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**HEDGING: A COMPARATIVE STUDY OF RESEARCH ARTICLE RESULTS
AND DISCUSSION SECTION IN APPLIED LINGUISTICS AND
CHEMICAL ENGINEERING**

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Abstract

The use of hedges is used in academic writings as metadiscourse markers to present findings with caution and modesty, and leave more room to audience for negotiation. This study tried to examine the use of hedges in results and discussion (R&D) section of research article (RA) in Applied Linguistics (AP) and Chemical Engineering (CE). Two corpora consisted of 15 R&D sections of RAs in AP and 15 in CE. Both quantitative and qualitative analyses were employed. The findings showed that a difference appeared in the use of hedges between AL (a soft-applied science) and CE (a hard-applied science) as the use of hedges in AL was more frequent than that in CE. Moreover, the qualitative analysis of hedging in two disciplines revealed that the use of hedges depended much on the nature of data in each discipline.

Keywords: *Hedging, research article; results and discussion section; Applied Linguistics; Chemical Engineering*

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1. Introduction

Over the past years, the use of hedges has attracted increasing attention from researchers, especially from those of scientific and scholar writing (e.g., Gillaerts & Van de Velde, 2010; Hyland & Tse, 2004; Peterlin, 2005) as hedges play a critical role in academic writing, especially in research articles (RAs) and are a vital means of “presenting new claims for ratification and are among the primary features which shape the RA as the principle vehicle for new knowledge” (Hyland, 1998, p.6). The study of hedges used in RAs, hence, helps to see an essential element of academic argument because writers try to include their claims and argumentation through their writing RAs (e.g., Hyland, 1998; Hewings, 2006), which are considered as a social genre employed as a communicative way among members of a specific discourse community (Bruce, 2005). Furthermore, RAs from different disciplines or discourse communities, in Bazeman’s (1988) viewpoint, vary in their representation of the subject matter and the audience, and communicate information based on the accepted way and ideology of that discipline or discourse community.

The present study focuses on the R&D section of RAs in AL and CE because it is considered as one of the most important parts in the RA. In the R&D section, writers present and interpret the findings of the study, discuss other related literature, and answer the research questions raised in the introduction. It is, Basturkmen (2012) argues, the place where writers stake claims about how the findings “integrate with and contribute to the disciplinary knowledge” (p.135). In addition, in terms of hedges, writers tend to use hedges most in the R&D section compared with other parts of the RA (Salager-Meyer, 1994). What is more, AL and CE are two opposite disciplines since AL is ‘soft applied science’ (social profession) whereas CE is ‘hard applied science’ (science-based profession) (Becher, 1994), so the use of hedging varies in accordance to each discipline as “different disciplines may not be altogether uniform when it comes to frequency, forms, and variety of hedges” (Varttala, 2001, p.248). Therefore, this study tried to examine the use of hedges in the R&D sections of RAs in AL and CE, which were accessible to the researchers, in order to find out the similarities and differences in using

hedges. In order to achieve the above objective, two research question were formulated as follows:

1. What are frequencies and functions of hedges used in R&D section of RAs in AL and CE?
2. Are there any similarities and differences in frequencies and functions of hedges in R&D section of RAs between AL and CE?

2. Literature review

2.1 Definitions and functions of hedging

According to some researchers (e.g., Hyland, 1998; Bonyadi, Gholami & Nasiri, 2012), it is not easy to give a direct definition of hedging because it has been viewed from different perspectives by different researchers for ages. The notion of hedging is seen as “any linguistic means used to indicate either (a) a complete commitment to the true value of an accompanying proposition, or (b) a desire not to express that commitment categorically” Hyland (1998, p.1). He then points out that hedges are a means whereby writers can present a proposition as an opinion or plausible reasoning rather than a fact or certain knowledge with the avoidance of responsibility for the certainty of a proposition (Hyland, 1998, 2005 & 2008). Arising from the above-mentioned viewpoints, Hyland (2005, p.130) specifically categorizes hedges into three functions: (i) reducing force of statements by using *fairly, almost, partly*; (ii) making statements indefinite by means of frequency adverbs, e.g., *usually, sometimes*; and (iii) and decreasing responsibility for truth with the use of *probably, perhaps, or may*.

Salager-Meyer (1994) presents two main purposes for the use of hedges. The first one is to imply purposive vagueness and tentativeness and to make sentences more acceptable to the hearer/reader by using understatement, and thus to reduce the risk of negation. In fact, Lakoff (1973) indicates that a sentence can be true to a certain degree and false to another degree or true in a certain context and false in another context. Accordingly, hedges are referred to as “words whose job is to make things fuzzier or less fuzzy” (ibid., p.471). Fuzziness can help writers avoid embarrassing situations and express the writers’ commitment to the true value of statements, and it can also provide them with more open room for the possibilities of interpretation (Salager-Meyer, 1994). In other words, it refers that writers show their modesty for their achievements and avoid their personal involvement (Crompton, 1997). The other purpose is to increase the precision in the

writers' claims through the negotiation of the right representation of the state of knowledge under discussion. Hedging probably presents "the true state of the writers' understanding, namely, the strongest claim a careful researcher can make" (Salager-Meyer, 1994, p.151). In general, the notion of hedging is used not only to make things fuzzy but also to negotiate for the optimal interpretation of understanding to achieve precision in scientific claims.

In another aspect, Geyer (2008) asserts hedging expressions are examples of politeness strategies. Crompton (1997) pinpoints that hedging can be seen as a positive politeness strategy as it reflects positive face of the hearer. In contrast, Riekkinen (2009) argues hedging is a kind of negative politeness since the speaker or the writer makes the content of the utterance fuzzier instead of keeping its original meaning. For example, a criticism is softened to become more acceptable to the hearer or reader.

2.2 Taxonomies of hedges

Various taxonomies of hedges have been addressed by several researchers (e.g., Salager-Meyer's, 1994; Crompton, 1997; Hyland, 1998). Among these, Salager-Meyer's (1994) and Hyland's (1998) taxonomies are commonly used in a variety of studies on account of their sufficiency and popularity (e.g., Vázquez & Giner, 2008; Jalilifar, 2011; Bonyadi, Gholami & Nasiri, 2012).

Salager-Meyer's (1994) taxonomy of hedges is categorized into five types as follows:

- **Shields** consisting of modal verbs expressing possibility; semi-auxiliaries (*to appear, to seem*); possibility adverbs (*probably, likely*) and their derivative adjectives; and epistemic verbs (*to suggest* or *to speculate*) and their derivative nouns.
- **Approximators** of degree, quantity, frequency and time (*approximately, quite, often*).
- **Expressions of the authors' personal doubt and direct involvement** (*I believe, to our knowledge*)
- **Emotionally charged intensifiers** used to project the authors' reaction (*unexpectedly, surprisingly*).
- **Compound hedges** are composed of strings of hedges. They can be double hedges (*It could be suggested that*), treble hedges (*It would seem likely that*), etc.

(*ibid.*, 1994)

Hyland (1998) states that hedges are used either singly or in combination in daily conversations as well as academic research writing. In a research project regarding hedges used in research writing of three fields of biology, chemistry, and physics, Hyland (2000) sets out a list of the most frequent hedges including modal verbs (*would, may, might, could*), epistemic adverbs and adjectives (*possible, possibly, about*) and epistemic lexical verbs, both those involving mental states (*assume, seem*) and those referring to discursive presentation of evidence (*suggest, indicate*). Moreover, diverse expressions of hedging, such as *it seems that, it might be speculated that* are used to “make use of the full range of epistemic lexical resources” (ibid., p.3). In addition to lexical items, scientific statements can be weakened by drawing on the limitations of results or experimental conditions. Specifically, comments on difficulties encountered, shortcomings of findings, or the possibility of alternative interpretations. For example, “*Crystallographic investigation of membrane proteins is difficult because of the difficulty of obtaining suitable diffraction quality crystals*” (ibid., p.4). Regarding the expressions of the author’s doubt, Hyland (1998) asserts that ‘if’ clauses or contrastive markers can qualify certainty and measure the writer’s doubt. For instance, “[i]f correct, this prediction might explain why previous exhaustive screens have...” (ibid., p.4)

2.3 Hedging in previous studies

On account of the abundance in science and the critical role in academic writing (Hyland, 1998), the notion of hedging has been discussed in different respects (e.g., Hu & Cao, 2011; Jalilifar, 2011; Bonyadi, Gholami & Nasiri, 2012).

Jalilifar (2011) conducted a study entitled “World of Attitudes in Research Article Discussion Sections: A Cross-Linguistic Perspective” to investigate metadiscourse variations in the discussion sections of RAs written in Persian and English and published in Iranian and international scholarly journals in English Language Teaching and Psychiatry. The findings indicated the significant differences in terms of frequency, types, and functions of these devices. The author attributed the differences to lack of awareness of the conventional rules of academic English and lack of explicit instruction and exposure to pragmatic and sociolinguistic rules of English by Persian researchers.

Bonyadi et al. (2012) carried out a study comparing and contrasting the frequency and types of hedges in Discussion sections of Environmental Sciences Research Articles written in English by English writers and in Farsi by Iranian writers. The findings reported the significant differences between English and Farsi written research articles.

Particularly, hedges were used more frequently when the authors wrote in English. It was because of the authors' different cultural and linguistic backgrounds such as values, conventions, beliefs and attitudes.

To sum up, the findings of these studies demonstrated that the use of hedges in academic writing significantly differs across cultures and across linguistics. In terms of methodology, whilst Bonyadi et al. (2012) based their study on Salager-Meyer's (1994) taxonomies of hedges, Jalilifar (2011) built up his own categorization. In addition, the sample size of the studies was quite big.

3. Methodology

3.1. Corpus

Two corpora were built based on the selection of 30 R&D sections of RAs in AL and CE. The AL corpus included 15 R&D sections of RAs taken from three journals: International Journal of AL, Canadian Journal of AL, and International journal of AL and English literature. The CE corpus consisted of 15 R&D sections of RAs from three journals: Applied Catalysts A: General, Applied Catalysts B: Environment, and Applied Thermal Engineering. All the RAs that were compiled were published during the period 2008-2013. Only RAs which combined results and discussion in one section were chosen. The two corpora thus contained about 65,487 running words (36,140 for AL; 29,347 for CE).

3.2. Data analysis

The software named Wordsmith was used to count the frequency and look for the types of hedges used in two fields. Contextual and textual analyses were also taken into account in order to see how hedges in two disciplines were utilized. Four categories of hedges (Table 1) adapted and adopted from Hyland's (1998) and Salager-Meyer's (1994) hedging items were used for this study's analysis.

Table 1: Four categories of hedges

Hedges	Example
Modal auxiliaries	might, could, would, etc.
Epistemic lexical verbs	seem, assume, suggest, etc.
Epistemic adjectives and adverbs	perhaps, likely, mainly, etc.
Miscellaneous*	certain extent, assumption, indicator, etc.

(*) nouns, phrases, if-clauses, etc.

4. Results and discussion

4.1 Categories of hedges

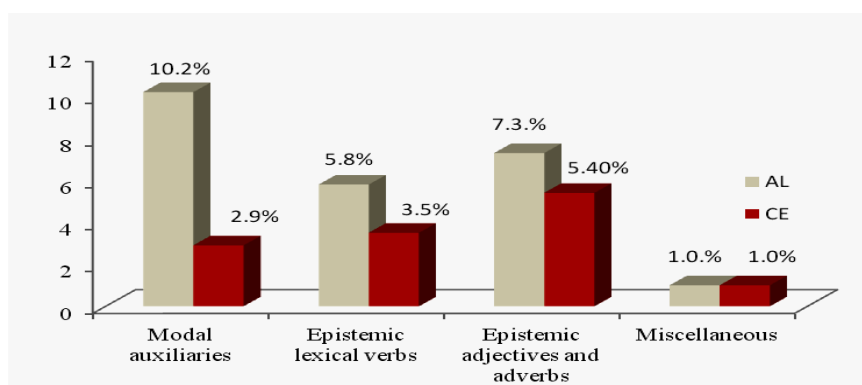
As displayed in Table 2, it is seen that the total raw number of hedges used in AL was 877 within 36,140 running words, while that used in CE was 375 within 29,347 words. This means that the amount of hedges in AL doubles that in CE. One of the possible explanations is that the nature of data in AL is quite abstract and not very numerical while that in CE is very numerical and precise. Additionally, CE belongs to hard science, which has outcomes with more exact research methods such as measurements or calculations of numerical data than AL of soft sciences. This leads to the little use of hedges in CE. This finding is supported by studies done by many researchers (e.g., Hyland, 2008; Varttala, 2001; Vázquez & Giner, 2008) who have confirmed that the nature of science appears to strongly influence the use of hedges.

Table 2: Categories of hedges in R&D section of RAs in AL and CE

Hedges	AL		CE	
	Raw number	%	Raw number	%
Modal auxiliaries	367	40.2	85	22.5
Epistemic lexical verbs	209	22.9	102	27.1
Epistemic adjectives and adverbs	264	28.9	158	41.9
Miscellaneous	37	4.1	30	8.0
Total	877	100	375	100

It is specifically seen a difference between two disciplines in terms of the most used category in Figure 1 as Modal auxiliaries (10.2% per 1,000 words) was the most used category among four categories in AL while Epistemic adjectives and adverbs (5.4% per 1,000 words) was the most used category in CE. On the contrary, Miscellaneous (1.0% per 1,000 words for AL and CE) was utilized the least in both disciplines.

Figure 1: Categories of hedges in R&D section of RAs in AL and CE per 1,000 words



4.2 Functions of hedging

4.2.1 Hedging in Applied Linguistics

As regards the first example [1], four tokens of hedging elements were found, and they all expressed the writer's toning down his/her statements to reduce the risk of opposition as the nature of the abstract data in this field - soft science - can lead to different interpretations. Moreover, by the use of downtoners, the writer in this field also tried "to protect him/herself from potential anger, contempt or other humiliation on the part of the addressee" (Markkannen et al., 1997, p.8) because these hedges could express ambiguity in analysis.

[1]...Mike's protocol contained 117 discourse markers (9%), but his score was the lowest at 30%. This variability *might* be due to individual verbalization preferences and it is therefore *possible* that participants such as Pam *might* have been deploying discourse markers, and other linguistic resources, covertly, namely, as part of their inner speech. This *can* be understood through the lens of the Vygotskian concept of orientation. (AL1)

In respect of the second example [2], the writer tried to modulate his statements by quoting others' words to support his potential claims. Due to the abstract data, hedges (*support*, *suggest* & *can*) were used to enhance the writer's credibility of his findings (Varttala, 2001). Additionally, the use of 'should' aimed at conveying vagueness and politeness to avoid confrontation between writers and readers (e.g., Hyland, 2008; Salager-Meyer, 1994).

[2] These findings are *supported* by the literature Warn (2006:206) *suggests* that cyberplagiarism *can* be controlled if it is embedded within the teaching objectives of the course and become a part of the instruction. Plagiarism *should* be a part of pedagogy and it *should* be embedded within instruction (Lee, 2011). Faculty *should* act as educators, rather than as detectives; the focus *should* not be diverted to detection than instruction (Scanlon 2007:161). (AL12)

The writers in examples [3] and [4] did not use rigid claims to avoid personal accountability. By using the tokens 'tend(ed)' and 'likely', they toned down their propositions.

[3] In an EFL context such as Taiwan, English is more *likely* to be taught by separating the language into several segments such as words, phrases, clauses or sentences.... (AL10)

[4]...[T]hough the number of distinct words used by the Taiwan-based group is smaller than that of their counterparts in the US, there are more keywords in their DA. This means that they *tended* to use less commonly used words, while their US-based counterparts were more *likely* to use more common words, as evidenced by the smaller number of keywords identified in their corpus. (AL10)

There were three tokens in examples [5] and [6], which expressed the writers' modulation of their claims. The tokens 'relatively' were used to reduce force of these statements as a result of abstract data in this field. What is more, by using hedges 'suggest(s)' and 'may' in these examples, the writers tried to make their propositions more acceptable and reduce the risk of negation.

[5] When thanking their families, the writers in the Taiwan-based group chose less formal words such as 'dear', 'deep', or 'especially', while the US-based group preferred to use stronger words such as 'deepest', 'endless', 'tremendous', or 'extreme'. This *suggests* that the family's support for those studying abroad *may* be *relatively* more important, thus affecting their choice of modifiers. (AL10)

[6] Participles used as adjectives are *relatively* common in everyday use, and thus their use in acknowledgments *suggests* that DA written by TWC have a less formal tone. This diversity *may* come from different academic conventions or contextualised factors such as experiences of learning English, as mentioned in the preceding discussion. (AL15)

In brief, it seems that the aim of the use of hedges in AL was to convey fuzziness to avoid possible risks of negation between writers and audience and to give some room for alternative interpretations. Thus, a sense of politeness was recognized in these discourses.

4.2.2 Hedging in Chemical Engineering

As CE is of hard science and its nature of data is more precise and accurate, hedging is theoretically less found than that of soft science (e.g., Hyland, 2008; Vázquez & Giner, 2008). Indeed, Vázquez and Giner (2008) claims, "Mechanical Engineering, as a hard science, should not include a great amount of hedging elements due to the precise nature of the data this discipline is nurtured with" (p.180).

Examples [7] and [8] get involved in 'Epistemic adjectives and adverbs'. Both writers were likely to reduce force of the statement by using 'relatively' and 'almost' while the writer in example [8] employed another token 'probably' in his statement to decrease the responsibility for the truth of the statement (Hyland, 2005).

[7] The spectrum of the catalyst sulfided at 200 °C was fitted by a Mo-S contribution at 2.46 ° A and a Mo-Mo contribution at 2.73 ° A. The Mo-Mo distance is smaller than the typical Mo-Mo distance of 3.16 ° A in MoS₂ [34] and indicates that sulfidation is not complete yet. The Mo-S coordination number is *relatively* low.... (CE6)

[8] Additionally, in the case of the Sueoka medium the hydrogen production starts *almost* immediately, while in TAP medium there is a lag phase of about 90 min. This can *probably* be attributed to a slower rate in the surfactant's effect in the opening of the cell membranes. (CE10)

Examples [9] and [10] refer to ‘Epistemic lexical verbs’, which include discursive presentation of evidence ‘suggest(ed)’ and mental state ‘appear(s)’. The aim of the use of ‘suggest(ed)’ was to reduce the risk of negation, whereas the token ‘appear’ in example [10] was likely to show uncertainty about the results from the analysis.

[9] In addition, authors *suggested* the same mechanism for other metal oxides like CeO₂, CuO, ZnO, Cr₂O₃ and Fe₂O₃. (CE9)

[10] As the Mo K-edge EXAFS data *appear* to indicate that the complete sulfidation also resulted in changes in the MoS₂ dispersion, we evaluated the performance of Co(2.25)Mo(7)/C in thiophene HDS (sulfidation at 400 °C, reaction at 350 °C, 4 vol% thiophene in H₂). (CE6)

Example [11] concerning ‘Modal auxiliaries’ consisted of two tokens. Recognizably, the writer was trying to tone down the propositions and avoid personal accountability. It can be concluded that these modal auxiliaries aimed to decrease responsibility for truth or certainty (Vázquez & Giner, 2008).

[11] However, it *should* be noted that a higher temperature *could* promote more evaporation of water in the droplet, and accelerate the regeneration of the desiccant solution. (CE13)

In summary, the writers tended to give space for negotiations of interpretations and representations, which may lead to precision in scientific claims (Salager-Meyer, 1994) and a sense of politeness in the discourses (e.g., Geyer, 2008; Vázquez & Giner, 2008).

5. Conclusion

As the nature of data influences the use of hedges, RAs in different disciplines follow their own patterns. This study found that writers in AL, a soft-applied science, tended to employ more hedges than those in CE, a hard-applied science. Because data in soft science are quite abstract and appear to be subjectively analysed, writers in AL are likely to show fuzziness and to leave space for negotiation whereby a sense of politeness is shown. When compared to data in soft science, those in hard science are more precise with numerical figures, and tend to be more objectively analysed to avoid ambiguous interpretations; however, writers in CE also offered a room for alternative interpretations and representations to achieve precision in scientific claims and to express politeness as well. Arising from these differences and similarities, writing conventions should be considered in teaching as rhetoric allows RAs to be recognizable within each discourse community. Besides, different forms of hedges and the reasons underlying the use of hedges should be taken into great consideration as well.

There remain some limitations in this study. The main limitation was the limited time for conducting the research, which leads to other limitations such as the quite small corpus size and a mere variable, the use of hedges. Hence, it would be better if the study were conducted with larger sample size and more disciplines. In addition, future research should also consider different variables such as boosters, gender, etc.

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