"Based on the data in …" Cohesive Markers in Results and Discussion Section of Research Articles

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Abstract

Cohesive frames are linguistic elements that precede the grammatical subject in the main clause. This study investigated the frequencies and communicative purposes of cohesive frame types in results and discussion sections of research articles from 4 disciplines. To run this study, 40 results and discussion sections of research articles were selected from 4 disciplines, namely Applied Linguistics, Psychology, Chemistry and Environmental Engineering (10 from each discipline). Then, the corpus was analyzed using Ebrahimi's (2014) taxonomy of cohesive frame types. The results showed that frequencies and communicative purposes of cohesive frame types were imposed by the rhetorical functions of results and discussion sections and disciplinary conventions of writing. The results may have implications for teaching students in writing the results and discussion sections of research articles, particularly for nonnative novice writers of English.

Keywords: Cohesive Frames, Results and Discussion Section, Research Article, Discipline, Genre

Introduction

It is well-known that one of the important requirements in an academic career is the ability to write professionally. This importance possibly arises from the dictum of "publish or perish" that has been given greater prominence in recent years by many universities and academic institutes. Thus, academics, especially, postgraduate students, need to be familiar with and competent in writing with academic genres in mind. Among the genres are the research article (henceforth RA) and conference abstract. RA is an important academic genre which scholars and practitioners have to be adept in for career advancement. In the last three decades, RA has become one of the primary means of communicating new achievements and information among disciplinary members. To write the RA, writers need to know the basic conventions of writing a professional RA that could be published in international prestigious journals (Berkenkotter & Huckin, 1995; Paltridge, 2001; Peacock, 2005; Swales & Feak, 1994).

Based on Swales (1990), RA consists of generally four sections including introduction, methodology, results, and discussion. In the last three decades, several studies have focused on the RA (Dressen-Hammouda, 2014; Kanoksilapatham, 2005, 2015; Lim, 2012; Tessuto, 2015), and its sections, Introduction (Ebrahimi, 2017; Hirano, 2009; Gupta, 1995; Martin & Periz, 2014; Ozturk, 2007; Samraj, 2002; Sheldon, 2011), Methodology (Bruce, 2008; Lim, 2006; Gollin-Kies, 2014), and Results and Discussion (Brett, 1994; Basturkmen, 2012; Josef & Lim, 2018; Kanoksilapatham, 2012; Peacock, 2005; Salahshoor & Afsari, 2017; Williams, 1999). Researchers pointed out that writing results and discussion is the most challenging in writing the RA especially if writers are nonnative writers of English (Basturkmen, 2009; Lim, 2010; Nguyan & Pramoolsook, 2015). The results section is a crucial component in RA because writers are required to present their findings that emerged from the data collected. In the discussion section, writers provide claims about the interpretations of the results and contribute to the knowledge of their disciplines. Swales (1990) noted that the discussion section of a RA adopts an inside-out approach in writing. This means adopting a writing movement that extends from the results of the study to their wider significance. Writers, in the discussion section, present the significance of findings and compare their findings with those from related literature. In this section, writers could consider theoretical contributions and "explanation of why the results occurred as they did" (Bitchener, 2010, p.179). It is commonly agreed upon that without a discussion of the results, data especially those presented visually in tables or graphs would be meaningless. Due to the mutual dependence of the results and discussion (henceforth RD) sections, many writers prefer to merge the two sections into a single entity resulting in one RD section.

This study investigated how writers from different disciplines use cohesive frames in sentence initial position while writing the RD section of RAs. This study

also identified the communicative purposes performed by using such frames in the RD section of RAs from four disciplines, namely Applied Linguistics (AL), Psychology (Psy), Chemistry (Che), and Environmental Engineering (EE). Thus, the following research questions were raised:

1. What are the frequencies of cohesive frame types used in the RD section of RAs from four disciplines, namely AL, Psy, Che, and EE?

2. What are the communicative purposes performed by the use of cohesive frame types in the RD section of RAs from the four disciplines?

Methodology

Sample

To run this study, forty RAs (ten from each discipline) were selected from high-impact journals in the four disciplines. To give currency to the publications, the selected RAs were published between 2008 and 2012. Only RD sections of RAs were selected for the analysis in this study.

Conceptual Framework

This study relied primarily on the conceptual framework developed by Ebrahimi (2014). In this framework, cohesive frames include linguistic elements that precede the grammatical subject of the main clause (Table 1). Examples accompany the framework to illustrate each of the frames in question.

Table 1. The conceptual framework of cohesive frames

	Types	**Communicative purpose (CP)**
Cohesive frames	*Location in Discourse (Data)*	To show and describe the world-related or discourse-related context of the research or its findings and claims.
		Example: ***In the present study***, we aim at establishing a detailed procedure to treat Al powder and to give reference treatment parameters to use in order to obtain the wanted oxide content. (EE 4)
	Validation	To provide supportive evidences to validate the research hypothesis, findings, and conclusions. These supportive evidences could be sourced from the same study by reference to the tables, figures or from other studies in the disciplinary discourse community.
		Example: ***In accordance with Alden et al., and consistent with overall research in the area,*** we hypothesized that clinical self-evaluation, whether measured by the APS-R or FMPS, would be a positive predictor of social anxiety. (Psy 4)
	Condition	To report the real-world events and facts coming from process and procedures of the experimental section, with cause and effect relationship. It also focuses on hypotheses which are not fully tested yet. These hypotheses are resulted from observed phenomenon or unexplained or partial data that need to be clarified in the future.

Types	**Communicative purpose (CP)**
	Example: _If BED is an associated feature of effective or anxiety disorders_, it should be more likely to co-occur with these conditions than to present without them. (Psy 7)
Cause	To help writers present the cause or the rationale for the research actions and hypothesis.
	Example: _Since slightly elevated levels of heavy metals in the environment are more common than severe contamination_, the effect of elevated CO2 on growth and development of plants grown in slightly heavy metal-contaminated soils should receive attention. (EE 6)
Purpose	To present the purpose for which a research action was used.
	Example: _To improve treatment efficacy_, it is essential to gain more insight in causal and maintaining factors of anxiety disorders. (Psy 1)
Contrast	To sharply juxtaposed with the positive additive aims of addition CF, since these CFs are mainly used for negative expansion.
	Example: _Although several researchers have reported structural and/or linguistic changes in certain sections of medical RAs (Atkinson, 1992; Ayers, 2008; Huangfu, 2005; Liang, 2005)_, no report, to our knowledge, has specially dealt with the structural or linguistic changes in complete medical RAs. (AL 3)
Addition	To exemplify and elaborate by using opposition and expanding on the preceding statements through positive emphasis.
	Example: _In addition to the analyses of treatment outcomes,_ we also wanted to investigate the predictors of treatment adherence. (Psy 9)
Means	To introduce common processes and techniques of scientific investigation.
	Example: _By comparing the locations of the IREDs over time_, it is possible to track movement in three dimensions. (AL 6)
Viewpoint	To show overt viewpoint temporarily to help writers to gain a high discourse profile, "similar to the participant role of *We* as subject."
	Example: _From the semantic and pragmatic point of view_, she also detected a strong tendency towards self-promotion and "interestingness" in the group of titles written in English, which was almost absent in the Slavic title group. (AL 8)
Time	To show time-related context of the research, research actions, findings and claims.
	Example: _In the last three decades_ the field of genre analysis has seen a great number of studies on written academic genres, especially the research article (e.g., Hyland, 2000; Swales, 1990, 2004). (AL 2)

Analytical procedures

To analyze the corpus for frequencies and communicative purposes of cohesive frame types, the following procedures were followed. First, 10 RD sections from each discipline, 40 RD sections in all, were extracted from the target journals and

converted into word files. Second, after establishing the sample, the researchers proceeded to identify the cohesive frames at the sentence initial position. To this end, the researchers read the 40 RD sections closely and identified all the cohesive frames. In this step, three raters were invited to check a sample of 8 RD sections from the sample to mitigate the threat of false identification of cohesive frames. The three raters were students pursuing their PhDs in Applied Linguistics. If there were differences in cohesive frames identification, they were subject to negotiation and discussion to reach an agreement. After having identified the cohesive frames objectively, they were counted and analyzed. Third, to identify the communicative purposes of the detected cohesive frames, Ebrahimi's (2014) taxonomy was used. At this stage, the data was "cleaned" several times through repeated review to mitigate any false detection of the communicative purposes. This was especially vital in the detection of communicative purposes of cohesive frames in the Psy, Che and EE RD section as the researchers have little or no knowledge about the topics covered in these RD sections. In addition, in the cases where the researchers were unclear or doubtful about the content and the communicative purpose, the researchers discussed the content with an M.A. or PhD. candidate researching in the same discipline. Fourth, having analyzed all the cohesive frames for the types and communicative purposes, the researchers increased the reliability of the analysis by asking the same three PhD. candidates to go through the analysis of a sample of eight RD sections to give their comments. Finally, the frequencies and communicative purposes of cohesive frame types were recorded and tabulated to be discussed.

Results and Discussion

The cohesive frame types found in the data were location in discourse (data), time, purpose, cause, condition, validation, and contrast. The results obtained concerning the frequencies and communicative purposes of the frame types are presented and discussed across the four disciplines.

Location in discourse (data)

As for manifestations of the location in discourse (data), a visible disciplinary difference was reported in the results of the data analysis. Based on the figures in Table 1, the Che writers showed the least attention towards the use of this cohesive frame, whereas AL writers outnumbered those from the other three disciplines in its use. It would seem that AL writers used this cohesive frame more frequently and explicitly to provide the reader with spatial location of the presented findings and claims. This approach is favored likely as a lead in to a better interpretation of the RD section. AL writers, in this study, preferred to use such a cohesive frame, which was represented by some "deictic forms" in the writing of cohesive texts.

Inferred from the communicative purposes enacted by the location in discourse (data) cohesive frame, it was found to serve three communicative purposes (see Table 2). The first communicative purpose, found in the four sets of RD sections, was that of stating the discourse-related location of findings and claims (Example 1-4). Through such use, writers could explicitly guide the reader to identify where the findings and claims were stated in the result section. Besides assisting reader to have a better interpretation of the RD section, this type of cohesive frame in relation to grammatical subject (GS) development could be quite helpful in imposing a structure to guide reading.

Example 1: ***In the following sections***, I will describe the patterns found in the three categories under investigation and provide examples of them. (AL 1)

Example 2: ***In the present study***, significant correlations between data obtained from sleep/wake diaries and actigraphy were found for sleep onset latency (r ¼ 0.69, p ¼ .029), total sleep time (r ¼ 0.85, p ¼ .004), and sleep efficiency (r ¼ 0.80, p ¼ .01). (Psy 8)

Example 3: ***In this study***, the gaseous WS containing all target VOCs (five new odorants together with two reference gases) were analyzed by direct injection into GC. (Che 3)

Example 4: ***In Table 3***, parental reports and inspectors' observations on dampness are compared. (EE 2)

Indicating the data-related location of the findings and claims was the second communicative purpose enacted in the four sets of RD sections by this cohesive frame (Example 5-8). This communicative purpose stresses the specification of location for the findings and claims in such a way that any changes in the location could result in different findings and claims. This importance of specifying the location made writers explicitly highlight the information to direct the reader's attention.

Example 5: ***In attributive clauses***, the (sub)aspect commented upon, or evaluated aspect, is followed by an attribute which denotes that the evaluated aspect is ascribed or given a value as a member of a class (what is said about the (sub)aspect, or criticism). (AL 1)

Example 6: ***In the autogenous group***, fifteen patients completed the treatments, but only fourteen are considered in these analyses, as one of them was not available at follow-up. (Psy 5)

Example 7: ***In these sediments*** the main P mineral phase is apatite, present mainly in the fine fractions A and B. (Che 4)

Example 8: ***Among the estates***, the mean maximum level of vegetation is 40%. (EE 1)

The third communicative purpose was stating the real world-related location of the findings and claims. This communicative purpose was unique to the EE discipline (Example 9). A plausible explanation might be the perceived importance or possible impact attached to the real world-location of the study on its findings and claims.

Example 9: ***In Bulgaria***, a common word "balatum" is used for both linoleum and vinyl flooring. (EE 2)

Table 1. Frequency and percentage of the location in discourse (Data) cohesive frame in RD

	AL	Psy	Che	EE
Location in Discourse (Data)	89 (30%)	47 (22%)	65 (21%)	85 (27%)

Table 2. Communicative purposes of the location in discourse (data) cohesive frame in RD

	CPs	AL	Psy	Che	EE
1	Discourse-related location	✓	✓	✓	✓
2	Data-related location	✓	✓	✓	✓
3	Real world-related location	*	*	*	✓

Condition

An ostensible disciplinary difference was noted in the realization of the condition cohesive frame in the four sets of RD sections. Inferred from the figures in Table 3, Psy and EE writers had dedicated a greater portion of their context frames to this realization. Psy and EE writers appeared to prefer expressing the condition from which the results or claims were emerged to convince the reader about the validity and objectivity of the results or claims. Stating the findings or claims next to a condition could help readers who may want to carry out similar experiments with an expectation of knowing what findings or claims could be in store with the expressed condition in mind.

The four sets of RD sections were analyzed for the communicative purposes served by the use of the condition cohesive frame. From Table 4, this cohesive frame was only used to present the conditional context together with the stating of findings or claims (Example 10-13). A possible justification for such employment may rest on the experimental nature of the corpus in this study. In experimental studies, writers attach significance to justify the findings and claims based on the condition from which they emerged. This impresses the readers on the care and attention given by the researcher in reaching certain conclusions that enhance the validity of the claim. Another possible justification comes from the necessity to state explicitly under what conditions the findings were noted and the claims were

made as far as in some studies to conduct the experiment writers need to use different procedures.

Example 10: ***If lexical collocations are indeed the more interesting type***, then the listing is disappointing. (AL 3)

Example 11: ***When taking anxiety into account***, the results confirmed our hypothesis and demonstrated that both IAP Control and Noncontrol score significantly predicted anxiety scores. (Psy 1)

Example 12: ***When the title complex is incubated with CT-DNA at [Ru]/[DNA] = 1:8***, the CD spectra of the resulting DNA undergo a little increase in both the positive and negative bands, as shown in Fig. 5. (Che 2)

Example 13: ***If this 2m is attributed to the oxide layer***, the resulting oxide content can be computed to be 25.6%. (EE 4)

Table 3. Frequency and percentage of the condition cohesive frame

	AL	Psy	Che	EE
Condition	55 (18%)	58 (27%)	66 (22%)	80 (26%)

Table 4. Communicative purposes of the condition cohesive frame in RD

	CPs	AL	Psy	Che	EE
1	Stating the conditional context for the findings or claims	✓	✓	✓	✓

Validation

The data analyzed for manifestation of the Validation cohesive frame and the result is presented in Table 5. As shown in the Table 5, Che and AL writers were more disposed to applying this cohesive frame explicitly compared to their counterparts in EE and Psy. This implies a stylistic preference among disciplinary writers. This frame reaches out to convince the discourse community by way of creating a link between the current study and that of previous studies. It also impacts the writers' contribution to the existing literature.

In the case of the EE and Psy RD sections, the lack of application of the validation cohesive frame might reveal that EE and Psy writers believed that their findings can speak persuasively for themselves and they did not need to be supported by references to earlier studies from within the community. These two groups of writers' little disposition towards the validation cohesive frame might reveal their intention to convince the reader that the findings and the claims made in the RD section are obtained via a "sound and justified methodology" (Kanoksilapatham, 2005).

The validation cohesive frame was used serve three communicative purposes in the four sets of RDs (see Table 6). The first communicative purpose, which was found in all RD sections, was drawing the reader's attention to the evidence in the tables, figures, examples and/or features of the data analyzed (Example 14-17). With this communicative purpose, the validation cohesive frame worked as a pointer to the source of data, thus indicating which data were being discussed. Validating the results and claims by referring to the information presented in the tables and figures could help the reader not only to understand the claims better but also to figure out the relationship between the information presented in the tables or graphs. This communicative purpose, internally, validated the study since findings and claims of the study are supported by referring to the information come as the result of the data analysis.

Example 14: However, ***as Table 5 illustrates***, these epistemic modal markers interact with the total incidence (74) of conditional meanings expressed in if-clauses (Quirk et al., 1985), conditional items, and non-lexical hedges (Hyland, 1998). (AL 7)

Example 15: ***As shown in Table 5***, individuals in the BED taxon with and without co-occurring affective or anxiety disorders had similar eating disorder psychopathology, health services use, and early childhood experiences (p > .01). (Psy 7)

Example 16: ***From Table 3 and Fig. 7***, we can clearly see that the order of the energies of L + x (L = LUMO; x = 0, 1, 2) of complexes 1 and 2 is eL+x(1) > eL+x(2), moreover, most of them are distributed on the intercalative ligand. So the interaction between complex 2 and DNA must be stronger than that between complex 1 and DNA as above-mentioned. (Che 2)

Example 17: ***Based on data in Fig. 3a***, one would conclude that the impact of increased ammonia loads HAc utilization is more dramatic for THD compared with MAD. (EE 9)

The second communicative purpose enacted by the validation cohesive frame in the four sets of RDs section was to make reference to previous research in order to justify the procedures, applied methods, findings reported or claims made in the current study (Example 18-21). This communicative purpose, in contrast to the earlier one reported above, is aligned to external validation. With this communicative purpose, writers aimed to link their own findings or claims to earlier ones in the discourse community. This, in turn, helped in convincing the readers that writers are fully aware of the existing claims and findings in the discourse community literature. In other words, writers could choose to contextualize their findings or claims which help them to indicate and reflect their sense of membership with the larger discourse community. This communicative purpose also aids writers to highlight the differences between their findings and claims made in previously

reports thus emphasizing their novel contribution to the existing disciplinary literature.

Example 18: Indeed, ***as Hyland (2000, pp. 64-65) indicates***, the competitive nature of the research community causes RA abstracts to function as an advertising means for attracting readers to the full-length text of the research article, and this ties in with the observation that boosters are the most important means of interaction marking in RA abstracts in any period. (AL 6)

Example 19: ***As previously suggested***, patients' acceptance may be of special relevance to the effectiveness of self-help treatments (Ritterband et al., 2010; Waller & Gilbody, 2009). (Psy, 9)

Example 20: ***According to a number of previous studies***, the modification of the GC system with a preconcentration system (such as TD) can induce considerable reduction in absolute sensitivity [27, 28]. (Che 3)

Example 21: ***On the basis of the literature results [44, 45]*** it can be expected that, the metal ions participate in long-range and short-range interactions with the carboxyl groups on the pore surfaces and in the membrane matrix. (EE 3)

The third communicative purpose performed by the application of the validation cohesive frame was validating findings or claims by referring to earlier stated findings or claims from the current study (Example 22-24). This communicative purpose was found in three sets of the RD sections analyzed (AL, Che, EE). Through validating the findings or claims with reference to earlier stated findings or claims in the same study, writers could reinforce the cohesive validity reference in a RD section. This is an instance of recursivity in academic writing where backward referencing can be employed to serve as a useful cohesive link.

Example 22: However, ***as indicated above***, some noticeable differences have been observed in both sub-corpora at the individual level. (AL 1)

Example 23: ***As was explained above***, the presence of residual monomer in the lamellar structure induces a decrease of the bilayer thickness that would explain the low value of d0 as compared with the expected value (1.96 nm). (Che 9)

Example 24: Further ***as discussed above*** the anthropogenic heat to get into these surfaces. (EE 1)

Table 5. Frequency and percentage of the validation cohesive frame

	AL	Psy	Che	EE
Validation	57 (19%)	21 (10%)	62 (20%)	22 (7%)

Table 6. Communicative purposes of the validation cohesive frame in RD

	CPs	AL	Psy	Che	EE
1	Drawing the readers' attention to evidences presented in the tables, figures, examples and/or features of the analyzed data	✓	✓	✓	✓
2	Referring to previous researches to justify the procedures, method used, findings reported and/or claims made in the current study	✓	✓	✓	✓
3	Validating findings and/or claims by earlier stated findings or claims from the current study	✓	*	✓	✓

Contrast

A noticeable disciplinary difference was found in the manifestation of the contrast cohesive frame in the four sets of the RD sections (see Table 7). The highest and the lowest inclination reported to be showed by the AL and Che writers by dedicating 15% and 5% of their cohesive frames to the manifestation of the contrast cohesive frame, respectively. This finding might suggest that AL writers prefer highlighting their findings through contrasting them to each other. This also helps in indicating that findings were unexpected. It seems that AL writers use this method of writing due to its importance as a method of text development.

The results of the data analysis reported three communicative purposes enacted by the manifestation of the contrast cohesive frame in the four sets of the RD sections (see Table 8). The main common communicative purpose was to substantiate findings (Example 25-28). It would appear all the writers favored the technique as a way to emphasize   the soundness of their findings. As a reach out, the writers could be seen as serving a petition for consideration of the findings of the current study as a part of the consensual knowledge of the disciplinary discourse community (Kanoksilapatham, 2005).

Example 25: ***Though there are some exceptions***, most referee reports in the corpus conformed to this trend. (AL 1)

Example 26: ***Despite diagnostic co-occurrence of BED and affective and anxiety disorders***, the probability for BED to occur without an affective or anxiety disorder was twice as large as to co-occur with these conditions at the latent level. (Psy 7)

Example 27: ***Although the original spherical form of precursor polymer particles is preserved***, a high extent of roughness develops at the particle surface, probably due to the combined effect of methanol excess and particles collision due to the agitation of the reaction medium during the partial hydrolysis of PVAc to form the layer of PVA shell. (Che 10)

Example 28: ***Despite the lower temperature in SBR25*** also a similar nitrogen removal rate of 0.49 gN/L/d was achieved in SBR25 compared to 0.40 gN/L/d in SBR35. (EE 8)

The second communicative purpose served through the application of the contrast cohesive frame was to contrast findings with the literature (Example 29-31). This communicative purpose assisted writers in highlighting the difference and the novelty between their findings and those reported by earlier studies. This contrast might also point to the worth of further investigation of the area of study.

Example 29: ***In contrast to Hyland's (2002) findings from the analysis of L2 undergraduate student texts***, the results from the analysis of master's students' writing indicates that these graduate student writers do reflect, to a certain extent, the variations in discursive practices exhibited by more established members of disciplinary communities. (AL 2)

Example 30: ***In contrast to the current and another clinical study's results (Wilfley et al., 2000)***, these studies also found significantly greater eating disorder psychopathology in patients with BED with psychiatric comorbidity than in patients with BED without psychiatric comorbidity. (Psy 7)

Example 31: ***In contrast to pure gaseous standards***, the analysis of VOCs in real air samples collected under various environmental conditions is rather intricate because of large interferences (e.g., complex matrices). (Che 3)

As for the third communicative purpose, Che and EE writers used the contrast cohesive frames to identify an existing gap in the literature (Example 32-33). This might suggest that writers in these two disciplines, representing hard science preferred to indicate explicitly the contribution and significance of their findings to the existing disciplinary discourse community literature.

Example 32: ***Despite the importance of these odorant species***, there has been little research on the techniques required for their quantification in environmental samples (at sub-ppb levels). (Che 3)

Example 33: ***While the implication of the covariance of rmax and KS on the constant substrate affinity of THD and MAD communities is clear***, the cause of this covariance is not well described in the literature. (EE 9)

Table 7. Frequency and percentage of the contrast cohesive frames

	AL	Psy	Che	EE
Contrast	45 (15%)	26 (12%)	16 (5%)	20 (6%)

Table 8. Communicative purposes of the contrast cohesive frames in RD

	CPs	AL	Psy	Che	EE
1	Substantiating findings	✓	✓	✓	✓
2	Contrasting of findings with literature	✓	✓	✓	*
3	Identify an existing gap in the literature	*	*	✓	✓

Purpose

The figures in Table 9 pointed to a clear disciplinary difference concerning the application of the purpose cohesive frame. Application of this cohesive frame fluctuated from a low of 5% in AL to an increased 14% in the Psy RD sections. A possible reason for the phenomenon could be that Psy writers were more inclined having to account for the *Why* of data selection or production (Kanoksilapatham, 2005).

The data were analyzed for the communicative purposes served through the application of the Purpose cohesive frame (see Table 10). The result reported that this cohesive frame was used to serve two communicative purposes in the four sets of the RD sections. The first communicative purpose was to state the purpose behind the selection of a particular technique, action or procedure (Example 34-37). This communicative purpose might be rooted in the fact that writers due to the nature of their research, sometimes, need to select more than one technique, action, or procedure to analyze their data. Therefore, stating the purpose for which the technique, action, or procedure was selected was deemed necessary. This also contributed to the validity of the study, since the selection of research techniques, actions or procedures were rule- governed and purposeful. This communicative purpose also helped the reader to understand the one to one relationship between the techniques, actions, or procedures on one hand and the expected result on the other.

Example 34: ***To this end***, a schematic framework of discussion sections in Applied Linguistics (Basturkmen, 2009) and the same method and definitions used in that study (op. cit.) were used to analyse texts from Dentistry. (AL 10)

Example 35: ***To compare results that CT produced for patients in the two groups under study***, one-way ANCOVAS were conducted considering the post-treatment scores as dependent variables and the pre-treatment scores as covariates. (Psy 5)

Example 36: ***To further clarify the nature of the interaction between the title complex and DNA***, viscosity measurements were carried out by keeping [DNA] = 0.4 mM, and varying the concentration of the complexes. (Che 2)

Example 37: ***To investigate a potential selection bias between participating and non-participating children***, a non-respondent analysis was made among parents

of 240 (78 in Burgas and 162 in Sofia) children who did not participate in the ALLHOME-1 study. (EE 2)

The second communicative purpose served by the application of the purpose cohesive frame was stating findings or claims using a purpose-result structure (Example 38-41). Through this communicative purpose, writers direct the reader's attention to the result that was being discussed. This, in turn, could be very helpful in having a better interpretation of a RD section especially when it is usually the longest section of the article. Via a purpose-result structure, writers also intended to bold the major findings of their studies.

Example 38: ***For new referents***, the default expectation would be a lexical form. (AL 9)

Example 39: ***To explain this result***, it can be argued that, although clearly related to self-report of disgust sensitivity (DS and DSQ), this behavioral index did not specifically tap feelings of disgust. (Psy 2)

Example 40: ***For B, T, and X***, variation in sensitivity was not distinctive enough, as the TD-based calibration slope values increased slightly with increases in molecular mass. (Che 3)

Example 41: ***For the same level of Cd treatment***, the concentration of Cys in either roots or shoots was, in general, lower under elevated CO_2 than under ambient CO_2. (EE 6)

Table 9. Frequency and percentage of the purpose cohesive frame

	AL	Psy	Che	EE
Purpose	16 (5%)	30 (14%)	39 (13%)	22 (7%)

Table 10. Communicative purposes of the purpose cohesive frame in RD

	CPs	AL	Psy	Che	EE
1	Stating the purpose behind the selection of a particular technique, action, or procedure	✓	✓	✓	✓
2	Stating findings or claims using purpose-result structure	✓	✓	✓	✓

Cause

In terms of the cause cohesive frame, (Table 11), the least use of this cohesive was identified among the AL writers (4%) and Psy (5%). The Che and EE writing (9% frequency for both disciplines) had a greater incidence of the cause cohesive frame. Thus it could imply that in hard science writing, there were more occasions to rely on the use of a cause-result structure to convey their findings.

As for the communicative purposes (see Table 12), the first communicative purpose was reporting findings and/or claims in the context of a cause-result structure (Example 42-45). Through this communicative purpose, writers preceded the reported findings or imposed claims with a support (cause) aiming at explaining a rationale to account for the results.

Example 42: ***Because these are structured as yes/no questions***, their literal meaning could induce somebody knowing little about the pragmatics of the English language to believe that questions with this pattern asks for a positive or a negative answer. (AL 1)

Example 43: ***Since one of the recovered patients at post-treatment was not available at follow-up***, 3 out of 14 patients (21.42%) were improved at this assessment time, and 11 out of 14 patients (78.57%) reached recovery status. (Psy 5)

Example 44: ***Since the title complex does not exhibit emission in the presence of DNA***, and also show no influence on the emission intensity of free EB (in the absence of DNA), the competitive DNA-binding of the title complex with EB could provide further information regarding its nature of DNA-binding [42,57]. (Che 2)

Example 45: ***Due to the high acid concentration (20 wt. %)***, the oxide content is multiplied by a factor 5 in only 5min (from5 to 10min of treatment). (EE 4)

The next communicative purpose was justifying a research action, procedure, or hypothesis (Example 46-49). This communicative purpose helped writers from the four disciplines to state the rationale behind the selection or use of a particular research procedure, action or hypothesis as a justification. This could be perceived as an explicit way to convince the reader that the research findings and arguments were highly valid and reliable.

Example 46: ***Because our analysis was restricted to title construction at surface structure***, the connections between these structural features and their communicative functions in relation to other sections of the papers to which the titles analyzed belong were not explored in the present study. (AL 8)

Example 47: ***Due to an unforeseen feature of the joystick***, reaction times of some trials were not recorded and were excluded from analysis. (Psy 1)

Example 48: ***Because of their complexity***, the spectra were separated into two regions, namely: the OH and CH stretching vibrations in the 3900–2700 cm−1 region (Fig. 3) and the "fingerprint" region in 1900–800 cm−1 (Fig. 4). (Che 5)

Example 49: ***As the high number of small particles perturbs the counting***, the size distribution is studied in terms of volume (Fig. 5). (EE 4)

The third communicative purpose (shown in Example 50-51) was only used only among the soft science disciplines (AL and Psy). A possible reason for its

absence among the hard science writers might be that the scientists did not see the significance of elaborating on the direction of future research. Additionally, the writers themselves may want to extend their research further. Berkenkotter and Huckin (1995) speculated that this deliberate avoidance could also be due to the fierce competition for grants in science, which motivated writers wanting to keep their ideas to themselves for their own grant proposals.

Example 50: In Spanish, ***as the rate of occurrence of this construction in RP titles was extremely low***, further studies based on larger databases will be necessary to be able to conclude whether or not this structure type is also a distinctive characteristic of RP titles written in this language. (AL 8)

Example 51: However, ***because it is possible that the original experience of a highly fearful event has caused the memories in both disorders to resemble each other***, future research should also study so-called PTSD-specific memory characteristics in other disorders, like obsessive-compulsive disorder. (Psy 3)

Justifying a study's limitations was another communicative purpose performed by application of the cause cohesive frame. This communicative purpose was found only in the Psy RD sections (Example 52). This could show Psy writers tended to place "carefulness and honesty in acknowledging the limitations of the various aspects of the study" (Kanoksilapatham, 2005, p. 285) as a writing routine.

Example 52: First, perhaps ***because of the present sample was self-recruited***, the variance of the predictors tended to be small. Greater variation in comorbidity might yield different results. (Psy 9)

Table 11. Frequency and percentage of the cause cohesive frame

	AL	Psy	Che	EE
Cause	12 (4%)	11 (5%)	28 (9%)	27 (9%)

Table 12. Communicative purposes of the cause cohesive frame

	CPs	AL	Psy	Che	EE
1	Reporting findings and/or claims in a cause-result structure	✓	✓	✓	✓
2	Justifying research action, procedure, and hypothesis	✓	✓	✓	✓
3	Justifying the necessity of further research	✓	✓	✓	✓
4	Justifying the study limitation	✓	✓	✓	✓

Time

The application of the time cohesive frame and the results showed a discernible disciplinary difference. As is evident in Table 13, EE writers practiced the highest employment of the time cohesive frame, whereas this cohesive frame received least

use by AL writers. A plausible reason for the predominance of this cohesive frame in the EE RD sections could be attributed to the more experiment-based nature of the discipline. Experiment-based studies are often "longitudinal and time related", therefore predominance of the time cohesive frame is not unusual (Williams, 1999, P.352). It seemed that the chronological presentation of the results "parallels the order of research procedures: data collection, comparison, statistical assessment and interpretation" (Williams, 1999, P.351).

According to the results presented in Table 14, the time cohesive frame served four communicative purposes. The most common communicative purpose was pointing to the time context for the results obtained (Example 53-56). This propensity might suggest that the four groups of writers, in conducting their studies, had to select some procedures. These procedures are discussed in different sections of the study and generated their own results. As a result, the writers had to relate the results obtained to different time periods, requiring the writers to contextualize the time frame for easy and logical interpretation by the reader.

Example 53: ***During these turns***, there is no non-verbal feedback from the opposite team. (AL 5)

Example 54: ***At twelve-months***, participants reported significant improvement in the behavioral (fewer binge episodes, less disinhibition and hunger, and greater restraint) and attitudinal (concerns about weight, shape and eating concern) features of BED as well as symptoms of depression (all ps < 0.001). (Psy 8)

Example 55: ***During a 133-day period***, at each 7-day interval, three lime wood samples were taken up from the exposure medium, mycelia were removed from their surfaces by repeated washings with twiced is tilled water and then the samples were oven-dried to constant weight. (Che 5)

Example 56: ***During peak summer months***, daytime UHI ranges between _0.6 and 2.5 1C while nocturnal UHI ranges between _0.2 and 1.5 1C. (EE 1)

Apart from AL RD sections, this cohesive frame was used for the chronological and parallel presentation of the results and the cause procedures (Example 57-59). This again was expected as experimental studies were not only time related but also chronological. Therefore, writers needed to document the specific procedure chronologically in relation to the results. As such, the results section is amply characterized with the procedure-result structure with reference to time and chronology.

Example 57: ***After CT***, patients with autogenous obsessions reduced their scores on the two Y-BOCS subscales more than patients with reactive obsessions did. (Psy 5)

Example 58: ***After 7 h***, heating and stirring are stopped and the reaction mixture is maintained under inert atmosphere overnight. (Che 7)

Example 59: ***After counting the number of particles corresponding to several size ranges***, it is possible to plot the resulting powder distribution. (EE 4)

Recounting the procedure was another communicative purpose fulfilled by the application of the time cohesive frame in the Psy and Che RD sections (Example 60-61). This might reflect the writers' tendency to highlight some critical information in the methods section, even if they were not novel, to ground the reader for a better interpretation of the findings stated in the results section (Kanoksilapatham, 2005). Recounting the procedures in the results section contributed to the affirmation of reliability of stated findings, as the reader is aided in creating a link between a procedure and results that emerged.

Example 60: ***Before considering anxiety in our analyses***, we checked in the entire group whether the IAP worked at all. (Psy 1)

Example 61: ***Before polymerization***, monophasic samples are transparent and after a few seconds of irradiation time, the samples become turbid in the region of the capillary where the X-rays traverse the sample, due to the phase separation process produced by the polymerization. (Che 9)

Stating the significance of the study from the time perspective was another communicative purpose found in the AL and Che RD sections (Example 62-63). These writers had chosen to impose this purpose as a means of reinforcing the value of their study to the intended readers. This might also help in having the paper published.

Example 62: ***To date***, most of the studies on academic discourse have not considered the use of citations and the first person pronoun together. (AL 2)

Example 63: ***In the last few years***, many studies from a number of laboratories have concentrated on the anticancer activities of citrus limonoids. (Che 6)

Table 13. Frequency and percentage of the time cohesive frame

	AL	Psy	Che	EE
Time	3 (1%)	10 (5%)	18 (6%)	42 (13%)

Table 14. Communicative purposes of the time cohesive frame

	CPs	AL	Psy	Che	EE
1	Pointing to the time context for the gained result	✓	✓	✓	✓
2	Chronological parallel presentation of procedures and results	*	✓	✓	✓
3	Recounting the procedures	*	✓	✓	*
4	Stating significance of the study	✓	*	✓	*

In summary, Tables 15 and 16 present salient information that has been discussed concerning use of the cohesive frame types in the RA results and discussion section.

Table 15. Frequency and percentage of the cohesive frames

		AL	Psy	Che	EE
1	*Location in discourse (data)*	89 (30%)	47 (22%)	65 (21%)	85 (27%)
2	*Time*	3 (1%)	10(5%)	18 (6%)	42 (13%)
3	*Purpose*	16 (5%)	30 (14%)	39 (13%)	22 (7%)
4	*Cause*	12 (4%)	11 (5%)	28 (9%)	27 (9%)
5	*Condition*	55 (18%)	58 (27%)	66 (22%)	80 (26%)
6	*Validation*	57 (19%)	21 (10%)	62 (20%)	22 (7%)
7	*Contrast*	45 (15%)	26 (12%)	16 (5%)	20 (6%)
	*Others	21(8%)	12 (5%)	14 (4%)	12 (5%)
	Total	298 (100%)	215 (100%)	309 (100%)	310 (100%)

*Others include cohesive frames, which their manifestation did not reach 5% in at least one discipline.

Table 16. Communicative purposes of the cohesive frames

	Cohesive frames	CPs	AL	Psy	Che	EE
1	Location in Discourse (Data)	Discourse-related Location	✓	✓	✓	✓
		Data-related Location	✓	✓	✓	✓
		Real World-related Location	*	*	*	✓
2	Condition	State conditional context for findings/claims	✓	✓	✓	✓
3	Validation	Draw readers' attention to evidences presented in tables, figures, examples and/or features of analyzed data	✓	✓	✓	✓
		Refer to previous researches to justify procedures, method used, findings reported and/or claims made in current study	✓	✓	✓	✓
		Validate findings and/or claims by earlier stated findings or claims from current study	✓	✓	✓	✓
4	Contrast	Substantiate findings	✓	✓	✓	✓
		Contrast of findings with literature	✓	✓	✓	*
		Identify an existing gap in literature	*	*	✓	✓
5	Purpose	State purpose behind selection of a particular technique, action, or procedure	✓	✓	✓	✓
		State findings/claims using purpose-result structure	✓	✓	✓	✓
6	Cause	Report findings and/or claims in a cause-result structure	✓	✓	✓	✓
		Justify research action, procedure, and hypothesis	✓	✓	✓	✓
		Justify necessity of further research	✓	✓	✓	✓
		Justify study limitation	✓	✓	✓	✓
7	Time	Point to time context for gained result	✓	✓	✓	✓
		Chronological parallel presentation of procedures and results	*	✓	✓	✓
		Recount procedures	*	✓	✓	*
		State significance of study	✓	*	✓	*

Conclusion

This study intended to investigate the frequency of realization and communicative purposes of cohesive frames in RD section of RAs from four disciplines namely AL, Psy, Che, and EE. The results reported that writers showed some noticeable differences in the use of the six types of cohesive frames – location in discourse (Data), time, purpose, cause, condition, validation, and contrast. The results reported that cohesive frames were used to serve different communicative purposes. It is worth noting that the number of communicative purposes performed by the cohesive frames could differ among the cohesive frames. The cause and time cohesive frames were used to perform more communicative purposes compared with other types of cohesive frames. It could be an emphasis to instructors of teaching the writing of RD section that they would need to give more attention to the cause and time cohesive frames as a result of their prominence in conveying communicative purposes. Essentially, the analysis has revealed choices that writers can make to give cohesion in writing and the manner in which the cohesive frames are used to front the grammatical subject is obviously a useful technique for writers to acquire as they endeavor to publish their works. The findings reported in this study may point to some implications for teaching RD writing in English for Academic Purposes (EAP) courses. The findings of this study could clearly assist the textbook developers to include information about how the cohesive markers are used and how it serves different communicative purposes in RD section. In addition, the findings reported in this study stress the fact that writing is restricted by disciplinary conventions. Therefore, EAP instructors who run writing courses need to inform learners about how communicative purposes enacted by employment of different cohesive markers are restricted by the disciplinary conventions. This could enable learners to make more conscious selections of cohesive markers to serve the communicative purposes.

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