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A Comparative Study of Hedging Expressions in the Conclusion Sections of Science Research Articles Authored by Yemeni Nonnative English Writers and English Native Writers

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Keywords

1. Hedging
2. Research Articles
3. Disciplinary Variation
4. Cultural Variation

Abstract:

This study explores the use of hedges in the Conclusion sections of scientific research articles (RAs) written by Yemeni nonnative English writers (NNEWs) and native English writers (NEWs). To this end, a corpus was collected of 48 Conclusion sections of research articles (24 by NNEWs and 24 by NEWs) published over a span of three years (2022-2024) in four science disciplines: Chemistry, Physics, Biology, and Medicine. The corpus was analyzed using AntConc concordance program, supplemented by manual analysis to ensure the identified items have hedging functions in their specific contexts and then to sort them into categories according to Hyland's (1996a, 1998b) poly-pragmatic model. The results revealed that while the overall frequency of the identified hedging items was very similar across both groups of writers, there were noticeable differences in terms of the categories employed. Yemeni NNEWs exhibited a greater tendency towards Attribute and Writer-oriented hedges, whereas native writers favored Reliability hedges. Regarding disciplinary variation, Medicine articles by both writer groups employed the highest proportion of hedges, followed by Physics and Biology articles in favor of Yemeni NNEWs. Chemistry articles had the lowest proportion of hedges in the two groups in favor of NEWs. The findings suggest that cultural variation in hedging lies in strategic preference and positioning rather than overall frequency, which has implications for scientific writing pedagogy and cross-cultural research.

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دراسة مقارنة لعبارات التحوط في استنتاجات مقالات البحوث العلمية للباحثين اليمنيين والناطقين باللغة الإنجليزية

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الكلمات المفتاحية

1. التحوّط
2. المقالات البحثية
3. التباين التخصصي
4. التباين الثقافي

الملخص:

تهدف هذه الدراسة إلى تحليل استخدام عبارات التحوّط في أقسام الخاتمة للمقالات البحثية التي كتبها باحثون يمنيون غير ناطقين أصليين باللغة الإنجليزية وباحثون ناطقون أصليون بها، وذلك عبر أربع تخصصات علمية هي: الكيمياء، والفيزياء، وعلم الأحياء، والطب. وقد اعتمدت الدراسة على تحليل (48) خاتمة بحثية منشورة خلال الفترة من 2022 إلى 2024، بواقع 24 لكل مجموعة. وقد تم تحليل البيانات باستخدام برنامج AntConc لاستخراج مسرد السياقات، مع الاستعانة بالتحليل اليدوي للتحقق من أن الكلمات المحددة تُستخدم بوصفها أدوات تحوط وتصنيفها وفق التصنيف التداولي المتعدد الذي اقترحه Hyland (1996a; 1998b).

وأظهرت نتائج الدراسة أن التكرار الكلي لعبارات التحوّط كان متقاربًا إلى حد كبير بين المجموعتين، إلا أن تحليل الفئات كشف عن اختلافات ملحوظة في استراتيجيات استخدامها. فقد أظهر الكتّاب اليمنيون ميلاً واضحًا نحو استخدام عبارات التحوّط الوصفية وعبارات التحوط المتمحورة حول الكاتب، في حين فضّل الكتّاب الناطقون أصليًا استخدام عبارات المرتبطة بالموثوقية. وعلى مستوى التخصصات، تصدر مجال الطب من حيث استخدام عبارات التحوّط لدى المجموعتين، تلاه الفيزياء ثم علم الأحياء لصالح الكتّاب اليمنيين، بينما سجل تخصص الكيمياء أدنى معدل استخدام مع تفوق نسبي للكتّاب الناطقين أصليًا.

تشير هذه النتائج إلى أن الاختلاف الثقافي في استخدام التحوّط لا يتمثل في الكمية الإجمالية بقدر ما يظهر في تفضيلات الاستخدام وطرائق توظيفه داخل النص، وهو ما يحمل دلالات مباشرة لتدريس الكتابة العلمية وللبحوث المقارنة عبر الثقافات.

Introduction:

Writing is a language skill that enables communication among people, and assists their ideas to be translated into words and to be brought to light in a meaningful way. Written communication gives people the capacity to express themselves and transfer personal information, knowledge, ideas, and experiences effectively and successfully to others (Hyland, 2004b; Jabbar, 2019). Scholarly, it is vital to move beyond the ordinary vernacular language of everyday writing to concentrate on a new style of writing, i.e. academic writing, which has its own regularities, principles and concepts (Hyland, 2009). Academic writing is designed to clearly share thoughts, knowledge, and research with broader academic community (Smith, 2021). Though the style, content, and organization of academic compositions differ across genres, almost all academic writings attempt to provide a new contribution produced in a piece of text that is composed in a formal, clear, concise, precise, accurate, intelligible, salient, evidential, hedged, and objective style (Akkaya & Aydin, 2018; Birhan, 2017).

Academic writing also aims at constructing high-quality research, which presents evidence-based truths with an eye to transmitting its outcomes and data in a way that is comprehensible for audience and peers. Otherwise, such text production will not be noticeable within its scientific community (Carraway, 2006). To this end, science writers need to pay more attention to and apply certain textual features (lexico-grammatical and phraseological features) of scientific discourse relating to its social and genre field through which various rhetorical meanings are sent (Pérez-Llantada, 2012). The good choice of words, phrases, terminologies, syntax, grammar, punctuation, etc. is thus of high importance (Carraway, 2006) to make a firm basis of any scientific composition (Rashid, 2018). In other words, these features help scientists to organize their papers logically and appropriately according to their purpose and genre type, and produce a text in a brief, precise, and objective way.

Further, given the fact that English has become the lingua franca language of science, scientists of other languages need to be able to effectively and efficiently compose and disseminate their outcomes and discoveries in English should they wish their research work be recognized internationally rather than nationally only (Starovoytova, 2017). Starovoytova (2017) adds that these scientists have to learn English to be updated with what other scientists are discovering, what is happening in the world of science, and to be members of this world. Due to this demand, non-native English-speaking scientists will have obstacles when writing their research in English. They need to learn the linguistic rules of English, be acquainted with its style and vocabulary, and be aware of the culture of English-speaking countries (Pérez-Llantada, 2012), which may differ from their native languages. Scientists should use good language to successfully transmit their concepts (Suharno & Sastra, 2001). Proper writing in science has no obvious difference from proper writing in other disciplines and fields (Effective scientific writing. n.d.; Plotnick, n.d.). In all fields, researchers need a solid base in "English sentence structure, usage and punctuation" (Rashid, 2018, p. 5).

Therefore, a great focus has been paid to improving English language learners' academic writing in various disciplines (Ángel & García, 2017). However, nonnative scholars often have difficulties, not only in the use of language at its surface structure, but also in the appropriate choice of scientific figurative language when constructing their statements. Rahmat (2019) divides these difficulties into three categories: linguistic, cognitive, and physiological (which are related to face-to-face communication with audience and getting immediate feedback from them). At the same time, Noori (2020) relates these

problems to the issues of content, language, and structure. Although nonnative writers face challenges in acquiring English writing skills, mastering English academic writing is essential and needed internationally (Mutwarasibo, 2013). Accordingly, nonnative researchers should articulate their claims and ideas in English in a manner that conforms to both linguistic accuracy and accepted rhetorical conventions of specific genre and field.

Science research articles are among academic writing genres that have gained much attention recently due to their major rules in transferring knowledge (Khamkhien, 2015; Khany, Aliakbari & Mohammadi, 2019; Musa, 2015). Scientific writing involves more than producing a publishable paper; it functions as a rhetorical persuasive practice through which writers illustrate and justify their findings in ways that can influence the academic community (Hyland & Salager-Meyer, 2008). The success of any article depends on the proper and careful choice of rhetorical and linguistic elements and following the disciplinary conventions and norms (Hyland & Salager-Meyer, 2008), with the intent of persuading imagined readers. Hedging is one of those rhetorical and linguistic strategies that assist in producing an objective and accurate paper and thus promote the reliability and acceptability of stated claims.

The concept of 'hedges' or 'hedging' was first introduced by Lakoff (1973) who defines hedges as "words whose meaning implicitly involves fuzziness-words whose job is to make things fuzzier or less fuzzy" (p. 471). They are used to qualify the truth conditions of the claims (Itakura, 2013) that cannot mainly build on the literal surface meaning but also on the deep meaning (Lakoff, 1973). According to Crompton (1997), hedges are "items of language which a speaker uses to explicitly qualify his/her lack of commitment to the truth of a proposition he/she utters" (p. 281).

Similarly, Hyland extensively investigates hedging in various academic genres, such as book reviews, dissertations, science writing, and research articles. He looks at hedging as a critical feature of academic writing but not as a means of merely creating confusion. Hyland (1995, p. 34; 1998b, p. 9) defines hedging as "any linguistic means used to indicate either a) a lack of complete commitment to the truth value of an accompanying proposition, or b) a desire not to express that commitment categorically". By using hedges, writers obviate stating categorical assertions for their claims (Hyland, 2005; Qanbarov, 2019). Swales and Feak (1994) are among those who deal with the concept of hedging in academic writing through their comment on how to strengthen and highlight claims. They suggest that highlighting claims requires accurate evaluation, alongside a clear presentation of both that evaluation and its level of certainty. This process involves two main elements. The first one is to be careful and cautious in presenting information, and the second requirement is to own the appropriate means to show such prudence.

Hedging thus plays an essential role in scientific writing by allowing authors to make claims without admitting they are the ultimate solutions, avoid any direct face threat to audience, and offer readers the opportunity to express their own viewpoints. Therefore, there is a need to tackle the issue of hedging, its importance and its appropriate use in academic writing which researchers can make use of when making new knowledge claims while also admitting that there might be other counter-standpoints. Within its boundaries, this study attempts to draw the attention of Yemeni researchers writing in English in the fields of science, particularly Chemistry, Physics, Biology, and Medicine to the technique of hedging and its significant role in making novel contributions more persuasive and acceptable to their research community and in allowing them to produce RAs that

international journals can perceive as publishable.

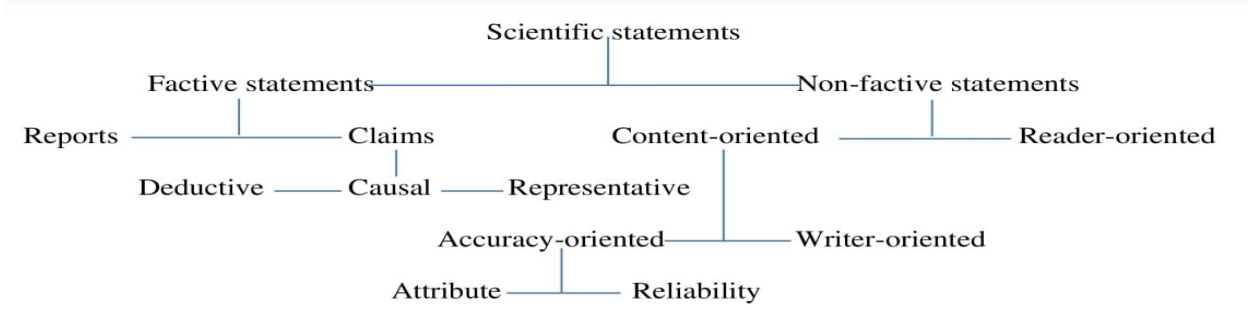
The importance of this study lies in its focus on the employment of hedges in nonnative research articles (NNRAs) as a crucial mechanism for making claims with appropriate flexibility rather than absolute certainty, thereby contributing to the development of academic writing that aligns with the standards of native English research articles (NERAs). Furthermore, it will, hopefully, contribute greatly to the literature on the phenomenon of hedging in academic compositions by nonnative writers in general and Yemeni writers in particular.

2. Literature Review

Hedging is essential in scientific writing for it enables writers to express the outcomes of their work as evidence-based opinions rather than as hard facts, and as likelihood rather than absolute certainty (Akbas & Hardman, 2018; Azar, Yi & Azhar, 2020; Shen & Tao, 2021). It also helps them to show the degree of their distance from or investment in the expressed propositions, thus leaving a space for other potential alternative views and voices (Akbas & Hardman, 2018; Anh, 2018; Azar, et al., 2020; Khedri, Ebrahimi & Chan, 2013; Widiyati, 2018). Hedging, as vague language, is thus regarded as a strategy of formulating spoken or written discourse while managing the degree of commitment to the propositional content and its accuracy enhances pragmatic communicative competence (Rowland, 2007). Additionally, hedging is often used by writers to maximize the possibility of having their claims ratified by the intended audience (Doğan & Akbaş, 2021; Hyland, 1998b; Shen & Tao, 2021).

In other words, writers can use hedges to manage the organization of their information and remarks, making them expressive and easy for the audience to follow and grasp (Akbas & Hardman, 2018; Hyland, 1998b). Texts then can be shaped to fit into a more reader-oriented, writer-oriented, and/or accuracy-oriented mold, by means of which writers can explicitly signal how their statements are meant to be interpreted and thus draw the readers into a dynamic negotiation (Hyland, 1998b). This is what was also highlighted by Hyland's classification of scientific statements or scientific hedges in Figure 1 (Hyland, 1996b, p. 438, 1998b, p. 93). He divided non-factive statements based on their functions into **content-oriented** and **reader-oriented**. Content-oriented statements were further classified into **accuracy-oriented** (which were also subdivided into **attribute** and **reliability**) and **writer-oriented**. The present study draws on this categorization of scientific statements in analyzing hedging devices.

Figure (1): Categorization of Scientific Hedges (Hyland, 1996b, p. 438, 1998b, p. 93)



Handling and understanding this aspect of discourse aptly as an interactive means allows FL/L2 writers, ranging from experts to amateurs, to use language accurately and subtly to express themselves appropriately and achieve academic success, and thus to be recognized as members in their particular

community (Hyland, 1994). The mastery of the hedging resources requires of writers, particularly nonnatives, to be fully aware and conscious of the roles of hedges and their formulations and usage in the target language (Gribanova & Gaidukova, 2019; Nekoueizadeh et al., 2020). However, many nonnative writers have difficulty in acquiring and using these hedging resources appropriately (Hyland, 1998b; 2005; Wiboonwachara & Rungrojsuwan, 2020). They, even those with a good level of proficiency in English, have a problem in expressing their adherence to or 'detachment' from their propositional information and in mitigating their statements (Hidayati, Muhammad & Dallyono, 2008; Hyland, 1995). This will in turn hinder their academic recognition in the international world of research, given the fact that English is the sole medium of presenting and publishing research work at the international level (Hidayati et al., 2008).

This may relate to the indeterminate and heterogeneous nature of hedges, which makes it more difficult for L2 writers to acquire and handle hedging devices well. Hedges can express a range of meanings, including epistemic meanings, and occur in a variety of lexicogrammatical expressions that indicate both the writer's certainty in the veracity of the propositions expressed and his/her relationship with the audience (Hyland, 1998b). Further, culture and society can play a role in compounding such a difficulty, as hedging devices may differ from one culture to another (Fløttum, 2012; Hyland, 1998b; Kim & Lim, 2015; Varttala, 2001). This shows how significant it is for writers to get acquainted with the hedging items in English should they wish to appropriately present a discussion of the results of their studies and persuasively state their own interpretations of and explanations for the findings. These difficulties and problems emphasize the importance of hedging in academic writing of nonnatives and its involvement in teaching materials to equip EFL students with this crucial feature of academic English and raise their awareness of its linguistic realizations and their rhetorical functions (Hyland, 1998b).

Scientific discourse constitutes one form of the academic discourse and science research articles resemble those in other disciplines in that they should take account of the socio-cultural principles and values of their fields and communities (Musa, 2014). Such conventions also shape writers' communicative intentions and their construction of meaning in such a way that ensures the acceptability of their claims on the part of the readers and scholarly peers (Hyland, 1998b). Readers have a right to reject or accept the presented statements, and thus the audience plays an active and notable role in determining the way scientists opt to create and articulate their claims and results (Hyland, 1996a, 1998b). Scientists then resort to mitigating or reinforcing their statements in an attempt to use language means suitably, not only to follow the obligatory rules of grammar but also to build good interactional relations with readers and peers so as to gain acceptance (Hyland, 2004a). This is also supported by Salager-Meyer (1994), who views hedges as ways of presenting findings more accurately and of emphasizing the strongest claims scientists wish to present, in order to persuade the intended audience of the validity of their contribution to the relevant literature and of the objective basis of their work.

Obviously, hedges are thus very important for writing science research articles, as they involve three elements: proposition, writers, and readers. The first two are epistemic and 'content- oriented' in that they indicate tentativeness and caution toward the knowledge claims

being presented. The third one is viewed as interpersonal in that it shows modesty and solidarity to get readers' ratification of the claims (Hyland, 1998b). Due to the vital role of hedges in the creation of SRAs, the current study aims to investigate hedges in the *Conclusion* sections of science research articles by Yemeni NNEWs, comparing their frequencies and types to those in native English writers' work. This will, hopefully, add to the body of literature, particularly in the Yemeni context where a little attention has been paid to this essential strategy of hedging.

Hedges have become significant means in academic and scientific written texts in 1990 and many scholars have shown much interest in investigating these rhetorical devices (Varttala, 2001). This is because of the vital role hedges play in making claims accurate and in enabling writers to have a balance between 'facts and interpretations' (Sabet & Zhang, 2015, P. 17). For example, Demir (2018) and Kartikasari (2019) analyzed lexical hedges and hedging devices in RAs by Turkish and Indonesian nonnative English writers, respectively, and compared them to those used by native English writers. Regarding the overall frequency of the items identified as hedges, English native writers utilized and diversified hedges more compared to nonnative writers. In the same line, Kim and Lim (2015) examined the employment of hedges in academic writing, using a corpus of 30 RAs and interviewing some specialist informants. They concluded that L2 learners are unable to properly deploy hedges in academic texts and this may stem from a socio-culture reason, lack of instruction in classroom, and disciplinary cultural standards.

Regarding specific fields, Alghamdi & Suleiman Alyousef (2022) aimed to show the effects of disciplinary and cultural contexts on the use of hedges and boosters in making claims by Arab and Anglophone writers in the *Results* and *Discussion* sections of 90 English RAs in three fields: Journalism, Law and Political Science. The study indicated that there is a clear difference in the use of hedges in favor of Anglophone writers. Other researchers have attempted to examine the use and frequency of hedging devices in the different rhetorical sections of RAs in the field of Linguistics and Applied Linguistics. Korkmaz (2022), for example, examined the use of epistemic modality devices as hedges in the *Introduction* and *Conclusion* sections of academic articles written by Turkish scholars writing in English. The results of the study showed that Turkish researchers employ more epistemic modality items as hedges in the *Conclusion* section and tend to use more modal verbs than any other type of epistemic modality markers.

In the field of science RAs, which is the focus of the present study, a number of prominent researchers investigated the use and frequency of hedging devices. Of an invaluable contribution to the hedging literature is Salager-Meyer (1994), who investigated hedging in a corpus of 15 medical RAs and case reports (CR) and showed how the different communicative purposes of the rhetorical sections of Ras and CRs can dictate the frequency and distribution of hedges across these sections. Varttala is another prominent scholar whose work is of great value in the study of hedging in SRAs. Through his analysis of the occurrence of 80 lexical items in 15 specialist medical research articles and 15 popular scientific articles, Varttala (1999) shed light on the role of hedging in performing distinctive communicative functions in these two types of research article, showing that hedging can also be frequently utilized in non-specialist articles such as popular scientific articles whose interactive goal is different from that of specialized ones. Similarly, Afshar et al. (2014) attempted to examine hedging devices in the *Discussion* sections of 180 RAs in three

fields: Humanities (including Law, Persian Literature, and TEFL), Basic Sciences (including Biology, Applied Chemistry, and Geology), and Agriculture (involving Biotechnology and Horticulture).

Within the Yemeni context, a few studies have focused on the phenomenon of hedging. One of these studies is done by Alward (2014) who investigated the use of hedges and boosters in persuasive essays and job application letters written in English and Arabic by 120 Yemeni EFL students. Similarly, Al-Mudhaffari et al. (2020) investigated hedges and boosters in 34 Applied Linguistics RAs. Based on the literature reviewed above, it is clear that study of hedging in the writing of Arab EFL learners, particularly that of Yemeni learners, merits more investigation. This study will be beneficial in filling the gap of literature by shedding light on the frequency of hedging items in science RAs written in English by Yemeni scholars, focusing on hedges in the *Conclusion* sections of the data articles and comparing them to those employed by English native science RA writers. This study is an attempt to highlight the similarities and differences in terms of the frequencies of hedging devices. To this end, the study seeks to answer the following questions:

- How are hedging devices distributed in the conclusion sections in the science RAs of Yemeni and Native English Scholars?
- Are there any similarities and differences in the employment of hedging devices?

3. Methodology

The present study employed a comparative-descriptive approach, integrating both quantitative and qualitative methods to scrutinize the frequency and forms of hedges in the selected corpora according to the classification proposed by Hyland (1996a, 1998b). This model can help identify hedges, their types, and their rhetorical effects in the *Conclusion* sections of the data ERAs in the field of science. A comparison was also made between the identified hedges in the Yemeni scholars' writing and those in the native speakers'.

4. Corpus of the study

The corpus comprised a total of 48 *Conclusion* sections taken from science research articles written in English by Yemeni scholars and native writers (24 written by Yemenis and 24 by natives in the disciplines of Chemistry, Physics, Biology, and Medicine over the period of 2022-2024). The articles written by the Yemeni group were drawn from a range of Yemeni academic journals, and the ones by the native group were gleaned from journals published by Elsevier, with some articles being taken from other well-known journals like *American Physical Society*.

The data were deliberately kept limited to this number of articles (i.e. 48) so as to allow a detailed qualitative and functional analysis of hedges rather than a statistical analysis only. Since hedging is a complex and mainly dependent-context phenomenon, a smaller and tightly controlled corpus enables more nuanced interpretation than a broader one which may yield results that are more general but less detailed. The selected sampling was also drawn based on clear consistent criteria such as disciplinary focus and time of publication, ensuring a balanced comparison within the study boundaries.

In addition, given such a limited number of texts in each set of the articles, the possible effect of individual variation cannot be totally excluded. However, analysis is focused on frequent patterns across the data texts rather than individual cases. This can therefore minimize the effect of potential idiosyncratic styles.

5. Data analysis tool and procedures

To fulfil the main objective of the study, the data *Conclusion* sections were

analyzed using AntCone software program to identify the linguistic items that can serve as hedges. Then a manual analysis of the identified items was conducted to ensure that each of them did have a hedging function in its specific context. A second manual search was done across all the *Conclusion* sections to identify any other linguistic items with a hedging effect but not identified by the software program. After that, all the identified hedging items were sorted out into categories based on Hyland's (1996a, 1998b) poly-pragmatic model, the analytical framework utilized by the current study and according to which hedges fall into four categories (see Table 1).

To ensure validity and reliability, three independent experts in the fields of linguistics and discourse analysis were requested to review the identified hedging items and their categorization. There was a mean agreement of 89.90% between the experts and the researcher, which confirms the reliability of the researcher's categorization and offsets the absence of formal inter-rater statistics. Additionally, the raw frequencies were normalized to per 1000 words to allow for a comparable analysis since the *Conclusion* sections of the two groups are of different sizes, as follows:

$$\frac{\text{(Number of occurrences of hedges in the text)}}{\text{(Number of words in the text)}} \times 1000 = \text{number of hedges}$$

Table (1): Summary of hedging functions and principal realization devices (Hyland, 1996b, p. 450)

Content- oriented		**Reader-oriented** (Hedges assertiveness)
Accuracy-oriented (Hedges propositional content)	**Writer-oriented** (Hedges writer commitment)	
Attribute type Precision adverbs	Epistemic lexical verbs judgmental evidential	Epistemic lexical verbs judgmental deductive
Content disjuncts Style disjuncts Downtowners **Reliability type** Epistemic lexical verbs Epistemic modal adjectives Epistemic modal nouns Content disjunct adverbs Limited knowledge	Impersonal expressions passive voice abstract rhetors empty subject Thematic epistemic device Attribution to literature Impersonal reference to method model experimental conditions	Personal attribution Personal reference to methods model Other alternatives conditionals indefinite articles Involve reader direct questions reference to testability Assumption of shared goals Hypothetical e.g. would

6. Results and discussion

To address the research questions, all the identified hedging items used by Yemeni writers and native writers in the *Conclusion* sections of their research articles across the four science disciplines (Biology, Chemistry, Physics and Medicine) are calculated and categorized according to Hyland's four kinds of hedges.

As illustrated in Table 2, both groups made a logical use of hedges in the *Conclusion* sections of RAs, showing an awareness of the importance of this strategy to achieve the purpose of this rhetorical section of RA where writers comment on the data analyzed in the previous sections, summarize the main findings, and suggest further development. This corroborates Seyyedi (2025) in his study where hedges notably emerged in the *Discussion* and *Conclusion* sections to serve the communicative purposes of these

sections. However, the overall distribution of hedges across the two groups of corpora showed that Yemeni NNEWs generally employed more hedges than their native counterparts. This can be noticed through the total numbers of hedges identified in both sets of the corpus (66 vs. 54) with a normalized rate (18.41 vs. 15.09 per 1000 words). There is some variation in the figures, but it is not substantial, which indicates a close use between both writer groups. However, it reflects distinct rhetorical orientations as seen in the table below.

Table (2): Overall Distribution of Hedges in Yemeni nonnative and native English corpora

Hedging Category	Yemeni nonnative		English Native	
	Frequency	Per 1000 words	Frequency	Per 1000 words
Attribute hedges	21	5.86	6	1.68
Reliability hedges	22	6.14	32	8.94
Writer-oriented hedges	23	6.42	16	4.47
Reader-oriented hedges	0	0	0	0
Total	**66**	**18.41**	**54**	**15.09**

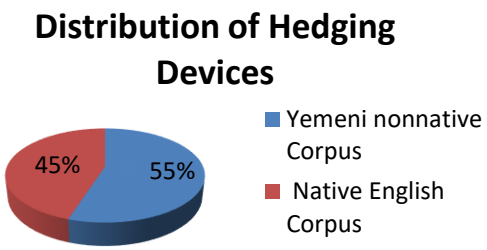
Strikingly, although the total numbers of hedges across both groups do not vary greatly, the internal distribution of hedging patterns differs considerably across categories. Yemeni NNEWs showed an even distribution across the three hedging categories identified in the corpora. However, when compared to their native English counterparts, they appear to have more inclination to Attribute and Writer-oriented hedges to mitigate description and qualification and background their stance and persona rather than relying heavily on reliability devices. This could arise from distinct educational backgrounds or differential exposure to discipline-specific writing norms alongside cultural variation. On the other side, native writers placed more emphasis on Reliability markers to foreground evidential certainty and probability and maintain an image of rigorous methodology that may align with the norms of Anglophone scientific discourse particularly in experimental sciences where precision is required when drawing conclusions. Such consistency of specific hedging types suggests that the observed preferences are unlikely to be attributable only to individual differences but may reflect wider rhetorical tendencies across the two groups of writers. Such distinct rhetorical variation could be related to differences in the norms and guidelines of specific journals where both groups of writers publish, indicating that differences in hedging types arise from authentic writing environments rather than abstract cultural discrepancies. The variation in publication venues and environment therefore supports the current study to provide a realistic understanding of the way cultural and institutional factors construct and shape the rhetorical preferences and choices in the *Conclusion* sections of science research articles. This divergence also suggests that cultural differences in hedging are not a matter of who hedge more but of strategic positioning and preference. The current result is in agreement with those studies of cross-cultural academic writing that demonstrate that authors from different linguistic and academic cultures employ diverse rhetorical strategies for expressing confidence (see, for example, Hyland, 1998a and Salager-Meyer, 1994).

Both groups also showed a total absence of Reader-oriented hedges, a finding which was initially unexpected. However, that could be due to the nature of the *Conclusion* sections, which function less as a dialogic space and more as a place of closure. This may also reflect that the making of scientific

conclusions favors impersonal and evidence positioning over direct involvement of readers, indicating the negotiation with readers is expected to be stopped, and such interactions could be done in other sections such as *Introduction* or *Discussion*. Alternatively, it may point to limitations in getting less explicit forms of engagement or number of the investigated articles, encouraging future research to test this type of hedging by enlarging the sample size.

The ratio between Yemeni NNEWs and native English peers in using hedges (55% vs. 45% of the total number of hedges across both groups as shown in Figure 2) indicates that Yemeni writers were more cautious in stating their NNEWs and tried to be less assertive than native writers. The outcomes also indicate that Yemeni writers writing in English were reluctant to express propositions with full commitment and absolute precision. Thus, they presented claims as being provisional and open to negotiation and reinterpretation, which is in contrary to the outcomes of Al-Mudhaffari et al. (2020) who showed Yemeni L2 writers in Applied Linguistic RAs inclined to express their claims as being proven facts. On the other hand, native English writers appeared to have a desire to show authority and decrease the need for clear qualification.

Figure (2): The percentage of hedges used by Yemeni nonnative and native English authors



Beyond the environmental differences, there is a cultural variation, which influences the way writers display their stance and state their claims and results. As observed, Yemeni writers deal with science topics more sensitively in a contrast to the hedging behavior of native English authors. In this case, hedging tactics are influenced by not only discipline but also the social and linguistic context. In this regard, a study conducted by Hyland (1996b) revealed that science is interactive in nature and scientific discourse is shaped by its social context and governed by established structural conventions. Further, other factors could also explain such noticeable divergence in hedging types between both groups, such as variation in writers' methodological training, differing training in the writing conventions of specific fields or training on scholarly writing, level of language proficiency, writer expertise, and degree of topic complexity.

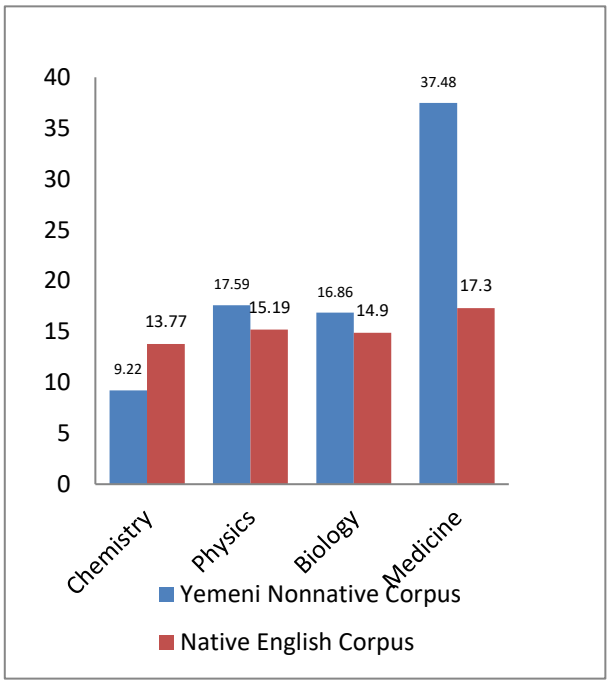
The findings of the current study agree with those of Çapar and Turan (2020) who found that Turkish writers as nonnative employed more hedges among the interactional metadiscourse markers than American academic writers to indicate their propensity to elude making categorical statements and also allow other views to be discussed. The outcomes are also in a harmony with a study conducted by Nizigama and Mahdavirad (2021) who found that Iranian authors utilized more hedges than English writers. However, the results of del Saz-Rubio (2019) showed a contrary orientation, in which native researchers showed more understanding of the significance of presenting claims tentatively to open a door for negotiation and avoid rejection by using more hedges to be the most remarkable category among metadiscourse devices. The results of these studies revealed that cultural and linguistic factors have important effects on the way and the extent writers use hedging items besides writers' competence, and this underpins what was concluded in this study.

In addition, the results of the current study contradict the results of many previous studies which indicated that

native English writers deployed more hedges than their nonnative counterparts to mark their propositions as contingent and to be more humble (Demir, 2018; Đorđević, 2017; Ghia, Petrocelli & Sergio, 2022; Hu & Cao, 2011; Kartikasari, 2019; Kim & Lim, 2015; Laghari, Akhter & Kakepoto, 2022; Loi & Lim, 2019; Rezanejad, Lari & Mosalli, 2015; Samaie, Khosravian & Boghayeri, 2014; Sanjaya, Sitawati & Suciani, 2015; Shafqat, Memon & Khan, 2022). These studies also attributed variations in use of hedges to different culture-based strategies and preferences, the nature of topic, the anticipated readers, and inadequate hedging training among nonnative writers.

As for disciplinary variation, both writer groups showed the same tendency in using hedging devices. Most of hedges deployed in the field of Medicine in both sets of the articles, as shown in Figure 3. Physics was the second highest discipline in terms of frequencies of hedges, followed by Biology, which ranked third. Yemeni NNEWs used more hedges in these fields compared to their native English counterparts. However, native writers reversed the pattern by employing more hedges in Chemistry, the discipline which was the least in using hedges across both groups. This could be attributed to the fact that Chemistry is a field where statements are basically based on firm equations and thus tend to be more objective than statements in Medicine or Biology, which involves more evaluation on the part of the writers. Such variation in the frequencies of hedges across these disciplines shows how disciplinary conventions and norms may control the way writers use hedges. This is also confirmed by Taşpinar (2017), who inferred that hedges used in engineering articles are far less than those employed in educational articles. Mifdal and Lewis (2023) reached contrary results, finding that Physics employed more boosters because it is based on statistics, whereas Biology and Chemistry tended to use more hedges.

Figure (3): Frequency of hedges per 1000 words in Yemeni nonnative and native English corpora in terms of disciplines



As is evident from Figure 4, various hedging items were also used by both writer groups but with different frequencies in respect to category. The most frequent hedging category across both corpora was modal verbs, especially *can* and *may*, followed by epistemic lexical verbs like *indicate*, *observe*, *conclude*, *seem*, *suggest*, *suspect*, then epistemic adverbs as *mainly*, *probably*, *relatively*, *presumably*, *likely* and epistemic adjectives such as *potential*, *certain*, *frequent*. Korkmaz (2022) had a similar result by revealing that more hedges were employed by Turkish writers in *Conclusion* sections, especially modal verbs, in a comparison to other forms, then main verbs and adverbs.

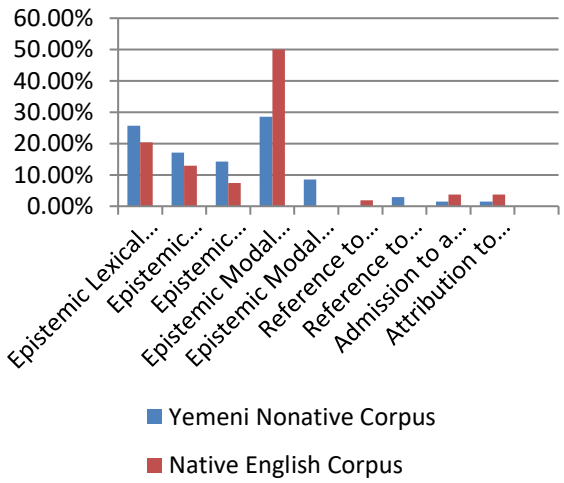
In their studies examining hedging devices in medical RAs, stance markers in medical RAs, and use of hedging in academic thesis abstracts, Doğan and Akbas (2021), Shen and Toa (2021), and Ghia et al. (2022), respectively, have also

found a similar result – a higher proportion of modal verbs as hedges. Similarly, Salager-Meyer (1994) found that modals were the most heavily used of what he called **shields**. In the same vein, Musa (2014) categorized hedging devices into two categories: **lexical hedges** (including modal verbs, lexical verbs, adverbs, adjectives, and nouns) and **non-lexical hedges** (including admission to limited knowledge, reference to a model, theory or method, and reference to experimental limitations). The results of Musa's study showed that modal verbs accounted for a higher proportion among lexical hedges. This is attributed to their main function in moderating the degree of confidence and tempering the intensity of claims and therefore improving quantitative and qualitative information. However, the findings are not in line with the study of Hyland (1995) who found that lexical verbs had the highest quantity, followed by adverbials, modal adjectives and modal verbs.

Based on the analysis of hedges in the Yemeni corpus, what came next at the fifth level were modal nouns such as *possibility*, *probability*, and *likelihood*. This was then followed by strategic devices as reference to a model, theory, or methodology, and the least categories with the same frequency were admission to a lack of knowledge and attribution to literature. In the native corpus, by contrast, strategic devices such as admission to a lack of knowledge and attribution to literature ranked fifth, followed by reference to limited conditions. Worth noting is that some modal verbs occurred in clusters with other hedging items, such as, for example, lexical verbs (Examples 1 and 2) and adverbials (Example 3), which strengthens their epistemic meaning:

1. The prevalence of CAs among Yemeni newborns is relatively high and *can be observed* in more than one in ten newborns. (Yemeni nonnative, Medicine)
2. Likewise, a comprehensive molecular and functional atlas of the arm nervous system *would require* further connectomics and physiological studies of the ANC that may in turn facilitate developmental, regenerative, and behaviorally based experiments. (Native English, Biology)
3. The variations in blood glucose levels *may be mainly* due to lifestyle modifications (diet, physical activity, and sleeping hours) during Ramadan month. (Yemeni nonnative, Biology)

Figure (4): Frequency of hedging categories in Yemeni nonnative and native English corpora



Starting with the first three categories (epistemic lexical verbs, epistemic adverbials, and epistemic adjectives), it is clear that Yemeni NNEWs utilized them more extensively with greater lexical variety than native writers (5.02, 3.35, and 2.79 vs. 3.07, 1.96, and 1.12 per 1000 words) and percentages (25.71%, 17.14%, and 14.29% vs. 20.37%, 12.96%, and 7.41%), respectively. Epistemic lexical verbs allow writers to state their statements as being based on observation and logical reasoning rather than as ultimate facts. Both groups showed different flavors when using lexical verbs as illustrated in Table 3, suggesting common disciplinary expectations. Further, epistemic adverbials limit the extent of claims to indicate approximation or reduce the level of certainty invested in

the propositions. Epistemic adjectives also shape knowledge as provisional. These results indicate that Yemeni writers depended more on hedging while their native peers showed economical use of hedges.

Table (3): Frequency of hedging categories in Yemeni nonnative and native English corpora[1]

Category	Yemeni Nonnative corpus			Native English corpus		
	Total	Per 1000 words	%	Total	Per 1000 words	%
Epistemic Lexical verbs	18	5.02	25.71	11	3.07	20.37
Epistemic Adverbials	12	3.35	17.14	7	1.96	12.96
Epistemic adjectives	10	2.79	14.29	4	1.12	7.41
Modal verbs	20	5.58	28.57	27	7.55	50
Reference to limited conditions	0	0	0	1	0.28	1.85
Modal nouns	6	1.67	8.57	0	0	0
Reference to a model, theory, or methodology	2	0.56	2.86	0	0	0
Admission to a lack of knowledge	1	0.28	1.43	2	0. 56	3.70
Attribution to literature	1	0.28	1.43	2	0.56	3.70
Total	**70**	**19.53**	**100**	**54**	**15.09**	**99.99**

On the other hand, modal verbs revealed a great divergence where Yemeni NNEWs used a notable number (20 cases, 5.58 per 1000 words, 28.57%) and NEWs greatly exceeded this number with (27 instances, 7.55 per 1000 words, 50%). These outcomes reinforce that the difference is based on writers' preference. Yemeni NNEWs did not concentrate on one particular category while native writers did by utilizing modal verbs as the main category expressing their caution. Instead, Yemeni writers distributed hedging across a variety of lexical categories.

Lastly, modal nouns and reference to a model, theory, or methodology were totally absent in native corpus whereas Yemeni writers used these categories as one of the major devices to express epistemic caution, accounting for 8.57% and 2.6% of the total hedges. However, reference to limited conditions was absent in Yemeni corpus while it made up 1.85% in native corpus. Other strategic devices expressing lack of knowledge or attribution to literature were infrequent in both corpora. Overall, Yemeni writers mitigated more, relying greatly on epistemic modal verbs, epistemic lexical verbs, epistemic adverbs, and epistemic adjectives to articulate their tentativeness and likelihood. Native English writers hedged less, concentrating heavily on epistemic modal verbs. This again reflects different hedging preferences and orientations.

Finally, the results of the current study should be construed in light of its focused design, which gives priority to careful analysis and investigation within a restricted corpus and scientific section of research articles. This approach can enable researchers to gain a deeper understanding of hedging use in distinct contexts. The study also arouses an important methodological issue, that is, quantitative analysis of hedging items

[1] **Note:** the differences between Table 2 and 3 arise from difference in the way of analysis. Table 2 follows a functional method where multi-word expressions like "*may … potential*" are counted as a single unit if they serve a unified rhetorical function (Reliability hedge). Table 3 counts each word separately (*may and potential*), resulting in a higher total without indicating inconsistency in the data, but reflecting methodical variation between functional and lexical analysis.

should be integrated with normalization and category-based analysis. Overall number or apparent similarities in quantity may obscure meaningful rhetorical variation in either hedging categories and items or disciplines. Furthermore, the results of the study accentuate the importance of examining hedging not just as a total frequency but through considering both category distribution and disciplinary context.

7. Conclusion

The study results demonstrate that Yemeni nonnative writers and native English writers deployed almost similar number of hedging tools in the *Conclusion* sections of science RAs. However, their strategies varied noticeably across hedging categories. While Yemeni NNEWs used mostly Attribute and Writer-oriented hedges to have a balanced integration between descriptive tentativeness and implicit presence of writers, native writers showed more dependence on Reliability hedges to indicate their claims based on evidence. This might be due to the differences in academic writing training, familiarity with discipline-specific conventions, language expertise, L1 influence, specific journal style and publication norms with cultural divergence.

These results also highlight that numerical analysis alone may conceal significant cultural differences in scientific writing. The current study is beneficial for researchers and language instructors as it underscores the importance of analyzing hedging by regarding its frequency along with its category-specific examination, which may reflect different writing strategies shaped by disciplinary and sociocultural principles and conventions. Further, although the current study is restricted to a specific sample size and disciplines, its results are of great value in that it informs EAP specialists with the significant role of hedging in shaping the rhetorical strategies of scientists across the four investigated fields since writers require enriching their awareness of the writing norms of their disciplines.

Since the study is limited in terms of its size and scope to ensure deeper analysis, further research may extend this study by enlarging the sample size and investigating research articles in other disciplines and sections of RAs to find how cultural variation and other possible factors in hedging patterns contributes to the construction of epistemic meaning and stance in academic writing. In addition, other studies can be conducted to explore the correlation between hedging and other features as self-mention or boosters. They can explore the deployment of hedging items by Yemeni researchers in various genres (e.g. dissertations, written texts by university students, letters, popular research articles, etc.) across various disciplines (e.g. hard disciplines vs. soft disciplines).

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