

A Cross-Disciplinary and Linguistic Study of Context Frames in Research Article Abstracts

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Abstract

This study intends to scrutinize the realizations and discourse functions of context frames in research article abstracts written by native and non-native writers of English from four disciplines namely: Applied Linguistics, Economics, Biology, and Mechanical Engineering. To this end, 200 research article abstracts (50 from each discipline) were selected for analysis. From the 50 research article abstracts of each discipline, 25 were written by native writers of English and 25 written by Iranian non-native writers of English. The corpora, then, were analyzed based on the analytical framework proposed by Ebrahimi (2014). Based on the findings obtained, it can be concluded that the context frame's selection, frequency and discourse functions are affected and imposed by the nature of discipline and genre of RA abstracts. The result also indicated that there is a difference between native and Iranian non-native writers of English in dealing with these elements. In addition, the findings stress the fact that writing is restricted by the disciplinary conventions and writers' background knowledge of English language.

Keywords: Genre, Research Article Abstracts, Context Frame, Discipline, Native and Non-native Writers

1. Introduction

Recently, a number of researchers have studied research article (RA) abstracts across disciplines and languages for the rhetorical structure and/or linguistic features (Cross & Oppenheim, 2006; Gillaerts & Van de

Velde, 2010; Hu & Cao, 2011; Hyland & Tse, 2005; Khedri, Chan & Ebrahimi, 2013; Kanoksilapatham, 2013; Lores, 2004; Pho, 2008; Salager-Meyer, 1992; Santos, 1996; Sauperl, Klasinc & Luzar, 2008; Stotesbury, 2003). For instance, Lores (2004) analyzed

36 RA abstracts from four highly reputed journals in the linguistics field, to uncover the thematic structure used across and within the rhetorical structure of RA abstracts. The journals were the *Journal of Pragmatic*, *Linguistics*, *Journal of Linguistics*, and *Applied Linguistics*. Nine RA abstracts were extracted from each journal. She, at the beginning, scrutinized the corpus for the rhetorical structure. Her findings revealed that RA abstracts were following one of the three rhetorical structures of IMRD (introduction, method, result, discussion), CARS (create a research space), or combination of both. She then studied the corpus to find out the possible adopted thematic progression patterns and methods of thematic development. She relied on Danes' (1974) model of thematic progression including linear, constant, derived theme patterns. To see the method of thematic development, she drew on Gosden (1992) and Davies' (1988) categorization of theme content into context frames (marked theme) and grammatical subject (unmarked theme).

Concerning method of thematic development (Grammatical Subject and Context Frames), the result was classified into two sections of method of thematic development used in IMRD and CARS rhetorical structures. In abstracts following IMRD rhetorical structure, introduction and method moves mostly situated the grammatical subject in the thematic position, while in discussion move both grammatical subject and context frames occupied the thematic position. The result also displayed that the grammatical subjects, which used in the introduction were mostly within the discourse domain. In method, result, and discussion moves, real world domain was more dominant. This could proclaim the "transition from more text-related perspective to more objective, external-world related views" (p.295). In case of RAs using CARS

rhetorical structure, the result showed differences between the three moves regarding the thematic development method. In the first move, grammatical subject was predominant. In the second move, context frame and grammatical subject were used in the thematic position. Context frames were used to connect the first and second moves together. This use of context frame could be explained through the need for linking the gap to the earlier studies. In third move, context frames and grammatical subjects appeared in the thematic position and this appearance was more than that in second move. She finally concluded that structuring the text thematically doesn't happen at random. She also, based on the reported results, proclaimed that different moves of the of IMRD and CARS rhetorical structures displays different and distinct thematic progression patterns and methods of thematic developments within and across the boundaries between moves.

To explore the discourse function of context frames (Marked theme) used in research articles, Gosden (1992) analyzed 36 RAs written by native speakers of English. The articles were taken from 12 international academic journals published in U.K., U.S.A., and Canada from three hard science disciplines of Physics, Chemistry, and Biology. Each three RAs were taken from a journal. All the 36 RAs were extracted from 1989 and 1990 issues and were following IMRD structure (p.210). To analyze the data in terms context frames (CF), he used his own model, which was the modified version of analytical model proposed earlier by Davies (1989). He categorized context frames into nine groups. Based on the new model, context frames fulfill nine discourse functions in the text which are *Location in time*, *Location in space*, *Addition*, *Contrast/Concession*, *Cause*, *Means*, *Condition*, *Validation*, and *Viewpoint*.

The result indicated that CFs applied more in introduction, result and discussion sections suggesting the higher topic shifting in these sections, which are signaled through CFs. The result also showed that the more application of CFs the more cohesive the text will be (p. 215). Lower manifestation of CFs in method (experimental) section could be due to the “matter-of-fact” statements that the writers’ use to figure out the scientific procedures taken while conducting the study (p.215). The findings illustrated that writers in introduction section used location in time and space CFs to present previous researches and real-world entities within the context of scientific procedures and processes temporally and spatially. While writing this section, writers utilized contrast and addition CFs to fulfill the need for finding a gap through contrasting their study with the current state of knowledge, as well as raising problem and showing disagreement with existing research. In experimental (Method) section writers relied on cause CF mostly to replicate the data collection stages and present the experimental procedures and sequences (p. 217). In result section, writers focused on location in space CF to have another presentation of experimental procedures and sequences. Contrast context frame was employed to contrast the gained results with the earlier stated ones, to present the unexpected ones, to show the technical problems, and to put forward the possible solution, which at the same time indicate the gap for future research. The other context frame used in this section was validation. Using this context frame helped providing support and strength to the gained results with reference to graphic data. Discussion section had the highest CFs appearance to indicate the great need of discourse manipulation from a rhetorical angle in this section. As in the introduction section, research questions and objectives

are also addressed in discussion section. Therefore, similarities in terms of kinds of context frames between these two sections are not unexpected. Similar to introduction section, three context frames of contrast, addition and cause were also found in discussion section. He concluded that the context frames (marked frames) selection is related to the discourse function of the rhetorical sections of RA and they could be predicted based on the discourse function of the rhetorical structure of the RA.

The studies reviewed in literature motivated this study to scrutinize the realizations and discourse functions of context frames (CF), linguistic elements that precede the grammatical subject, in RA abstracts written by native and Iranian non-native writers from four disciplines namely: Applied Linguistics, Economics, Biology, and Mechanical Engineering.

2. Methodology

2.1. Corpus

This study was run on a corpus of 200 RA abstracts. The particulars of corpus are as follows:

- **Disciplines:** Applied Linguistics (AL), Economics (Eco), Biology (Bio), and Mechanical Engineering (ME)
- **Writers of RA abstracts:** Native writers of English and Iranian non-native writers of English
- **Number of Abstracts:** 200 RA abstracts; 50 from each discipline (25 written by native writers of English and 25 written by Iranian non-native writers of English)
- **Journals:** The corpus was extracted from eight journals. RA abstracts written by native were extracted from four journals of ‘English for Specific Purposes’, ‘Economic Modelling’, ‘Biologica’ and ‘Journal of Mechanical Engineering’. These journals are published by Elsevier and indexed in Thompson and Reuters. RA abstracts written by Iranian non-native writers were extracted from four journals of ‘Iranian

Journal of Applied Linguistics', 'Economic Modelling', 'Iranian Journal of Biology' and Mechanical Aerospace Engineering'. These journals are published in Iran and indexed in Islamic Science Center (ISC).

2.2. Unit of Analysis

In text analysis, selection of the unit of analysis is one of the crucial points. This becomes more crucial when it comes to the study of context frames in the text. In this regard, Halliday (1994) points out that sentence initial elements such as context frames can be analyzed at different structural levels such as clause and clause complex or T-unit. This study adopts T-unit as the basic unit of analysis. Fries (1994) defined T-unit as a clause complex, which contains one main independent clause together with all the hypotactic clauses which are dependent on it.

2.3. Analytical Framework

This study adopted the analytical framework suggested by Ebrahimi (2014). The rationale behind the adoption is that this analytical framework is the recent and more comprehensive one. The types and definition of the CFs are presented in Table 1.

2.4. Analysis Procedure

To analyze the data for the CF types and discourse functions, the following analytical procedures were taken. First, 50 RA abstracts (25 written by Native and 25 written by Iranian non-native writers of English) from each discipline, 200 RA abstracts in all, were extracted from the target journals and converted into word file. Then, word count was ran on each set of RA abstracts to ensure that the four sets of RA abstracts are of approximately the same

Table 1. *The Analytical Framework of Context Frames*

<i>CF types</i>	<i>Definition</i>
<i>Location in Discourse (Data)</i>	The CFs aim to show and describe the world-related or discourse-related context of the research or its findings and claims.
<i>Validation</i>	The CFs aim at providing 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.
<i>Condition</i>	The CFs aim at reporting 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.
<i>Cause</i>	The CFs aim to help writers present the cause or the rationale for the research actions and hypothesis.
<i>Purpose</i>	The CFs aim to present the purpose for which a research action was used.
<i>Contrast</i>	The CFs aims are sharply juxtaposed with the positive additive aims of addition CF, since these CFs are mainly used for negative expansion.
<i>Addition</i>	The CFs aim at exemplifying and elaborating through using opposition and expanding on the preceding statements through positive emphasis.
<i>Means</i>	The CFs introduce common processes and techniques of scientific investigation.
<i>Viewpoint</i>	The CFs aim to show overt viewpoint temporarily help writers to gain a high discourse profile, "similar to the participant role of <i>We</i> as subject."
<i>Time</i>	The CFs aim to show time-related context of the research, research actions, findings and claims.

size. This could increase the reliability of the study since CF, as cohesive marker, might be affected by the text length.

Second, after establishing the corpus, the researchers proceeded to identify CF of each T-unit. To this end, the researchers read the 200 RA abstracts carefully and identified all the T-units. In this step, to mitigate the threat of false identification of T-unit, three raters were invited to check a sample of 32 RA abstracts from the corpus. The three raters were three PhD students pursuing their PhD in Applied Linguistics. If any, the differences in T-unit identifications were subject to negotiation and discussion to reach an agreement. After having the T-units identified, CF of each T-unit was detected.

Third, the researchers analyzed the RA abstracts for the used CFs in terms of types and discourse functions. In this step, especially for detecting the discourse function, the researchers again read the RA abstracts to mitigate the false detection of the discourse functions due to partial understanding or misunderstanding of the RAs. This would be more vital in detecting the discourse functions of CFs in the Bio, Eco and ME RA abstracts as the researchers has little or no knowledge about topics covered in these RA abstracts. In addition, in the cases where the researchers could not understand the content to detect the discourse function, the researchers would discuss the content with an M.A. or PhD candidate practicing the same discipline.

Forth, having all the CFs analyzed for the types and the discourse functions, researchers increased the reliability of their analysis by having a sample of 32 RA abstracts to be checked by the same three PhD candidates. Fifth, the frequency and occurrence of the CF types and discourse functions were recorded and tabulated to be discussed. In the discussion section, those CF types, which occurred for more than ten percents in at least one discipline were discussed.

3. Results and Discussion

The RA abstracts were analyzed for the CF types and discourse functions and the results obtained are presented and discussed in the followings. The CF types found in the RA abstracts are *location, condition, purpose, validation, contrast, time, and means*.

3.1 Location CF

The RA abstracts were analyzed for the use of the location CF and the results are illustrated in Table 2. It is evident from the figures in Table 2 that there are differences not only between the four disciplines but also between native and non-native writers in each discipline. A plausible justification of the disciplinary differences is that in AL and ME RA abstracts, writers are keener to use the location CF as a signpost to guide the reader to get the intended interpretation and persuade the reader to read the RA. The inclination differences in the use of this CF between the native and non-native writers could be justified that the non-native writers, with the AL writers exception, are more oriented to quip the reader with the discourse-related location of the discourse presented. It seems that non-native writers are about to help the reader to achieve a better understanding and interpretation of the ideas.

Table 2. Frequency and percentage of the Location CF

Native writers	9 (31%)	5 (18%)	8 (22%)	13 (33%)
Non-native writers	1 (3%)	14 (33%)	20 (43%)	32 (44%)

The data were analyzed for the discourse functions enacted by the use of the location CF. The results reported that this CF performs two discourse functions. The first discourse function is indicating the discourse-related location of the data (Example 1-4). This discourse function is

common among the four groups of writers. A possible justification for such a use could be that writers prefer to help the reader to know where the source of the presented information is. In addition, some writers try to start their RA abstract by the “in this study” to show the contribution of their study in an explicit manner.

Example 1: *In this study*, C-DA is offered as a solution for overcoming such limitations. (AL/Non/24)

Example 2: *In this paper*, we propose new threshold cointegration tests based on instrumental variables estimation. (Eco/N/12)

Example 3: *In this study*, a mutant strain was isolated from a plenty of *Xanthomonas campestris* cells exposed to nitrous acid mutagenesis (NA1). (Bio/Non/2)

Example 4: *In the present study*, a model for calculating the flow in a vortex cell was obtained by replacing the laminar viscosity with the turbulent viscosity in the known high-Reynolds-number asymptotic theory of steady laminar flows in vortex cells. (ME/Non/3)

The second discourse function is data-related location (Example 5-8). This discourse function is also common among the four groups of writers. This discourse function could highlight the specification of the location of the presented arguments, findings, and claims. This might suggest that any changes in the location might generate change in the arguments, findings, and claims.

Example 5: *From the MICASE corpus (The Michigan Corpus of Academic Spoken English)*, two small corpora of lecture introductions of small- and large-class lectures were compiled. (AL/N/10)

Example 6: *In a nutshell*, the problem is that when one's favorite theory is foisted on the data, the end result is invariably an empirical model which is both statistically and substantively misspecified, but one has no way to disentangle the two sources of error in order to draw reliable inferences. (Eco/N/13)

Example 7: *In 2 randomized, parallel arm, blinded, phase I studies*, 142 healthy adult volunteers received a single dose of either the liquid or lyophilized formulation administered IM (300 µg in Study 1; 15 µg/kg in Study 2) or IV (50 µg/kg in Study 1). (Bio/N/2)

Example 8: *In this approach*, the quasi arbitrary Lagrangian–Eulerian finite element method (QALE-FEM) developed by the authors of this paper is combined with a commercial software (StarCD). (ME/N/6)

3.2. Condition CF

With respect to the findings in Table 4, it could be seen that there are ostensible differences between the disciplines and between native and non-native writers in relation to the use of the condition CF. These differences could suggest that non-native writers are not using this CF as an important element to validate their studies. They might not be fully aware that this CF,

Table 3. Discourse functions of the Condition CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 Discourse-related location	✓	✓	✓	✓	✓	✓	✓	✓
2 Data-related Location	✓	★	✓	✓	✓	✓	✓	★

which presents the condition next to the argument, findings, and claims could validate the study and make it more reliable. The more inclination of native writers might be because in RA abstract writing there is a word limit, which the writers should respect, thus they merge the arguments, findings, and claims with the condition from which they are generated.

Table 4. Frequency and percentage of the condition CF

	AL	Eco	Bio	ME
Native writers	5 (17%)	7 (25%)	7 (18%)	13 (33%)
Non-native writers	4 (13%)	1 (2%)	4 (9%)	10 (14%)

The result presented in Table 5 indicates that the condition CF was used to serve one discourse function. Presenting the conditional situation for the finding is the only discourse function found in the RA abstracts analyzed (Example 9-12). Presenting the condition next to the finding could validate and increase the reliability of the findings. It also could help better interpretation of the findings, which helps writers to convince the reader to read the paper and the editor to publish the paper.

Example 9: *Provided with the deleted words and asked to re-read the text*, they confessed that cloze reading was very different from the second reading. (AL/Non/5)

Example 10: *In case of technology shock*, there is no special difference between two scenarios. (Eco/Non/16)

Example 11: *Given that the antioxidant properties of bilirubin are well established*, it is possible that bilirubin helps protect albumin from oxidation during the pasteurisation step. (Bio/N/7)

Example 12: *Through the analytical and numerical solutions*, the dynamics of solid particle and air bubble in water have been found to behave differently especially at the early stages of motion, whereas some qualitative similarities exist in the long-term asymptotic. (ME/N/8)

3.3. Purpose CF

The data were analyzed for the realization of the purpose CF and the results are displayed in Table 6. Beside the noticeable disciplinary differences, there were clear differences between native and non-native writers dealing with the use of this CF. In relation to the disciplinary differences, it could be said that in Bio and ME RA abstracts, writers relied on the standard based nature of their studies and stated the reason for the arguments, findings, research process, and claims explicitly. In the case of the AL RA abstracts, it seems that these writers intend to give some reason-result structure to their RA abstracts for the case of increasing the validity. As to the differences reported between native and non-native writers using this CF, in three disciplines (see Table 6), non-native writers used more purpose CFs compared to their native counterparts. This could source from the fact that non-native writers are mostly novice researchers who feel the need to justify each and every step of their study to convince the possible readers and editor to read and publish their RA.

Table 5. Discourse functions of the Condition CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 Conditional situational for the findings	✓	✓	✓	✓	✓	✓	✓	✓

Table 6. Frequency and percentage of the purpose CF

	AL	Eco	Bio	ME
Native writers	4 (14%)	1 (4%)	7 (18%)	5 (13%)
Non-native writers	13 (42%)	8 (20%)	6 (13%)	19 (26%)

The result in Table 7 indicates that the purpose CF was used to serve one discourse function. The discourse function of justifying participants and instruments selections and data collection is common in all four disciplines (Example 13-16). It seems that writers intend to explain why they have selected special instruments, participants or data and provide more details concerning the relation between the research processes. This also results in RA abstracts with purpose-result structure, which contributes to the validity of the study.

Example 13: *To explore the lexico-grammar of Discussions*, this article relies on two small corpora, one of physics research articles and the other of student physics laboratory reports. (AL/N/18)

Example 14: *For this purpose*, an Auto Regressive Distributed Lag (ARDL) model will be developed. (Eco/Non/11)

Example 15: *To determine the quantity of a retroviral provirus in cellular DNA that can establish a productive infection in vitro*, we developed a transfection/co-culture system capable of recovering infectious virus from 1 pg of cloned HIV DNA and from 2 µg of cellular DNA from HIV-infected cells. (Bio/N/8)

Example 16: *To study the lean combustion instability experimentally*, one premixed combustion setup, equipped with reactant supplying system, is designed and manufactured. (ME/Non/6)

3.4. Validation

It can be seen from the data in Table 8 that the AL writers showed the highest tendency to use the validation CF, having both native and non-native writers on board. Table 8 also shows that ME writers dedicated the least attention to the use of this CF. Such findings could be justified based on the nature of the studies carried out in AL and ME disciplines. ME discipline belongs to hard science in which the studies are objective (experimental and standard based) in nature, while AL discipline belongs to soft science in which the studies are subjective in nature. This could lead the AL writers to seek the validation of their studies in the more use of linguistic features which indicates the validation of their claims, arguments, and findings.

According to the results presented in Table 8, it could be seen that while in AL and Bio RA abstracts, both native and non-native writers showed similar attention to the use of the validation CF, in AL and ME RA abstracts, non-native writers showed more inclination to the use of this CF. This might be sourced from the fact that non-native writers of RA abstracts are mostly novice writers in their field and they feel the need to validate their arguments, result, and claims to convince the readers among which are the journal editors and reviewers.

Table 7. Discourse functions of the Purpose CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 justify participants and instruments selections and data collection	✓	✓	✓	✓	✓	✓	✓	✓

Table 8. Frequency and percentage of the Validation CF

	AL	Eco	Bio	ME
Native writers	4 (14%)	2 (7%)	3 (8%)	1 (3%)
Non-native writers	4 (13%)	7 (17%)	4 (9%)	6 (8%)

As for the discourse functions enacted by the use of the validation CF in the RA abstracts analyzed, the results in Table 9 present three discourse functions. The first discourse function in the list is validating aim of study, which was found more in the two disciplines, which represent the soft science (Example 17-18). This discourse function could signify the importance of the study and in turn could help the writer to convince the reader about the effectiveness of the result of the study to the disciplinary community. This discourse function also shifts the responsibility of the study to the disciplinary community.

Example 17: *Following the proposal of Bhatia (2004) that genre knowledge needs to be investigated from two perspectives, an ethnographic perspective and a textual perspective*, the Results sections are analysed in terms of the *social genre/cognitive genre* model of Bruce (2008b). (AL/N/ 9)

Example 18: *Regarding the basic role of bank systems in economy of countries*, the present paper deals with the estimation of cost efficiency in 128 Branches of Tejarat Bank in Isfahan Province within 2007-2009, with the study of the affective factors of the above mentioned branches cost efficiency using the stochastic frontier analysis, Translog cost function and Maximum Likelihood method. (Eco/Non/10)

The second discourse function in the list is validating the results gained in the study (Example 19-22). This discourse function was common in all the eight group of RA abstracts analyzed. It seems that in RA

abstract writers need to support their findings by some evidences from inside or outside of their study to ensure the reader concerning the validity of the findings. This validation could be worked out by validating the finding a) by other findings from the same study, b) by presenting the procedures or actions from which the findings are generated, and c) by linking the findings of the study to the earlier findings in the literature.

Example 19: *Based on the results*, five categories of demotivating factors were identified: Learning Contents, Materials, and Facilities, Attitude towards English Speaking Community, The Teacher, Experience of Failure, and Attitude towards Second Language Learning. (AL/Non/19)

Example 20: *According to the results of the analysis*, the indices between two top enterprises are fluctuated between 77/93-99/21 based on Concentration Index, between 3625-4953 as per Herfindhal-Hirschman Index, and between 0/415-0/488 based on the Entropy Index. (Eco/Non/12)

Example 21: *From the amount of reduction of infectivity*, we calculate that clearance values in excess of 10^7 are attainable with respect to the infectivity associated with residual cell-substrate DNA. (Bio/N/8)

Example 22: *According to the results*, the optimum injection mode for this engine for simultaneous reduction of soot and NO_x emissions was achieved by injecting 75 percent of fuel in first pulse and 25 percent in the second with dwell time of 25 crank angle degrees between injection pulses. (ME/Non/12)

The third discourse function is validating the implications and recommendations of a study (Example 23-24). This discourse function was found only in the disciplines, which represent the hard science. This could suggest that presentation of such information in the RA abstract is a norm in the hard science disciplines.

Table 9. Discourse function of the Validation CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 Validating aim of study	✓	★	✓	✓	★	★	★	★
2 Validating results of study	✓	✓	✓	✓	✓	✓	✓	✓
3 Validating implication and recommendations of study	★	★	★	★	✓	✓	★	✓

Example 23: *Based on our results*, we recommend the use of either ML or SK at most virus concentrations; however, at low virus concentrations ML is preferred. (Bio/N/16)

Example 24: *With regard to numerical and experimental results*, we proposed an interval to estimate the initial size of droplet dispersed from a FAE device. (ME/Non/21)

3.5. Contrast CF

The RA abstracts were analyzed for the realization of the contrast CF and the results are presented in Table 10. It is evident that there is clear disciplinary difference between the four disciplines dealing with the realization of this CF. This might suggest that the Eco writers who inclined more comparing to other three groups intend to “create the polarizing tension necessary to set up and achieve certain rhetorical aims” (Gosden, 1992, p.212). The figures in the Table 10 indicate that with the exception of the AL, in other three disciplines native writers showed greater attention to the realization of this CF. This could be justified based on a) native writers use the contrast CF as a text development device, which helps them to create a contrastive (negative) relation between the ideas presented in RA abstract and b) the non-native writers are not fully aware of the function of this CF in creating a more valid RA abstract.

In relation to the discourse function enacted by the use of the contrast CF, it was

Table 10. Frequency and percentage of the contrast CF

	AL	Eco	Bio	ME
Native writers	2 (7%)	6 (21%)	5 (14%)	6 (15%)
Non-native writers	3 (10%)	1 (2%)	1 (2%)	1 (1%)

found that this CF was used to serve three discourse functions. The first discourse function in list is substantiating aim or topic of study (Example 25-28). This discourse function was found more in RA abstracts written by native writers. It could indicate that native writers prefer to show the validity and necessity of their study right from the beginning part of the research, that of topic and aim. This could show the necessity of their study and persuade the reader to read the RA abstract and RA.

Example 25: *Despite great attention to different aspects of teachers and their demographics in mainstream education*, such studies are rare in the English Language Teaching field. (AL/Non/17)

Example 26: *Unlike the existing literature*, this paper considers a model where foreign investment is endogenously determined. (Eco/ N/7)

Example 27: *Although currently available vaccines are derived only from viruses in genotype III*, vaccines are known to protect against naturally occurring strains. (Bio/N/5)

Example 28: *While some simple analytical solution is widely described in textbooks*, little research was conducted to date on the unsteady turbulence properties beneath negative waves. (ME/N/22)

The second discourse function is substantiating processes and procedures of carrying out the study (Example 29-30). This discourse function was found in Eco and ME RA abstracts. This discourse function could imply that in some disciplines the contribution of the study is in the method of study, thus writers feel the need to justify the processes and procedures by contrasting them with the available processes and procedures used to carry out similar studies in the literature.

Example 29: *Instead of imposing rational expectations and estimating the Phillips curve by the Generalized Method of Moments*, we use direct measures of inflation expectations from the CESifo World Economic Survey. (Eco/N/1)

Example 30: *Unlike conventional characteristic based (CB) schemes*, which use one-dimensional characteristic relations, the proposed scheme takes into account the physical multi-dimensional characteristic relations. (ME/Non/1).

The last discourse function in list is substantiating findings (Example 31-33). This discourse function could intend the writers' inclination towards underlining the soundness of their findings. Such soundness could convince the reader to take the

findings as contributions to the existing disciplinary knowledge and convince the journal editor to publish the paper.

Example 31: However, *despite concerns from some participants that communication in English can be problematic*, the analysis illustrates the overall positive linguistic performance of speakers in the meetings themselves. (AL/N/2)

Example 32: In addition, although *the markets of these countries have high capacities for return of investment*, but, in particular, the findings show a low correlation between these markets. (Eco/Non/21)

Example 33: *Although solvent/detergent concentration was the most critical parameter*, a concentration as low as 0.15% TnBP/0.5% Triton X-100 was still completely effective. (Bio/N/3)

3.6. Time CF

The data were analyzed for the use of the time CF and the results are illustrated in Table 12. As it is evident from the figures in Table 12, there is a telling disciplinary difference in relation to the use of this CF. Bio writers showed the highest inclination and ME writers presented the least inclination. These results could be interpreted as that Bio writers prefer to frame their RA abstracts from the time perspective. This might suggest that in Bio studies, the time length and chronological order of the processes of the experiment are of high value and any possible change these lengths or order may generate changes in findings.

Table 11. Discourse functions of the Contrast CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 Substantiating aim or topic	*	✓	✓	*	✓	*	✓	*
2 Substantiating process or procedure	*	*	✓	*	*	*	*	✓
3 Substantiating findings	✓	*	✓	✓	✓	✓	*	*

With exception of AL, in other three disciplines, non-native writers showed more inclination towards using the time CF. This might suggest that non-native writers intend to use this CF as an element to signify and indicate their contribution to the existing disciplinary knowledge.

Table 12. Frequency and percentage of the Time CF

	AL	Eco	Bio	ME
Native writers	2 (7%)	1 (4%)	4 (11%)	--
Non-native writers	2 (6%)	5 (12%)	6 (13%)	2 (3%)

The results in Table 13 indicate that the time CF was used to serve three discourse functions. The first discourse function is to state the significance of the topic under study (Example 34-35). This contributes to the significance of study and increases chance of publication. It also helps in persuading the reader to read the whole RA. Example 34: **Today**, however, university administrators increasingly rely on post-publication data such as citation records. (AL/N/24)

Example 35: **Over the past three decades**, there has been a trend towards increased asset return correlations across markets, a trend which has been accentuated during the recent financial crisis. (Eco/N/14)

The second discourse function is to organize processes of a study in chronologically (Example 36-39). Such a

function could imply that writers intend to state that the chronological order is of significance importance and change in the order could generate different results. They also want to give a clear image of their experiment to researchers who intend to carry out similar experiments.

Example 36: **After ranking the scores from the highest to the lowest**, two expert/expert pairs and two novice/novice pairs were chosen to perform four tasks. (AL/Non/23)

Example 37: **After analyzing the credit files of each customers**, we identified 11 explanatory variables including qualitative and financial aspects as follows: type of security, type of the workplace ownership, cooperation background, capital, current ratio, quick ratio, the ratio of current asset to total assets, total asset turn over, turnover, current capital turnover, dept ratio and stock holder equity ratio that have significant impact on credit risk. (Eco/Non/13)

Example 38: **Three months after the initial exposure**, the same animals were subjected to two full thickness dermal wounds on the dorsal surface. (Bio/N/13)

Example 39: **During the penetration process**, failure of target plate is assumed to be plugging with dishing of target plate and projectile deforms into mushroom shape.

The last discourse function in list is to state the time context of findings (Example 40). They want to indicate how the time length could affect the findings. This discourse function was unique to Eco non-native writers.

Table 13. Discourse function of the Time CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 State significance of a study	✓	★	✓	★	★	★	★	★
2 Organize processes of a study chronologically	✓	✓	★	✓	✓	✓	★	✓
3 Time context for findings	★	★	★	✓	★	★	★	★

Example 40: *In long-run*, GDP elasticity to public investment in transportation is a significant positive value equal to 0.08. (Eco/Non/11)

3.7. Means CF

Table 14 presents the results concerning the use of the means CF in the RA abstracts analyzed. It is evident that there is a telling disciplinary difference between four disciplines concerning the use of this CF. This could suggest that some writers (native writers in Eco and Bio and non-native writers in Eco) feel the need to present the means which generated the arguments, findings, and claims. The use of this CF in this manner could validate the study. The results in Table 14 also indicates that native and non-native writers have different views in regards to the use of the means CF. It could suggest that non-native writers are more inclined to validate the arguments, findings, and claims as they are mostly novice writers of their disciplines.

Table 14. Frequency and percentage of the means CF

	AL	Eco	Bio	ME
Native writers	2 (7%)	5 (18%)	1 (3%)	--
Non-native writers	3 (10%)	5 (12%)	4 (9%)	2 (3%)

The results in Table 15 indicate that the means CF is used to perform to discourse functions. The first discourse function is presenting the means by which the study is carry out (Example 41-43). This discourse

function helps writers to bring together the data and aim of the study. Such presentation of data and aim could be a strategy of saving space in RA abstract writing as the writers are limited in word count.

Example 41: *Using the academic writing sub-corpora of the Corpus of Contemporary American English and the British National Corpus as data and building on previous research*, this study strives to identify the most frequently-used multi-word constructions (MWCs) of various types (e.g., idioms, lexical bundles, and phrasal/prepositional verbs) in general academic writing across the academic divisions of the corpora and to examine their usage patterns. (AL/N/21)

Example 42: *By using contingent valuation*, this research examines people willing to pay in Polesefid of mazandaran province. (Eco/Non/15)

Example 43: *Using Sindbis as a representative enveloped virus*, the effect of various parameters on the inactivation process was tested. (Bio/N/3)

The second discourse function is presenting the means, which generated the findings and claims of study (Example 44-46). Writers use this CF in this manner to validate the findings and to save space in RA abstract writing by merging the method and result sections.

Example 44: *Using ARDL and ECM methods*, the results indicate that there is a long-run relationship between financial development and the growth of industrial sector. (Eco/Non/8)

Example 45: *By using experimental design (Plackett-Burman) and statistical analysis*,

Table 15. Discourse function of the Means CF

Discourse Functions	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
1 Means of carrying out a study	✓	✓	✓	✓	✓	★	★	★
2 Means generating findings	★	★	✓	✓	✓	✓	★	✓

among seven parameters tested, we found that whey, as the main substrate, and pH were the first factors affecting gum production. (Bio/Non/2)

Example 46: *Using this inherent upwinding technique*, no artificial viscosity is required, even at high Reynolds numbers. (ME/Non/1)

In summary, Tables 16 present the results obtained regarding the frequency of CF types.

4. Conclusion

This study aimed to study the CF types and their discourse functions served by the employment of these elements in RA abstracts written by native and Iranian non-native writers of English from four disciplines namely AL, Eco, Bo, and ME. The results were presented and discussed and from the discussed results, it can be

concluded that the CFs selection, frequency and discourse functions are affected and imposed by the nature of discipline and nature of the genre of RA abstract. The result also indicated that there is a difference between native and Iranian non-native writers of English in dealing with these elements.

The findings reported in this study may point to some implications for teaching RA abstract writing in English for Academic Purposes (EAP) courses. In addition, the findings have an implication for EAP textbook developers. A survey in the available textbooks dealing with teaching RA writing shows that these textbooks mostly dedicated little attention to the writing of RA abstracts. This little attention is mostly dedicated to the rhetorical structure of the RA abstracts and it seems

Table 16. Frequency and percentage of the CF types

	AL		Eco		Bio		ME	
	N	Non	N	Non	N	Non	N	Non
Location	9 (31%)	1 (3%)	5 (18%)	14 (33%)	8 (22%)	20 (43%)	13 (33%)	32 (44%)
condition	5 (17%)	4 (13%)	7 (25%)	1 (2%)	7 (18%)	4 (9%)	13 (33%)	10 (14%)
purpose	4 (14%)	13 (42%)	1 (4%)	8 (20%)	7 (18%)	6 (13%)	5 (13%)	19 (26%)
validation	4 (14%)	4 (13%)	2 (7%)	7 (17%)	3 (8%)	4 (9%)	1 (3%)	6 (8%)
contrast	2 (7%)	3 (10%)	6 (21%)	1 (2%)	5 (14%)	1 (2%)	6 (15%)	1 (1%)
Cause	1 (3%)	-	-	1 (2%)	-	1 (2%)	1 (3%)	1 (1%)
Time	2 (7%)	2 (6%)	1 (4%)	5 (12%)	4 (11%)	6 (13%)	0	2 (3%)
Means	2(7%)	3 (10%)	5 (18%)	5 (12%)	1 (3%)	4 (9%)	0	2 (3%)
Additive	-	-	1 (3%)	-	1 (3%)	-	-	-
Comparison	-	1 (3%)	-	-	-	-	-	-
Point of view	-	-	-	-	1 (3%)	-	-	-
Total	29	31	28	42	36	46	39	73

that the linguistic features used in the RA abstracts are neglected. Thus, the findings of this study could clearly assist the textbooks developers to include information about how CF as an important linguistic feature is used and how it serves different discourse functions in the RA abstracts.

The findings also stress the fact that writing is restricted by the disciplinary conventions and writers' background knowledge of English language. Therefore, EAP instructors, who run RA abstract writing courses, need to raise the awareness of the learners about how discourse functions enacted by employment of different CFs are restricted by the disciplinary conventions and writers background knowledge of English language. This could enable learners to have more conscious selections of CFs to serve the discourse functions.

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