Validation markers in introduction and results and discussion sections of research articles from four disciplines

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Abstract

In the last three decades, genre of research article, among other genres of academic writings, has received the greatest attention. This attention is due to the vital role that research article plays in the legitimating of claims and disciplines. Johns and Swales (2002) relate this attention to the intensive review process that research article goes through before getting "valorized and ratified by the very fact of being published" (p.13). Research article also plays a significant role in the circulation of academic knowledge that requires meeting the often-stringent requirements of a disciplinary community. The mentioned importance has provoked this study to investigate how writers validate the ideas, claims, arguments and findings reported in introduction and results and discussion sections of research articles across four disciplines namely; Applied Linguistics, Psychology, Chemistry, and Environmental Engineering. To this end, 40 introduction and results and discussion sections were extracted from 40 research articles published in high-impact journals from four disciplines (10 from each discipline). The data were analyzed and the findings reported some disciplinary differences concerning the frequency and discourse functions of validation markers. The differences could be attributed to the disciplinary conventions of writing or rhetorical functions of introduction and results and discussion section of research article. The

results of this study might act as a guide for novice writers from four disciplines to plot how successful writers validate their ideas, arguments, findings and claims in introduction and results and discussion sections of research articles.

Keywords: genre, research article, results and discussion section, introduction section, validation markers, discipline

Introduction

Students at postgradute level are required to share their research findings with their disciplinary community members using different genres of communication. Among the genres, in the last three decades, research article has received noticiable attention from postgraduate students for the sake of sharing recent achevements in disciplines.

Following Bruce (2003), research article is classified as a social genre in academic context. Ard (1983) notes that the genre of research article developed from the informative letters written by scientists to each other (cited in Swales, 1990, p. 110). At a more precise level, Jalilifar defines research article as "a piece of writing about a particular subject that is published in a scholarly journal or book for an intended audience. It is representative of accumulated knowledge of a field and also a report of a particular research study" (2009, p. 7). The research article genre can be further subdivided into three sub-genres: a) theoretical, b) review or state-of-art, and c) experimental (Swales, 2004).

An experimental research article is a genre in which the developmental stages of a scientific experiment are documented. It usually has a fixed format of sections and subsections of introduction, literature review, method, result, discussion and conclusion. Sometimes some of these sections are merged; introduction with literature review, result with discussion and

discussion with conclusion. This research article mostly follows Swales structure of introduction, method, result and discussion (IMRD) (Jalilifar, 2009).The first section, introduction, provides the anchor point after the title. According to Jalilifar (2009), this section is written to give information regarding the research in terms of several features. First, it provides the background whereby the researcher presents earlier studies and how the present study contributes to what have been done earlier. Then, there is the rationale by which the researcher shows the importance, reasons and benefits of investigating the study gap which is indicative of lack of existing knowledge that a research will fill. Objectives are also established to clarify the aims of the research which are accompanied usually by delimitations. Here, the researcher displays the limitations of the research to a specific geographical area or to certain aspects of the situation. Finally, assumptions are stated to the conditions, states, and requirements that may affect the conducting of the research.

The second section is methodology. In this section, the researcher gives sufficient details to describe how the study is conducted. This may help other researchers in replicating the study. The methodology section is composed of subcategories: a) participants, b) instruments and c) procedures (Jalilifar, 2009). In the participant subsection, the researcher gives information concerning the characteristics, selection and number of the participants. S/he may also mention if any participant has failed to continue or left in the middle of the experiment. In describing the participants, demographic information of age, sex, level of education, type of instructional affiliation, economic status and geographic location need to be included. In the subsection on instrument, the instruments used for data collection are briefly described. The standard instruments are tests, interviews, questionnaires, inventories and observations. The next subsection is the procedure which describes the procedures employed for data collection and

execution of the research. The researcher, in this subsection, generally describes "How was the data collected and analyzed?" (Jalilifar, 2009, p. 54).

The third section, result, includes a wide range of qualitative and quantitative analyses. Data analysis which is situated in the result section can be defined as "studying the organized materials from many angles in order to find out inherent facts" (Jalilifar, 2009, p. 65). Seliger and Shohamy (1989) remark that data analysis deals with "sifting, organizing, summarizing and synthesizing the data, so as to arrive at the results and conclusion of the research" (p. 201).

In the discussion section, the researcher attempts to put a summary of major findings of different parts together. The discussion section could consist of seven main functions which deal with: presenting background where the researcher sets the scene by making generalizations about research, making reference to previous research in which the researcher refers to earlier studies to support or reject certain beliefs, stating claims based on the obtained results, restating aims to remind readers about the stated goals. In addition, it provides limitations of previous research and at the same time shows the extent the data of the present study are applicable and making recommendations where the researcher presents the suggestions which can be made on the basis of the present study. Finally it promotes further studies by showing other works which can be conducted in the light of the present study.

In the last three decades, many researchers have studied research article introduction (Ebrahimi, 2017; Hirano, 2009; Gupta, 1995; Martin and Periz, 2014; Ozturk, 2007; Samraj, 2002; Sheldon, 2011) and results and discussion (Bertt, 1994; Busturkman, 2012; Josef and Lim, 2018; Kanoksilapatham, 2012; Peacook, 2005; William, 1999) sections and pointed that writing these two sections are quite challenging for researchers particularly novice researchers. These researchers have focused on rhetorical structure and linguistic features used in writing research

article introduction and results and discussion sections. One of the linguistic features that received little attention is the use of validation markers. It seems that it worth to show how successful researchers validate their information, claims, findings and arguments in these two challenging sections of research article. Validation markers 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.

Thus, this study intends to investigate the frequencies and discourse functions of validation markers in two sections of research article (RA) (introduction and results and discussion) from four disciplines namely Applied Linguistics (AL), Psychology (Psy), Chemistry (Che), and Environmental Engineering (EE).

Methodology

Data Collection

To collect the data, the following steps were taken. First, based on the cross disciplinary nature of the current study, the researchers needed to make sure that selected disciplines could represent the spread of academic disciplines, thus, following Becher's (1989, 1994) classifications of academic disciplines, four disciplines namely AL, Psy, Che, and EE were selected. Second, after the selection of disciplines, researchers selected the journals to represent four disciplines. Three journals from each discipline were selected. The selected journals are indexed in Thompson and Reuters and published by Elsevier. These journals could help the researchers to make sure that

data includes RAs that are produced by successful writers of disciplines. Mauranen (1996) named such texts as "good text". She states that:

> "We here take the typical native speaker user in edited and published texts as a criterion for acceptable use, and regard any text that meets this criterion as ''good''. In this way, all L1 texts in the material are good texts by definition. Even though they cannot be held up as ideal models, their typical features can be used as a guide to the working of text in that language (p. 213)".

Third, next to the journal selection was RA selections. 40 RAs (10 from each discipline) were selected based on the following criteria. A) The selected RAs had the macro structures of Introduction, Method, Result, and Discussion (IMRD) proposed by Swales (1990). The rationale is that this model has been successfully employed by researchers investigating texts in many disciplines such as Applied Sciences, Psychology, and Hard Sciences' disciplines (Jalilifar, 2006). Keeping to the same macro structures across the corpus would enable the researcher to have a better frame of reference for the analysis of the micro structures among which is the notion of validity. B) The RAs were data based RAs. There were three reasons for limiting the focus to data based RA. The first is to take into consideration Swales' (2004) caution that RA may not be a single genre. Rather it might well constitute three genres-experimental (data based) RA, theoretical RA, and the review RA. Second, there is a big number of data based RAs that lend themselves well to the IMRD structure and third, there is a high inclination towards writing data based RAs and it appears that journals are more inclined toward publishing data based RAs (Jalilifar 2009). To give currency to the publications, the selected RAs were published between 2008 and 2012 (two RAs from each

year). This help to moderate changes that may occur in style preference as some journals do change their requirements as an update.

Analysis Procedure

To analyze the validity markers for frequencies and discourse function, the following analytical procedures were followed. First, ten data based RAs from each discipline, forty RAs in all, were extracted from the target journals and converted into a word file. Then, word count was run on each set of RAs to ensure that the four sets of RAs were of approximately the same size. Second, the researchers analyzed the introduction and results and discussion sections of RAs for the validity markers in terms of frequencies and discourse functions. In this step, the data were 'cleaned' several times through repeated review to mitigate any false detection of the discourse functions. This was especially vital in the detection of discourse functions of validity markers in the Psy, Che and EE introduction and results and discussion sections as the researcher has little or no knowledge about the topics covered in these sections. In addition, in the cases where the researcher could not understand the content to detect the discourse function, the researcher discussed the content with an M.A. or PhD candidate researching in the same discipline.

Third, having all the validity markers analyzed for the frequencies and discourse functions, the researcher increased the reliability of his analysis by asking three PhD candidates to go through the analysis of a sample of eight introduction and results and discussion sections. Finally, the frequency and discourse functions of validity markers were recorded and tabulated for discussion.

Results and Discussion

The data were analyzed for the frequencies of the validity markers in introduction and results and discussion sections of four disciplines and the results are presented in Table 1.

Table 1: frequencies of validity markers

	Sections of RAs	AL	Psy	Che	EE
Validity Markers	Introduction	17	12	8	4
	Results and Discussion	57	21	62	22
	Total	74	33	70	26

The results in Table 1 indicate that the validation marker was used more by AL and Che writers compared with Psy and EE writers. This might show that Che and AL writers feel greater necessities to support and validate claims, arguments, and results stated in their studies.

The little application of the validation markers by Psy and EE writers might reveal that these writers believed that their study 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 marker might reveal their intention to convince the readers that the findings, claims, and arguments made in the RA are obtained via a "sound and justified methodology" (Kanoksilapatham, 2005).

In all four disciplines, the validation markers were used more in result and discussion (Rand D) section. This could be due to the fact that writers are mostly state their findings and make claims in this section of RAs. Thus, it seems that writers prefer to validate such information to ensure the acceptance of the information by the disciplinary community members. Inviting support from the discourse community could help in the creation of a link between the current study and that of previous studies. This link also helps writers to highlight their contribution to the existing literature.

The data were analyzed for the discourse functions of the validation markers in the introduction sections and the results are presented in Table 2.

Table 2: Discourse Functions of the Validation markers in Introduction section

	Discourse Function	AL	Psy	Che	EE
1	Validate earlier findings and arguments	✓	✓	✓	✓
2	Validate gap in literature	✓	✓	✓	✓
3	Validate key term's definition	✓	✓	*	*
4	Validate studies' hypothesis	*	✓	*	*
5	Validate topic of study	*	*	✓	*
6	Validate aim of study	✓	*	*	*

All four groups of writers applied validation markers to attest to the validity of earlier findings and arguments (Example 1-4). Thematizing the validity of earlier findings and arguments acted as an attention-catching device to focus the readers' attention on the fact that current studies were based on valid literature. In addition, it was the obvious notion of satisfying an obligatory step in the introduction section, which was reviewing related literature.

Example 1: ***Based on findings derived from examining several hundred titles of academic publications,*** Hartley concludes that titles differ across genres. (AL8)

Example 2: ***With respect to the disorganization***, findings are contradictory. (Psy3)

Example 3: ***According to the authors,*** the magnetic microparticles can be successfully used to occlude the vessels near to the aneurysm. (Che10)

Example 4: ***According to the kinetic selection theory*** (Chudoba et al., 1973) these low soluble substrate concentrations give competitive advantages to filamentous bacteria leading to bulking. (EE7)

Another discourse function which was found in the four sets of introduction sections was to make the current study stand out more by signifying a gap in the literature through phrases such as *to our knowledge/ to the best of our knowledge* (Example 5-8). Such use could mark the novelty of the current study. Writers also claimed their awareness of the existing literature and for their contribution to the field.

> Example 5: ***To my knowledge***, no previous research has focused on backchannelling behaviour in ELF negotiations involving only non-native speakers. (AL 5)
>
> Example 6: So far, ***to our knowledge***, no indirect measures have been reported in the study of perceived control. (Psy1)
>
> Example 7: ***To the best of our knowledge***, there is no information on purification of bioactive compounds from limes and their effect on human pancreatic cancer cells. (Che 6)
>
> Example 8: ***To our knowledge***, this is the first study carried out to investigate the interactive effects of CD stress and elevated Co_2 concentration on key responses of plants, ranging from element uptake to physiological processes. (EE6)

AL and Psy writers were seen to use the validation markers to authorize the definitions of key terms (Example 9-10). This seems to be important to these writers who might perceive that these definitions could serve to disambiguate which might be a major concern among soft science disciplines as many terms have a number of meanings. Such presentation of the definition of the key terms could help writers to show that they were using the most up to date and consensual definitions.

> Example 9: ***On the basis of the above***, I shall define a backchannelling item according to function:
> (a) It represents listener behavior does not interrupt someone else's turn.
> (b) It does not elicit a response from any of the interlocutors.
> (c) It does not represent a bid for the floor, thus unsuccessful bids like yes but are not counted as backchannels, but transcribed as turns. (AL 5)

> Example 10: ***As defined by Frost, Heimberg, Holt, Mattia, and Neubauer (1993)***, the Maladaptive Evaluative Concerns (MEC) subscale draws from the FMPS's CM, DA, Parental Criticism, and Parental Expectations subscales. (Psy 4)

Psy writers used the validation markers to give scientific backing to their studies' hypotheses (Example 11). This strengthened the claim that the hypotheses of their studies emerged from existing disciplinary literature. Such claims could convince readers and reviewers that these studies were the result of strong suggestions from within the disciplinary literature, thus giving a logical continuation in line with the existing disciplinary literature.

> Example 11: Taken together, and ***on the basis of the existing literature***, we hypothesized that higher baseline symptom levels of SAD, generalized SAD, and depressive symptoms would be associated with less favorable treatment outcomes. (Psy9)

In Che introduction section, the validation markers were used to indicate the significance of the topic studied scientifically. This was done by relying on the current disciplinary-based knowledge (Example 12). This might reflect the importance of Che studies by depicting the effectiveness of the outcomes of those studies to the disciplinary community.

> Example 12: ***According to the National Cancer Institute***, more than 37,680 American men and women will suffer from pancreatic cancer. (Che 6).

Validating the aim of a study was a discourse function unique to AL introduction section (Example 13). Such uniqueness indicated the AL writers' tendency to link their studies to the current state of disciplinary discourse. Such validation helped AL writers to pass the responsibility for their study to the disciplinary community.

> Example 13: ***In the view of the above,*** the present study aims to answer the following questions. (AL8)

The data were analyzed for the discourse functions of the validation markers in the R and D sections and the results are presented in Table 3.

Table 3: Discourse Functions of the Validation MT in RARD

	Discourse Function	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	✓	*	✓	✓

The first discourse function, which was found in all R and D sections, was drawing the reader's attention to evidence in the tables, figures, examples and/or features of the data analyzed (Example 14-17). With this discourse function, the validation markers worked as a pointer to the source of data, thus indicating which data were to be 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 discourse function, 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 discourse function enacted by the validation markers in the four sets of R and D 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 discourse function, in contrast to the earlier one reported above, looked for external validation. With this discourse function, through the reference to previously reported findings or claims, 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 contextualized their findings or claims. This contextualization helps writers to indicate and reflect their sense of membership of the larger discourse community. This discourse function also aided writers to highlight the differences between their findings and claims and those of previously reported ones suggesting that they were making a 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 discourse function performed by the application of the validation markers were validating findings or claims by referring to earlier stated findings or claims from the current study (Example 22-24). This discourse function was found in three sets of the R and D sections analyzed (AL, Che, EE). This discourse function, along the same lines with the first discourse function, helped in creating internal validation. Through validating the findings or claims with the earlier stated findings or claims in the same study, writers could create a cohesive R and D section, which persuaded readers to read the whole section of the R and D.

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)

Conclusion

This study aimed to investigate frequencies and discourse functions of the validity markers in introduction and R and D sections of experimental RAs from four disciplines namely; Applied Linguistics, Psychology, Chemistry, and Environmental Engineering.

The results indicated that writers in the four disciplines presented a greater attention to use validation markers in R and D section compared with introduction section. This result is

expectable as the rhetorical functions of R and D section requires writers to use more validation markers as to rationalize findings, claims and arguments. Thus, it can be concluded that the greater use of the validation markers in R and D are imposed by the rhetorical functions of this section. Concerning the frequencies of validation markers in the four sets of R and D section, it could be concluded that in some disciplines such as AL and Che, writers prefer to use more validation markers. This help to conclude that the difference in frequencies of the validation markers is sourced from the differences between conventions of disciplinary writings.

As to the discourse functions of validation markers in introduction section, it could be concluded that discourse functions of the validation markers are of two kinds. Two discourse functions were found in introduction sections of four disciplines. In these discourse functions, the validity markers were used to validate to obligatory steps in writing introduction section. Four discourse functions were used in one or two disciplines and absent in other disciplines. These discourse functions possibly imposed by conventions of disciplinary writings or used to validate and rationalize claims or arguments that are treated as optional steps in writing introduction section.

The validity markers were used to serve three discourse functions in R and D sections of four disciplines. This result helps concluding that rhetorical functions of R and D section imposed such discourse functions.

The results reported in this study could help novice writers, especially novice non-native writers, of introduction and R and D sections of RA in how to use validity markers to meet the rhetorical functions and disciplinary writings' conventions while writing these sections of RA.

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