & Tse, 2004).

As a repertoire of textual properties to construct discourse, metadiscourse use in the high-stakes genre of research articles has received much attention during the last few decades (Cao & Hu, 2014; Crismore, Markkanen, & Steffensen, 1993; Dahl, 2004; Hyland, 1998, 2001, 2005; Ifantidou, 2005; Khedri, 2016; Khedri, Swee Heng, & Ebrahimi, 2013; Loi & Lim, 2013; McGrath & Kuteeva, 2012; Vande Kopple, 1985). Metadiscourse is “a central pragmatic construct which allows us to see how writers seek to influence readers’ understandings of both the text and their attitude toward its content and the audience” (Hyland, 1998, p. 437). Academics choose from the range of stylistic and rhetorical devices common in their individual disciplines and sociorhetorical backgrounds to structure discourse, provide proofs, and present ideologies to persuade their audiences (Crismore, et al., 1993; Hyland, 2005). Metadiscoursal features, which are central to such interpersonal and social interactions, play a crucial role in knowledge construction and help writers manage writer-reader relationships. Their strategic use not only increases the possibilities of knowledge claims being acknowledged but also reflects authorial competency as a community member.

Literature shows that a number of studies have focused on metadiscourse use in research article writing from the perspectives of genre analysis (e.g., Hyland, 2002a, 2002c, 2003) and language or big culture (i.e., Mauranen, 1993; Molino, 2010; Sheldon, 2009). Another important line of inquiry has been the cross-disciplinary study of metadiscursive features (e.g., Abdi, 2002; Cao & Hu, 2014; D. Salas, 2015; Harwood, 2005; Hyland, 2001, 2005; Khedri, et al., 2013; Tse & Hyland, 2008), which have been found to vary across disciplinary rhetorical cultures in terms of both their frequency and range of uses. Metadiscourse markers, therefore, seem to be important foci of analysis for the study of disciplinary orientations in written academic discourse. However, most cross-disciplinary studies leaned to examine only a subset of metadiscursive resources each time (Abdi, 2002; Cao & Hu, 2014; D. Salas, 2015; Harwood, 2005; Hu & Cao, 2011; Hyland, 2001, 2007; Khedri, 2016).

A closer look at the literature also reveals that there are still areas of inquiry in metadiscourse, such as the move-metadiscourse linkage in different sections of research articles, especially Introductions that require further study. Both metadiscourse and rhetorical moves are the “main building blocks” in discourse

construction and organization (Biber, et al., 2007, p. 53). Once identified, metadiscoursal resources can be used to elucidate the communicative purposes of the moves. Exploring the move-metadiscourse linkage in a certain register could reveal writers' preferences in terms of microlevel (linguistic features) and macrolevel (rhetorical organization) structures used in discourse construction across various disciplinary communities. Notwithstanding the important role played by these two interrelated angles—move and metadiscourse—in constructing discourse, little empirical work has so far examined their linkage in different disciplinary writings. Among the few, del Saz-Rubio's (2011) has addressed this issue in a corpus of 28 research article Introductions (RAIs) in a single field of agricultural sciences but did not identify writers' pragmatic acts of metadiscourse use. More importantly, the macro and microlevel rhetorical structures used in hard science disciplines, like chemistry, remained largely unexplored, and this void is more acute when it comes to their comparison with soft science disciplines, such as applied linguistics.

To address all the aforementioned lacunae in the disciplinary knowledge, this corpus-based study aimed to examine the move-specific use and discursive functions of both the interactive and interactional metadiscourse markers proposed by Hyland (2005) in RAIs within the disciplines of applied linguistics and chemistry. The rationale for such a cross-disciplinary comparative design is the dependent stylistic nature of metadiscoursal features based on which "authors can vary at will" (Hyland, 1998, p. 438) because of distinct disciplinary norms and sociorhetorical structures in a community.

This study draws on Hyland's interpersonal model of metadiscourse (2005) to examine metadiscourse use in applied linguistics and chemistry RAIs and uses Swales' CARS model (1990, 2004) to see how such rhetorical devices are mapped onto the component moves in RAIs. The approach taken is pragmatic in nature given that evaluating the incidence of specific metadiscourse markers is closely associated with the rhetorical context in which they occur (which, in turn, will control the macro-organizational level of RAIs, as well) and the pragmatically discursive functions they fulfill. Overall, the following research questions are addressed to form the purpose of the study:

1. What are the similarities/differences in the use of metadiscourse between applied linguistics and chemistry RAIs?
2. How do applied linguistics and chemistry writers use metadiscourse to fulfill the rhetorical purposes of Introduction moves?

2. Theoretical Frameworks

2.1. Hyland's Interpersonal Model of Metadiscourse

Metadiscursive resources are divided into textual and interpersonal (cf. Crismore, et al., 1993; Vande Kopple, 1985). Hyland and Tse (2004) and Hyland (2005) extend the interpersonal aspect of metadiscourse and make it more robust taking into account “the reader’s knowledge, textual experiences, and processing needs [...]” (p. 161). They depart from the Hallidayan (1973) duality of textual and interpersonal facets of discourse, and take on Thompson and Thetela’s (1995) and Thompson’s (2001) description of interactive and interactional resources as two correlated planes of interaction viewed as “two sides of the same coin” (p. 61). This perspective considers all discursive elements to be derived from the relationship created in the text between writers and readers belonging to a specific discourse community. Interactive and interactional resources address the interpersonal aspect of communication, namely how writers present propositional material in writing. What follows is a brief description of the different resources that integrate interactive and interactional categories (see Table 1).

Citing Thompson (2001), Hyland and Tse (2004) define interactive as “the writer’s management of the information flow to guide readers through the text” (p. 168). Transitions which are primarily conjunctions create textual cohesion by clarifying the relationships across arguments. Pragmatically, writers use transitions to codify information to get the message across (Blakemore, 2002). In this study, transitions are restricted to intersentential features excluding intrasentential elements like *since*, *though*, *while*, *because*, given that they do not have an internal role, but refer to “the outside world” (Hyland, 2005, p. 50). Code glosses indicate “the restatement of ideational information” (Hyland & Tse, 2004, p. 168) to help readers access the meaning as writers intended. From a pragmatic perspective, they contribute to the lucidity of the message by explaining “implicated premises and conclusions” (Murillo, 2004, p. 2066). Endophoric markers, known as text references (Bunton, 1999) or locational metatext (Dahl, 2004), refer to information in other parts of the text. Pragmatically, they help readers recover the actual meaning by drawing their attention to the different units of the discourse (Hyland, 2005). Evidentials, known as citations (Swales, 1990), present information from sources outside the text. The appropriate use of evidentials may prevent possible objections and rebuttals (Hu & Wang, 2014), “strengthen readers’ assumptions of adequate documentation” (White, 2011, p. 3347), and reflect one’s belonging to a specific community (Hyland, 1999). Frame markers are used to divide the information into matching rubrics and mark out text boundaries in order to facilitate interpretation. As pragmatic acts, they organize the discourse locally or globally and assist processing by explicitly patterning discursive features and borders (Aguilar, 2008).

Interactional resources are used to “involve readers in the argument by alerting them to the author’s perspective towards propositional information and readers themselves” (Hyland & Tse, 2004, p. 168). Writers use hedges when making claims to allow for alternative voices. Pragmatically, they highlight the subjectivity of authorial voices, and differentiate facts from opinions. Boosters are used to ward off alternative voices or possible objections. They emphasize the author’s confidence and belief concerning a proposition, which may be the effect of particular pragmatic conventions in written texts. Attitude markers express writers’ affective viewpoints regarding a given proposition, and may reflect surprise, agreement, importance, obligation, and frustration through attitude verbs (e.g., *agree, prefer*), sentence adverbs (e.g., *unfortunately, hopefully*), adjectives (e.g., *appropriate, logical, remarkable*) or even exclamation marks. Engagement markers help writers bring readers into the discourse, inviting them into argumentations. Personal pronouns, directives, asides, and interrogative structures are sample constructions of engaging language. Self-mentions signal the explicit portrayal of an authorial presence in the text. Pragmatically, authorial self-positioning in discourse allows writers to highlight their own personal original thinking and “gain credibility by projecting an identity invested with individual authority, displaying confidence in their evaluations and commitments to their ideas” (Hyland, 2002b, p. 1091):

Table 1. *Hyland’s Interpersonal Model of Metadiscourse (2005)*

Category	Function	Examples
<i>Interactive</i>		
<i>Help to Guide Reader Through Text</i>		
Transitions	Express relations between main clauses	<i>in addition, but, thus, and</i>
Code Glosses	Elaborate propositional meanings	<i>in other words, e.g., namely</i>
Endophoric Markers	Refer to information in other parts of the text	<i>noted above, in Section 2</i>
Evidentials	Refer to information from other texts	<i>according to X, Z states</i>
Frame Markers	Refer to discourse acts, sequences or stages	<i>finally, to conclude</i>
<i>Interactional</i>		
<i>Involve Reader in Text</i>		
Hedges	Withhold commitment and open dialogue	<i>might, perhaps, possible,</i>
Boosters	Emphasize certainty and close dialogue	<i>in fact, it is clear that</i>
Attitude Markers	Express writer’s attitude to proposition	<i>unfortunately, I agree</i>
Engagement Markers	Explicitly build relationship with reader	<i>consider, you can see that</i>
Self-Mentions	Explicit reference to author(s)	<i>I, we, my, me, our</i>

2.2. Swales’ CARS Model

Swales’ CARS model is grounded in the view of academic writing as systematically structured discourse. RAIs comprise three obligatory moves, *establishing a territory* (M1), *establishing a niche* (M2), and *occupying the niche*

(M3), each comprising several steps to help writers fulfill their rhetorical purposes (Swales, 1990, 2004). Despite Swales' (1990) seminal work in accounting for the rhetorical organization of RAIs independently of disciplines, research has shown that there are disciplinary differences which require modification of the CARS model (cf. Anthony, 1999; Árvay & Tankó, 2004; Samraj, 2002). This led Swales to proposing a refined move scheme (2004) in which the most radical adaptation within M1 was reducing all three steps (claiming centrality, making topic generalizations, and reviewing items of previous research) to one step labeled "topic generalization of increasing specificity" (Swales, 2004, p. 230). With regard to M2, all its respective steps (1a-1d: "counterclaiming," "indicating a gap," "question-raising," and "continuing a tradition") were condensed to step 1a "indicating a gap" and step 1b "adding to what is known," followed by a new optional step 2, "presenting positive justification." In contrast to the three steps envisioned in the original model, occupying the niche (M3) is achieved by a number of seven possible steps. In this more elaborate and complex description, only step 1 ("announcing present research descriptively and/or purposively") is obligatory. This step conceptually agglutinates steps 1a ("outlining purposes") and 1b ("announcing present research") from the original version. Furthermore, three optional steps, which were absent from the original version, were introduced (step 2: "presenting research questions or hypotheses"; step 3: "definitional clarifications"; and step 4: "summarizing methods"), accompanied by three further "PISF" (possible in some fields) steps 5-7 (Swales, 2004, p. 232). Whilst step 5, "announcing principal outcomes" reproduces step 2, "announcing principal findings," step 7, "outlining the structure of the paper" corresponds to the originally envisioned step 3, "indicating article structure." Table 2 gives a clear picture of all the abovementioned amendments made to the original version:

Table 2. *Swales' CARS Model (1990, 2004)*

<u>Move 1</u> : Establishing a territory (citation required) via
Step 1: Claiming centrality
Step 2: Making generalizations of increasing specificity
Step 3: Reviewing items of previous literature
<u>Move 2</u> : Establishing a niche (citation possible) via
Step 1a – Counterclaiming (or)
Step 1b – Indicating a gap (or)
Step 1c – Question-raising (or)
Step 1d – Adding to what is known (step 1d: continuing a tradition) (or)/
Step 2 (Optional) – Presenting positive justification
<u>Move 3</u> : Occupying the niche (citation possible) via
Step 1 (Obligatory) – Announcing present research descriptively and/or
purposively (Step 1A: Outlining purposes or step 1B: announcing present research)
Step 2* (Optional) – Presenting research questions, hypotheses or assumptions
Step 3 (Optional) – Definitional clarifications

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- Step 4 (Optional) – Summarizing methods
 Step 5 (PISF)** – Announcing principle outcomes (Step 2: announcing principle findings)
 Step 6 (PISF) – Stating the value of the present research
 Step 7 (PISF) – Outlining the structure of the paper (Step 3: indicating research article structure)
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*Steps 2-4 are not only optional but less fixed in their order of incidence than the others

**PISF: Possible in some fields but not likely in others

In spite of these revisions, subsequent work on the rhetorical moves and structural organization of RAIs has kept drawing on Swales' (1990) model as an operative analytical framework (cf. Árvay & Tankó, 2004; del Saz-Rubio, 2011; Hirano, 2009; Ozturk, 2007). This is mainly due to the fact that the refined move scheme predominantly replicates the overall principal structure present in the 1990 model. Other possible explanations might be substantial outcomes generated from applying the original version, or entrenched research practice developed around it (see Hirano, 2009). Having said this, adopting Swales' original or revised move scheme still remains perplexing for some researchers. On the one hand, the application of the 1990 model may fail to accept the marked amendments within the new model. On the other, applying the new model may impede grasping as many rhetorical strategies as possible for move enactment, particularly for M1 and M2 in which some steps are reduced. Therefore, with a view to adopting as encompassing and comprehensive a model as possible, this piece of research rests upon the original model as a starting point for data analysis taking also into account the sizable changes in the new model.

3. The Corpus

The corpus compiled for the study consisted of two datasets, 36 RAIs in applied linguistics and 36 in chemistry, totaling just over 80,000 words (see Table 3). The corpus size was expected to be adequate as the study adopted a mixed-modes research design (qualitative and quantitative approaches), involving frequency and functional analyses of metadiscourse and examining its use in Introduction moves. Whereas the study is limited in generalizability of its findings due to the moderate data size, the systematic analysis and the cross-disciplinary perspective into the move-specific use of various types of metadiscourse have yielded some interesting findings that are helpful to discipline-specific writing practices:

Table 3. *Corpus Description*

	Applied Linguistics Subcorpus	Chemistry Subcorpus
No. of RAIs	36	36
No. of Journals From Which RAIs Were Extracted	4	4
Length of RAIs (Range of Words)	561-2387	416-1603
Average length of RAIs (Per Word)	1284.8	949.4

The articles selected for analysis were empirical research papers published between 2008 and 2017. They fell under the category of “original article” formatted according to the Introduction, Method, Results, and Discussion (IMRD) structure—a widely accepted conventional format for empirical research papers proposed by Swales (1990). In all the selected articles, the Literature Review sections were merged with the Introduction sections in order to control any possible effects that an independent Literature Review section might have on the move structure and metadiscourse use in Introduction moves.

The applied linguistics Introductions were extracted from articles published in *Journal of English for Academic Purposes* [JEAP], *English for Specific Purposes* [ESP], *Journal of Second Language Writing* [JSLW], and *Journal of Pragmatics* [JP]. The chemistry Introductions were taken from articles published in *Acta Biomaterialia* [AB], *European Polymer Journal* [EPJ], *Journal of Molecular Structure* [JMS], and *Microchemical Journal* [MJ]. The journal selection was made by consulting an insider-specialist in each discipline. All the journals selected are accessible online, indexed by ISI Web of Science (2011), have a high impact factor, and fulfill Nwogu’s (1997) criteria of representativity and reputation by being considered as highly prestigious in their respective discipline. They are comparable in terms of the outsized discourse community in which they function, cover a range of topics in each discipline, and publish articles which are extensively read by experts in the communities and representative of the genre with regard to the content and style.

4. Method

The WordSmith concordance software (Scott, 2004) was used to automatically identify metadiscourse features in each disciplinary subcorpus by examining the tokens of metadiscourse in Hyland’s (2005) list. However, due to the nature of the phenomenon, which is context-dependent and has been considered as both a fuzzy and functional category realized by a range of lexico-grammatical features (Ädel, 2006; Hyland, 2005), a manual annotation was also taken to tease apart multifunctionality and ascertain that the automatic-driven features are acting as metadiscourse. Also, this contextual analysis facilitated finding out the writers’ discursive use of metadiscourse in their texts. In this study, cases of use found in the texts in, at least, one discipline with the minimum frequency of once per 1,000 words were regarded as discourse functions.

Finally, Swales’ (1990, 2004) CARS model was run on the data to analyze the generic move structure. Once all the moves were identified, the most frequently used metadiscourse markers in each move were determined by drawing on a functional approach. As the main purpose of the move analysis was to see how metadiscourse markers characterized the constituent moves in the RAIs, the analysis

was limited to the organization of moves. The sentence was considered as the coding unit and each one was assigned a move label (e.g., M1, M2, etc.), following Swales' (1990, 2004) description. In cases where more than one move appeared in the sentence, the most salient one was selected, following del Saz Rubio (2011), Holmes (1997), and Ozturk (2007). This is exemplified below:

- Bisphenol-A polycarbonate (PC) is one of the toughest and clearest plastics, but it is also difficult to process due to its high melt viscosity caused by the rigid chain structure, resulting in a relatively high processing temperatures (at least 280 _C) and/or high screw torques. [EPJ3]

In the particular case, after making a generalization of increasing specificity (M1, step 2), the author made an attempt to establish a niche in the field by addressing a practical research problem in the field (M2, step 1b). As the latter move appears to be more salient, the whole sentence was considered as M2.

In order to control length variation and make the comparison between datasets of different sizes possible, the occurrence counts of the finalized identified features were normalized following Biber et al. (1998) [(Raw frequency count/number of words in the text) x 1,000 = normalized frequency count]. Also, in this study, in order to reduce the risk of randomness and demarcate the precision of the analytical approaches taken at an adequately high level of consensus, a consistent method was very central to data codification. Therefore, although the corpus was mainly analyzed by the researchers, the reliability of the data coding was assessed through intercoder agreement. The RAIs were first coded sentence by sentence and a sheet of analysis was appended to each one for systematic analysis. A quarter of the corpus was analyzed by two Ph.D. graduates who had done their dissertation on genre-based text analysis (nine RAIs each). They received exhaustive training for several sessions and were also given a coding manual containing descriptions and instances. Once the corpus was analyzed quantitatively and qualitatively, we went through the texts with the coders to identify any conflicting results. Slight conflicts in move boundaries and discursive uses of metadiscourse were found and ironed out in discussions. The intercoder agreement measured by Cohen's kappa obtained value signalled a high reliability index of .89.

5. Results and Discussion

5.1. Metadiscourse: Frequency Analysis

A total of 7,474 lexical items (9.2% of the total running words), functioning as metadiscourse, was identified in the whole corpus (4,812 tokens in applied linguistics and 2,662 tokens in chemistry). The most used metadiscourse in the two sets of disciplinary rhetoric was the interactive type (57.6% in applied linguistics and 67.2% in chemistry). This may indicate the writers' sensitivity to the readers' needs

and knowledge with regard to what has to be made explicit to help them comprehend the message easily. Nevertheless, the results revealed some differences between the two datasets in the use of the categories of interactive metadiscourse. As illustrated in Table 4, transitions were widespread in the applied linguistics writings, reflecting the writers' reader-oriented style in structuring discourse. The applied linguistics texts tended to be more discursive than the chemistry counterparts with the writers using transitions in crafting an unfolding text and, consequently, alleviating the readers' burden of understanding the logical relationship between propositions.

Code glosses occurred in both datasets, but more frequently in the applied linguistics writings. It appears that rephrasing or elaborating particular segments of discourse is a conventionalized writing strategy among the writers in applied linguistics. Endophoric markers were also frequent in the applied linguistics Introductions, which indicates the writers' tendency to make other salient information available to the reader. Referring forward and backward is likely to produce a more explanatory text, which may be related to the status of the applied linguistics writers as 'language' people, and reflect their disciplinary rhetoric.

The results also showed that whereas both the applied linguists and chemists favored outlining text boundaries and partitioning the propositional content by means of framing devices (about 3 instances per 1,000 words), evidentials were more widely observed in the writings of the former. This may indicate a greater need for applied linguistics writers to convince readers that the subject matter belongs to a well-established research niche. The findings support the claim that evidence markers are basically more substantial in soft texts (cf. Becher, 1989; Hyland, 2005), given that soft concepts are more detached from the immediately previous developments and depend less on a single line of text development. Writers are, therefore, more willing to embed their arguments in networks of references to document their own credentials, showing the relevance of their work and its significance.

Table 4. *Interactive Resources in RAIs Within Applied Linguistics and Chemistry*

	Applied Linguistics Subcorpus		Chemistry Subcorpus	
	Raw	Norm	Raw	Norm
Transitions	772	16.68	514	15.03
Code Glosses	670	14.48	458	13.39
Endophoric Markers	238	5.14	102	2.98
Evidentials	952	20.58	632	18.49
Frame Markers	138	2.98	84	2.45

In the interactional categories, hedges were most frequently used in the applied linguistics texts (18.76 occurrences; see Table 5), reflecting the need for "appropriate caution and deference to the views of" readers, taking into account their perspectives (Hyland & Tse, 2004, p. 171). In research practice, applied linguists

depend on personal interpretations of qualitative analyses or statistical probabilities to frame and present their ideas (Hyland & Tse, 2004), which could explain why they tend to withhold their commitment to propositional information through the use of tentative expressions such as *perhaps*, *may*, and *could*. The relatively frequent use of boosters suggests that there is a greater propensity for applied linguists to consolidate their research space more strongly, even at the beginning of articles. The present results match earlier findings (e.g., Hyland, 2005; Hyland & Tse, 2004), and confirm that boosters appear markedly more often in the soft disciplinary rhetoric of the applied linguistics Introductions.

Attitude markers occurred very infrequently—less than once per thousand words—in both applied linguistics and chemistry. Academics in these disciplines seem to avoid making subjective comments on the information being offered in order to preserve its scientific nature. It is not possible to conduct a functional analysis to identify the writers' discourse use of attitude markers on account of their low frequency. As with previous studies (cf. del Saz-Rubio, 2011), engagement markers also occurred very infrequently. However, whereas the chemistry writers never addressed readers, their applied linguistics counterparts were more inclined to bring them into the text as participants, building up relationships and expressing their appraisal of propositional information.

The applied linguists also tended to foreground their voice to display their academic authorial persona and endorse their credentials using self-representational devices. There seems to be a need to build up a convincing ethos through a focus on self-mentions to prove the legitimacy, originality, and relevancy of the research being reported. The chemists, on the other hand, favored to subsume their authorial selves by disciplinary knowledge and conventions, concealing themselves behind a screen of linguistic objectivity and choosing to dominate research credibility over their own personal authority:

Table 5. *Interactional Resources in RAIs Within Applied Linguistics and Chemistry*

	Applied Linguistics Subcorpus		Chemistry Subcorpus	
	Raw	Norm	Raw	Norm
Hedges	868	18.76	346	10.12
Boosters	784	16.94	448	13.10
Attitude Markers	44	0.95	28	0.81
Engagement Markers	128	2.76	*	*
Self-Mentions	218	4.71	50	1.46

5.2. *Metadiscourse: Functional Analysis*

The functional analysis showed that transitions were used in both applied linguistics and chemistry for communal discourse functions embedded in the rhetorical purpose of the RAIs. Their most common use was providing readers with

basic and particular information regarding the topic being reported (78.6% in chemistry and 76% in applied linguistics; examples # 1-2). The writers also used transitive devices to indicate a gap in the literature, mostly by the chemists (12.4% vs. 10.3%; examples # 3-4), and present their work, mainly by the applied linguists (13.7% vs. 9%; examples # 5-6). Consider the following examples:

- (1) The research article occupies a prominent position in research publications, *and* is... [JEAP4]
- (2) Autogenous bone grafts are *still* the most effective bone substitutes *and* are *therefore* considered [...]. [AB2]
- (3) *Yet*, despite a sustained interest in its rhetorical organizations, little research has examined [...]. [JP3]
- (4) *However*, the ideal biomaterial, defined as a “place holder” with an... has not *yet* been found. [AB2]
- (5) The two sides in this debate have offered very different interpretations of [...], *and* these differences have become an important part of [...]. [JSLW4]
- (6) The study *thus* aimed to evaluate... It *also* aimed to [...]. [AB1]

Reformulating given information and providing examples were the two discourse functions of the writers' use of code glossing devices in the two disciplines. The former was signaled by the use of punctuation marks (i.e., *comma*, *parenthesis*, etc.) or expressions like *this means*, *that is to say*, *in other words*, and so on (examples # 7-8), and the latter through observations such as *for instance*, *including*, *namely*, *i.e.* (examples # 9-10). The findings show that reformulating given information was common in the two sets of data, particularly chemistry (64.7% vs. 58.9%):

- (7) The idea here is that a goodness-of-fit principle can be used to [...]. *that is*, people in [...]. [JP1]
- (8) This motion is attributed to traction forces which arise at the two filament ends (*anchored at the actin cortex and the centrosome, respectively*). [AB3]
- (9) Of the studies that have examined lexical proficiency, much of the research has considered surface measures of lexical proficiency *such as* lexical originality, density, accuracy, and diversity. [JSLW1]
- (10) The action of SP is thought to vary. *For example*, during the transmission of pain, SP [...]. [MJ2]

Endophoric markers, which are explicit references to other parts of the text, include linear and nonlinear referencing devices (cf. Bunton, 1999; Mauranen, 1993). Linear references, which are used to enhance explicitness in writing (Mauranen, 1993), were found in the dataset (68% in applied linguistics and 76% in chemistry) and performed as backward/review (e.g., *as mentioned earlier, as described above*; example # 11a), inward/overview (e.g., *the present in vivo study*; example # 11b) or forward/preview (e.g., *as will be discussed later, in the following section*; example # 11c).

(11a) *As mentioned earlier*, RA abstracts have been shown not to be fully objective summaries of [...]. [JEAP3]

(11b) *The present in vivo study* aimed to analyze the cellular tissue reaction to five different b-TCP-based bone substitute materials. [AB2]

(11c) *As will be discussed later*, such discipline-specific information [...]. [ESP6]

Nonlinear references, on the other hand, (i.e., *refer to Fig X, as illustrated in Table X, see example X, as given in Scheme X*) were signposts pointing to figures, tables, formulae, extracts or stand-alone examples (see example # 12). They were used for different discourse purposes, such as (1) to introduce work purposively and/or descriptively, (2) to signify the value of work, and (3) to announce research outcomes. The first purpose dominated both sets of writings (100% in chemistry and 84.6% in applied linguistics; examples # 13-14). The other two uses, however, were exclusive to applied linguistics; 6.4% (second purpose; example # 15) and 9% (third purpose; example # 16) of the total endophoric markers used in the applied linguistics Introductions:

(12) The structure of the widely-used DOP *is shown in Fig. 1* as a representative of the [...]. [EPJ5]

(13) The 1990 version still seems to be more widely used than the 2004 version [...]. *This study* also uses the 1990 model. [ESP2]

(14) *The present in vivo study* aimed to analyze the [...]. *This study* investigated the [...]. [AB2]

(15) *This research* has an underlying pedagogical motivation as attempts to [...]. [ESP4]

(16) *This research* has convincingly shown significant differences in [...]. [JP5]

As regards evidentials, the writers made references out of the text in order to (a) hint a sensible and credible groundwork for their research (examples # 17-18);

(b) announce a gap in the literature (examples # 19-20); and (c) present a previously developed model applied in their own work (example # 21). The first two uses were evident in both sets of Introductions, especially (a) that was more prevalent in chemistry (96.9%) than in applied linguistics (77%). In contrast, the last discourse function was found to be discipline-specific with an occurrence of 3.2% in applied linguistics:

(17) The concept of the rhetorical move is discussed extensively in the works of *Swales (1981, 1990)* and by researchers such as *Bhatia (1993)* [...]. [JEAP5]

(18) The use of mesenchymal progenitor cells for preclinical in vivo studies is the subject of much interest [12]. [AB1]

(19) Yet, despite a sustained interest in its rhetorical organizations (*Lores, 2004;...*), little research has [...]. [JP3]

(20) Although a fully automatic device has been developed [...], purity issues remain to be solved [9]. [AB7]

(21) In our study, *Nwogu's (1997)* schema was used as [...]. [JEAP5]

The functional analysis of frame markers identified three discourse uses common to both disciplines: sequencing ideational meanings (examples # 22-23), presenting the aim of study (examples # 24-25), and labeling discourse stages (examples # 26-27). These uses occurred at approximately the same frequency in applied linguistics and chemistry: sequencing propositions (61%), introducing the aim (28%), and labeling different stages of propositions (11%):

(22) [...] it seeks to answer the following questions: (1) Are there . . . (2) Are there [...]. [JP3]

(23) Quantitative studies of micromechanical properties of cells are becoming of growing interest for several reasons. *First, ... Second, ... Finally,* [...]. [AB3]

(24) Our *goal* in this study is to investigate the potential for linguistic features related to [...]. This paper *focuses* on the language linguists use, particularly on the rhetorico-argumentative choices made by [...]. [JSLW2/JEAP2]

(25) The study thus *aimed to* evaluate [...]. It also *aimed to* investigate [...]. [AB1]

(26) *In short*, documents such as [...] provide useful global structuring and content advice. [JEAP5]

(27) *In general*, the increase of band area due to the formation of the H-bond results in [...]. [JMS3]

More frequently in chemistry than in applied linguistics (89.4% vs. 53%), the writers often used hedges to make general assumptions about the subject under investigation (examples # 28-29). Other uses include expressing uncertainty when presenting earlier findings and contentions, which was very frequent in applied linguistics (examples # 30-31); indicating a gap in the field, that was, by contrast, more frequent in chemistry (examples # 32-33); and presenting their ongoing work, which only occurred in the applied linguistics texts (7.2%, see example # 34):

(28) In line with the changing features in the full scientific article, *it is possible that* [...]. [JSLW3]

(29) Sediments are conventionally analyzed by bulk techniques [...]. These methods are time consuming *in general*. *Sometimes* their detection limits are *rather* high [...] although they *might* be present in the samples. [MJ1]

(30) Holmes (1995) *suggests* there *may* be a similar difference in [...]. [JP4]

(31) Current research information available *suggests* that few natural compounds [...]. [MJ4]

(32) Despite the fact that the CARS model has been used to analyze RAIs in languages other than English, *to my knowledge*, no study has used [...]. [ESP2]

(33) *To our knowledge*, there is no information on purification of [...]. [MJ4]

(34) Following other studies on contrastive academic writing, this paper has the general purpose of contributing, *to a small extent*, to demonstrating [...]. [ESP4]

Boosters were used by the two groups of writers to underline (a) common knowledge and facts (examples # 35-36), (b) previous findings and assertions (examples # 37-38), (c) the necessity and weight of the subject being studied (examples # 39-40), and (d) the novelty of research area (example # 41). The last use was exclusive to applied linguistics (18.3%), with no evidence in the chemistry subcorpus. However, the first three uses of boosters were detected in both sets of writings, but with different frequencies. The applied linguists mostly used boosters to highlight earlier findings in the literature (46.7%), whereas the chemists used them to foreground common knowledge and facts (48.1%). Text examples are:

(35) When applying for American graduate schools, Korean students *must demonstrate* English proficiency in [...]. [ESP3]

(36) Many important applications of these complexes require that the complexes could bind to DNA and *it is already known that* the intercalative ligands govern the DNA [...]. [JMS1]

(37) The few studies on statements of purpose *have shown* that different norms are *indeed* found in [...]. [ESP6]

(38) Earlier studies from our laboratory have *demonstrated* that [...]. [MJ4]

(39) As researchers have *emphasized* [...], *we need to* extend our research area to examine more international students in content classroom. [ESP3]

(40) Drugs, which [...], may alter each other's binding to the transporting protein. Therefore, *it is necessary to determine* both the location of [...]. [JMS2]

(41) This analysis is seen as *the first step* towards the preparation of effective, discipline-and culture-specific pedagogical materials. [JP5]

With regard to engagement markers, they were used exclusively in the applied linguistics writings. The writers used inclusive pronouns to involve the readers and include them in arguments as participants to make claims and assumptions (46.2%; example # 42), signal the necessity of investigating subject under study (27.7%; example # 43), express the value of their works (17.4%; example # 44), and indicate a gap in literature (8.7%; example # 45):

(42) [...] considering this together with the findings in previous research, *we can expect* [...]. [JP4]

(43) As researchers have emphasized, *we need to* extend *our* research area to [...]. [ESP3]

(44) In addition, a study of statements can enhance *our* understanding of [...]. [ESP6]

(45) To the best of *our* knowledge, there have not been any linguistic investigations into [...]. [ESP5]

Finally, both the applied linguists and chemists used self-mentions to display their presence and perspective when introducing their work purposively and/or descriptively (67.5% in applied linguistics and 64.7% in chemistry; see examples # 46-47) and conveying their knowledge claims (32.5% in applied linguistics and 13.7% in chemistry; see examples # 48-49). The chemists, however, made an additional exclusive use of self-mentions to cite their own previous work (21.6%; example # 50). Self-citation was found to be a common practice in hard disciplinary rhetoric that enables the writers to foreground their own contribution to the field, thus

establishing disciplinary integrity and authority. Generally, references in fields of hard knowledge strictly describe a particular setting and contribute to the sense of linear development. They are strongly limited to a specific area of inquiry that is mostly done by a limited number of investigators within a defined context due to the heavy involvement in practical potentials and technical apparatus that hard knowledge construction is usually based on. Consequently, such restrictions make writers participate in extremely focused area of research and fall back on their previous studies to a substantial extent. For example, as shown in 50, the term *recently* is conveying a specifically positive meaning to a speeding discipline, that is, chemistry, in which it looks as if it is of prime importance that the community members be cognizant of the latest advances.

One possible explanation for the absence of self-citations in soft disciplinary rhetoric might be the fact that soft concepts are subject to be moderately varied, ranging over a broad academic area and are cut off from directly preceding developments. That is, references are diverse and there is little opportunity for writers to cite their own work (cf. Becher, 1989; Hyland, 2001):

- (46) In *our* study, Nwogu's schema was used as a template [...]. [JEAP5]
- (47) In the present work, *our* aim was to... To achieve this goal, *we* focused on... Finally, *we* compared the [...]. [AB7]
- (48) By focusing on the same area of interest, *I* believed that [...]. [ESP2]
- (49) *We* argue that this discrete mechanical design provides [...]. [AB3]
- (50) *We* have shown **recently** that carboxylated SWNT can [...]. [AB5]

5.3. Metadiscoursal Features Enacted in Move Structure

The frequency analysis showed that M1 had the highest frequency of metadiscoursal features in the two sets of writings (67.4% [3,244 cases] in applied linguistics vs. 74.9% [1,996 cases] in chemistry). This was followed by M3, with 20.9% (1,008 instances) in applied linguistics and 15.7% (416 instances) in chemistry, and M2, which accounted for 11.7% (560 occurrences) and 9.4% (250 occurrences) of the total metadiscourse used in applied linguistics and chemistry, respectively. As seen in Figures 1-3, all the Introduction moves within the two disciplines comprised the five categories of interactive metadiscourse excluding endophoric markers, which did not occur in M2 in chemistry. Hedges and boosters were the only interactional categories frequently represented in all moves in both sets of writings. Also, attitude markers occurred in each disciplinary subcorpus but only in M1 and M2. Engagement markers occurred in all three moves in applied linguistics, but not at all in chemistry. Finally, whereas self-mentions were absent from M1 in both datasets and from M2 in the chemistry Introductions, they centered

on M3, especially in applied Linguistics. Altogether, the findings in Figures 1-3 indicate that interactive metadiscourse features were more commonly deployed in each move except for M2 in applied linguistics (M1: 61% in applied linguistics [1980 cases] vs. 67.4% in chemistry [1346 cases]; M2: 47.1% [264 times] in applied linguistics vs. 63.2% [158 times] in chemistry; M3: 52.1% [526 occurrences] in applied linguistics vs. 68.7% [286 occurrences] in chemistry). It seems that interaction in both applied linguistics and chemistry was driven by the use of several language devices which assist authors to structure their discourse following readers' expectations as against devices which symbolize authors' standings, bringing authors and readers together. What follows describes metadiscourse use for each move.

In M1, evidentials were most prevalent, especially in chemistry. This may be due to the fact that the move involves reviewing items of previous research (step 3). This enables writers to embed their arguments in networks of references, for example, associating their own and previous findings with each other. In this way, writers rely on evidentials and attribute assertions to other scholars, acknowledging a debt to them and indicating a commitment to the community, in general, and to specific members or an attitude in the field, in particular. As a result, they are able to guarantee both certain and uncertain standpoints they have had through the first two steps within M1, claiming centrality and topic generalization. In general, a considerable use of evidence markers could be conditional to fulfilling the rhetorical purposes of M1.

Hedges also dominated M1 in both sets of data. They were used to convey epistemic modality, which is concerned with the writer's suppositions, or valuation of likelihoods (Coates, 1995). By employing hedges, the writers appeal to the judgement of the reader, who is left to decide on the truthfulness and acceptance of the argument. In addition, politeness conventions lie behind the use of epistemic devices because, according to Myers, (1989), "scientific discourse consists of interactions among scientists in which the maintenance of face is crucial" (p. 5). Claiming new knowledge and/or counterclaiming existing knowledge may threaten both the readers and writers' negative and positive face, which would require alleviation so as to reinstate the interaction between them. Overall, as illustrated in Figure 1, not only did the applied linguists use tentative language (18.4%) more frequently than the chemists (12.9%), the two groups of writers also preferred different linguistic features to convey epistemic modality. The applied linguists tended to use epistemic modal auxiliary verbs (31.9%), especially *may* (34.6%), and epistemic verbs (29.6%), specifically *suggest* (19.7%) and *tend to* (13.1%). In contrast, the chemists, besides epistemic modal verbs (51%), especially *can* (61.1%), preferred approximators, such as *often* (29.8%), *usually* (28.8%), and *generally* (29.3%).

At other times, the writers used boosters to increase their commitment to propositional information. By drawing on emphatic devices, which constituted about 18% of the total metadiscourse in M1 in the two datasets, the writers indicated a firm belief in their own knowledge claims, reflecting their well-established areas of inquiry and leaving fewer doubts and alternative voices on the part of readers. Boosters were most widely realized through lexical verbs, namely *find* and *show*, in M1 in applied linguistics (34.4%) and chemistry (29%):

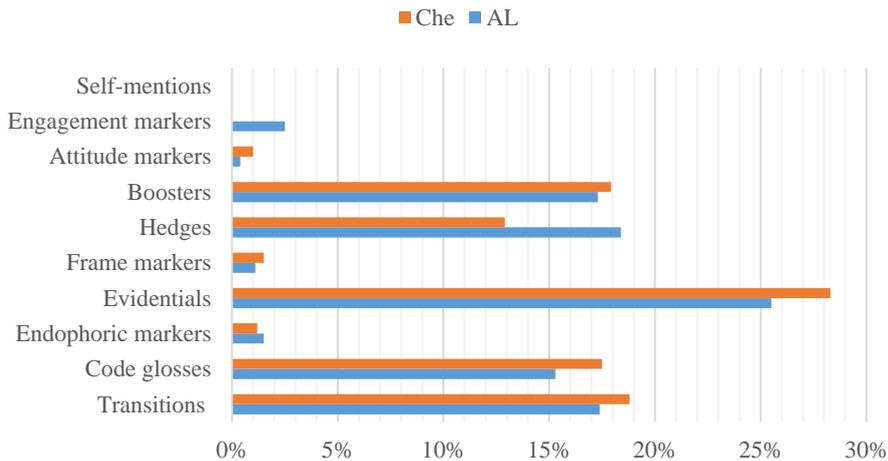


Figure 1. Metadiscourse distribution in M1.

Transitions made up 18.8% and 17.4% of the total metadiscourse recorded in M1 in chemistry and applied linguistics, respectively. They facilitated logical links between different segments of discourse cognitively based on different semantic functions of addition, contrast/comparison, and consequence. Additive (around 60%) and consequential (just below 14%) transitions appeared to be the most and least frequent logical markers in each set of data. However, whereas adding and contrasting ideas were materialized through similar devices (e.g., *and*, *also*, *but*, *however*) in both datasets, consequential transitions commonly appeared in different inferential characterizations: *thus* in applied linguistics (52.6%) and *therefore* in chemistry (38.4%).

Other noteworthy categories which enacted M1 were code glosses and engagement markers. Code glosses, which supply further information on some feature of the immediately preceding discourse segment, constituted almost a quarter of the total metadiscourse identified in M1 (17.5% [350 instances] in chemistry and 15.3% [498 instances] in applied linguistics). Engagement markers only occurred in M1 in applied linguistics (2.5%, 84 instances). Overall, the distribution percentages

for metadiscourse features enacted in M1 suggest a similarity between the two disciplines in their tendency to favor the same pervasive features, albeit to a different extent.

M2 (establishing a niche), known as minicritique (Shehzad, 2008), constitutes a significant rhetorical level in RAIs, functioning as a bridge between previous studies and the study being reported. Figure 2 shows that the most frequent categories in the two sets of writings were transitions, hedges, boosters, code glosses, and evidentials. Whereas transitions were mainly characterized through the comparative marker *however* in both datasets, they occurred twice as much in chemistry (32%) as in applied linguistics (16.7%). The applied linguistics writers used more hedges (21%) than their chemistry counterparts (14.4%). Assertions were often modified in applied linguistics through quantifiers (51.6%), with a marked preference for *a few* and *little*, whereas the chemists preferred modal auxiliary verbs, particularly *can*, which constituted 53.9% of the total auxiliaries in M2. Although boosters were as frequent in applied linguistics (18.5%) as in chemistry (19.2%), they appeared in different ways: adverbial expressions (48%) dominated certainty in applied linguistics, whereas the chemistry writers favored quantifiers, such as *very*, *completely*, *highly*, and so on, which accounted for 33.4% of the total boosters found in the subcorpus. The results, further, highlighted noticeable variations between the disciplines. For instance, endophoric markers, engagement markers, and self-mentions were used in applied linguistics to establish a niche, but were totally absent from chemistry:

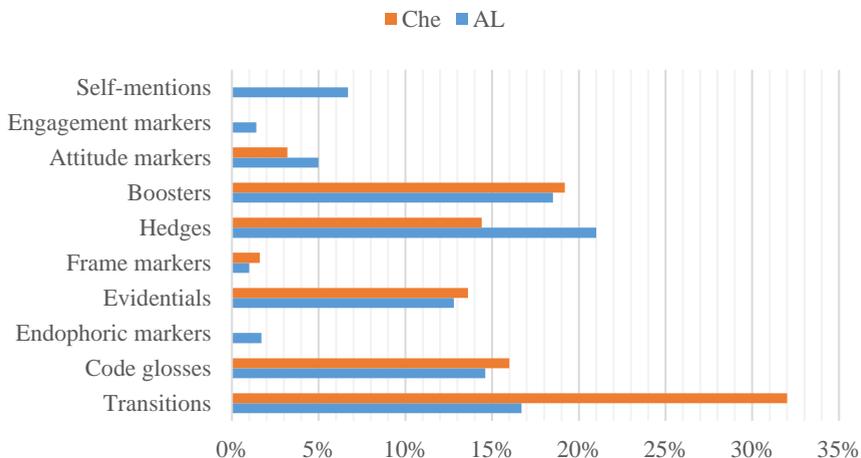


Figure 2. Metadiscourse distribution in M2.

Finally, self-mentions (17.8%, 180 instances), endophoric markers (17.6%, 178 instances), and hedges (16.2%, 164 instances) were the most frequent metadiscursive features used in M3 in applied linguistics to occupy already established niche and present the new research. On the other hand, as shown in Figure 3, endophoric markers (18.7%), followed by code glosses (16.3%), transitions (13.9%), and hedges (12.5%), dominated metadiscourse use for M3 in the chemistry Introductions:

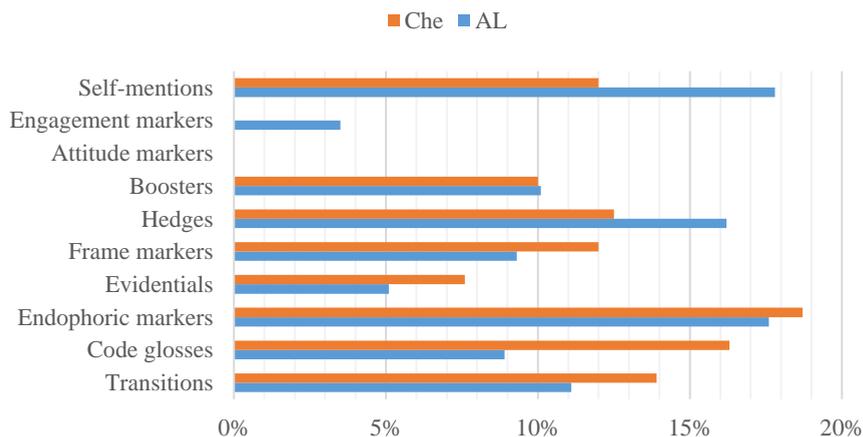


Figure 3. Metadiscourse distribution in M3.

6. Conclusion

This study examined the introductory section of research articles because of its multiple rhetorical functions including positioning the ongoing research in the context of relevant literature, announcing its novelty, and highlighting the key features of the study. The focus was on metadiscourse in RAIs in applied linguistics and chemistry, which were examined, first, to ascertain the frequency and range of use and, then, to find out how metadiscursive features enacted in Introduction moves.

Hyland's categorization of metadiscourse led to the conclusion that interactive resources dominated metadiscourse use in both sets of data, with evidentials, transitions, and code glosses being among the most frequent categories. The results also indicated disciplinary differences. Self-mentions were mostly recorded in applied linguistics, engagement markers were absent from chemistry, signifying work value and announcing research outcomes were among the uses of endophoric markers exclusive to applied linguistics, and self-citation was used only in chemistry to explicitly display the authorial presence. Interactive markers were predominantly used in all the three moves in both disciplines to achieve rhetorical

purposes through transitions, code glosses, and evidentials in M1 and M2, and together with endophoric and frame markers in M3. Hedges and boosters appeared in all the moves, but more frequently in M2, particularly in applied linguistics. Self-mentions were scattered in some moves in the two sets of writings. Finally, engagement markers were totally absent from chemistry.

Whereas Introduction sections may not be the most crucial section of a research article, they play an important role in creating a positive image of the writer. Strategies such as judicious discipline-oriented metadiscourse uses are generally used for face-saving purposes in order to present an authentic authorial persona and prepare for the more convincing discussion and conclusion sections, where writers make greater investments. As suggested above, these strategies are directly concerned with the conventional sociorhetorical disciplinary norms of research communities.

The results presented here have pedagogical implications that can (a) inform the creation, design, and elaboration of content material and (b) raise novice writers' consciousness of the pragmatic and sociorhetorical norms and conventions required to meet the expectations of gatekeepers. However, this is a preliminary study and much more research is needed. It also has some limitations which need to be tackled. Regarding discipline selection, only one representative from soft (applied linguistics) and hard (chemistry) sciences was considered. It would be, therefore, unreasonable to extrapolate the current findings to the whole disciplinary communities belonging to hard and soft fields of knowledge. Another restriction was the focus on specific areas of research within each discipline during the article selection. Further study is needed to explore other subjects within the two disciplines to better understand their sociorhetorical conventions. The vastness of the disciplines and their continuous expansion, however, require a mind open to new dynamic knowledge in order to understand metadiscourse use in academic writing, and the significant role it plays in conveying research information to an ever increasing audience in the global world.

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