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A Genre Analysis of the Introduction Section of Applied Linguistics and Chemistry Research Articles

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Abstract

This study investigated the cross-disciplinary variations in the generic structure of Introduction sections of 52 Applied Linguistics and 52 Chemistry research articles drawing upon Swales' (2004) framework, taking into account the new insights proposed by Bhatia (2004), Shehzad (2008), and Lim (2012, 2014). To this end, in addition to collecting quantitative data and conducting frequency and Chi-square analyses, a number of semi-structured interviews were conducted with some Chemistry scholars and Applied Linguistics (ALs) experts for triangulation purposes. The results of the quantitative data analysis indicated that the two disciplines showed significant variations in the frequency with which they used some steps and sub-steps to realize the moves. The results of the qualitative content analysis of the interviews also helped understand why authors in each discipline might use a specific move/step more than the others and why a move/step was frequently used by the authors in one discipline, but completely absent in another. Finally, based on the results, some implications were presented to postgraduate students and novice researchers in Chemistry and Applied Linguistics to help them write effective research articles in their field. The findings of the study could also provide some practical implications for the EAP teachers to help their students become better writers. In addition, some suggestions were presented to genre analysts to help them obtain more dependable results when analyzing the generic structure of various sections of research articles.

Keywords: Genre analysis, Move structure, Introduction, Research articles, Applied linguistics, Chemistry

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1. Introduction

1.1. Preliminaries

Since Swales' (1981) introduction of the concept of 'move' to analyze textual structure, genre analysis of research articles (RAs) in various disciplines has increasingly become popular. Recent definitions of genre focus on the role of social, cultural, and disciplinary factors in the production of particular types of writing. In fact, genre is defined as communicative events created based on expectations and conventions of a specific discourse community (Hyland, 2006). Genre analysis has concentrated mostly on English for Academic Purposes (EAP), particularly on academic articles as a specific genre (Dudley-Evans, 1994). A review of the literature (e.g., Basturkmen, 2012; Cheng & Unsworth, 2016; Lim, 2010, 2012, 2014; Liu & Buckingham, 2018; Samraj, 2005; Swales, 1990, 2004; Tanko, 2017) reveals that several genre-based studies and move analyses have been conducted on various sections of RAs (e.g., Abstract, Introduction, Results, Discussion, and Conclusion). It has been shown that each section follows relatively agreed-upon conventions in various disciplines. However, as Swales and Feak (1994) argue, writing introductions is commonly believed to be difficult and troublesome and "producing a good introduction section always seems like a battle won hard" (p. 173). What makes writing Research Article Introductions (RAIs) comparatively more challenging might be the fact that the introduction is expected to provide a rationale for conducting the research study by stating the objectives and significance and to attract the readers by creating interest in the topic (Swales & Feak, 1994). Also as Martín, Rey-Rocha, Burgess, and Moreno (2014) maintain, after the Discussion section, the Introduction is deemed to be the most rhetorically complex section and thus a challenging part to write, which might be the reason why journal editors and

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reviewers meticulously review and harshly criticize these two sections of the RAs submitted to be considered for publication. Hence, the effectiveness of writing the Introduction section is probably one of the important criteria determining whether the RA is likely to be published or not.

As a result, due to the complex nature and importance of RAIs, this genre-based study investigated the rhetorical structures (moves, steps, and sub-steps) of RAIs in Applied Linguistics (ALs) and Chemistry. Postgraduate students and novice researchers in both disciplines might benefit from the results of the study in writing more effective Introductions. The study also presents some pedagogical implications for EAP teachers, particularly those specializing in teaching writing to Chemistry and ALs students, to help them produce better writers.

1.2.Theoretical framework of the study and previous research findings

Swales' (1990) CARS (Creating a Research Space) model is probably the most frequently used framework for analyzing the generic structure of RAIs. The model consists of three separate moves (Establishing a territory, Establishing a niche, and Occupying the niche), each of which is realized through a number of steps.

In fact, the first move introduces and establishes the general topic to be discussed. In this move, the writers intend to make sure that the topic of their study is of concern to the relevant discourse community, and is also worth being investigated and finally read. References to previous research are frequently made to situate the study well within a particular circle. The second move involves the establishment of the niche for which the study is undertaken, and can be realized in a number of ways. This move might start

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with an adversative conjunction to show an opposing argument, with some expressions highlighting the inadequacy of previous research, with questions to be answered, or finally with expressions showing the strength of the previous research and the need to continue the research. Finally, in the third move, the author addresses the niche by, for instance, introducing the research to be undertaken or the purposes for which the research has been designed.

However, the framework has been called into question by more recent studies for its applicability (e.g., Anthony, 1999) and for the deviations which have been reported (e.g., Anthony, 1999, Samraj, 2002) due to which Swales (2004) revised the model and offered the fine-tuned version of CARS model accordingly. Anthony (1999), for instance, used Swales' (1990) framework to describe the structure of the introduction section of RAs published in the field of Software Engineering and found that although the model was very successful in describing the overall framework of the introduction, it was inadequate when a more detailed definition and description of individual steps were required. He argued, since various disciplines contributed to the development of the model, there were several redundant steps rarely found in the introductory sections of RAs in many disciplines. He added that a more serious problem with the model was the absence of a separate "evaluation of research" step, which was not only obligatory, but also essential in realizing the goals of the introduction. Samraj (2002) also used Swales' (1990) framework to analyze RA introductions from the fields of Wildlife Behavior and Conservation Biology and reported some shortcomings in the model. She argued that "a greater degree of embedding is needed" (p. 16) in the CARS model to adequately account for the rhetorical organization of RAIs. She found that writers of Wildlife Behavior RAs provided positive reasons for conducting

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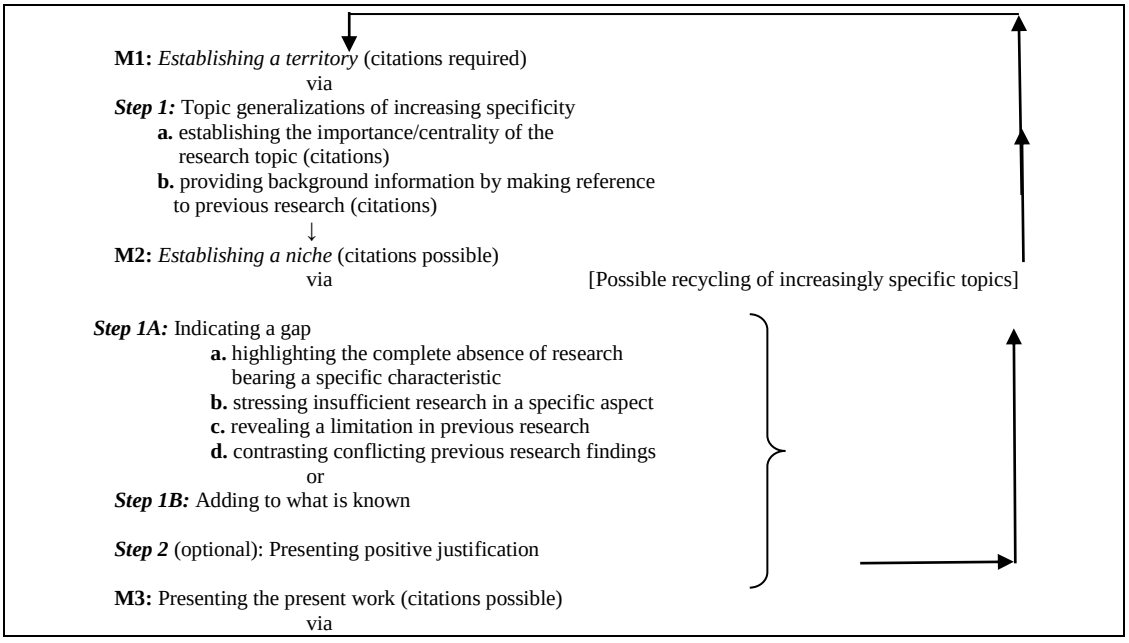
their research after indicating a gap in the literature. She called it *Positive justification* and argued that the step was needed to be added as a separate step to M2 of the framework. Furthermore, she argued that *Reviewing items of previous research*, which is the last step of realizing M1, had an important role in realizing M2 as well as supporting gaps in previous research.

Thus, due to the inadequacies and deviations reported by several studies applying Swales' (1990) framework, Swales (2004) revised the model by condensing the three steps in M1 into one step (Topic generalization of increasing specificity) and reducing the four steps in M2 into two separate steps (Indicating a gap and Adding to what is known). Instead, based on Samraj's (2002) proposal, he added a new step (Presenting positive justification) to the second move. Making reference to previous studies on RAIs that held "Indicating a gap" and "Continuing a tradition" were the most common options realizing M2, Swales (2004) proposed that the four realizations of M2 be reduced to two steps (Indicating a gap and Adding to what is known), "and also that the model take on board the potential cycling, or iteration, of M1 and M2 sequences..." (p. 230). Lim (2012) evaluated this reduction as justifiable since "Counter-claiming" and "Question raising" are now considered as part of "Indicating a gap". Analyzing 30 Management RAs, he argued that Management authors established their research niches through *Indicating a gap* and *Adding to what is known*, with the frequency of occurrence of the former being much higher than the latter. He asserted that research gap is indicated by the writer through four rhetorical sub-steps: highlighting the complete absence of research bearing a specific characteristic, stressing insufficient research in a specific aspect, revealing a limitation in previous research, and contrasting the conflicting findings of previous research. In addition, based on the

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finding of some other studies (e.g., Anthony, 1999) focusing on RAIs, Swales added more details to M3 now realized through seven steps. In relation to "Presenting the present work" (previously known as Occupying the niche), Swales (2004) maintains that M3 is more complicated than previously assumed due to the "evolution in the genre itself, or of further studies, or perhaps of both" (p. 231). Based on the findings of the previous studies, he modified M3 which is now realized by one obligatory and three optional steps, as well as three steps which are probable in some fields, but unlikely in others.

The consideration of the limitations and further developments proposed by studies evaluating Swales' (1990) framework (e.g., Anthony, 1999; Lim, 2012; Samraj, 2002; Swales, 2004) might yield the following updated framework to be employed as a point of departure for the analysis of RAIs in various disciplines (See Figure 1).



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Step 1 (obligatory): Announcing present work descriptively and/or purposefully
Step 2* (optional): Presenting research questions (RQs) or hypotheses
Step 3* (optional): Definitional clarifications
Step 4* (optional): Summarizing methods
Step 5 (PISF**): Announcing principal outcomes
Step 6 (PISF): Stating the value of the present research
Step 7 (PISF): Outlining the structure of the paper
*Steps 2-4 are not only optional but less fixed in their order of occurrence than the others.
**PISF: Probable in some fields, but unlikely in others.

Figure1. Swales' revised CARS model (Adapted from Swales, 2004, pp. 230-232 & Lim, 2012)

Displaying the updated version of Swales' CARS model, Figure 1 incorporates not only the modifications applied to the framework by Swales (2004) himself following Anthony's (1999) and Samraj's (2002) suggestions, but it also includes the improvements proposed by Lim (2012). Although it may not be a perfect and comprehensive framework, it can be reliably used to analyze the rhetorical structure of RAIs in almost any discipline.

Over the past few decades, a large number of studies have analyzed the generic structures of RAIs in various disciplines (e.g., Anthony, 1999; Feak & Swales, 2011; Lim, 2012; Ozturk, 2007; Samraj, 2002; Saz Rubio, 2011; Stoller & Robinson, 2013; Swales & Najjar, 1987). Swales and Najjar (1987), for instance, studied RAIs of two different fields (Physics as a branch of Pure Sciences and Educational Psychology as a branch of Humanities) to see whether they included a summary announcement of the principal findings in the closing section of the Introduction. They found a mismatch between the advice presented in the research manuals and what is actually practiced by authors of RAs, indicating that authors may sometimes develop idiosyncratic or personal ways of organizing RAs in various disciplines, violating the accepted conventions. In the same vein, Ozturk

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(2007) examined the subdisciplinary variation in the structure of RAIs in two subdisciplines of ALs (Second Language Acquisition and Second Language Writing research) based on Swales' (1990) CARS model. He found variations in the organizational structure of RAIs in Second Language Acquisition (SLA) research and Second Language Writing (SLW) research though the least variability was expected to be observed in the subdisciplines of the same field. He observed that most SLA researchers normally use the Move (M) structure M1-M2-M3. That is, they establish the territory in M1, establish the niche in M2, and present their work by occupying the niche in M3, respectively. In contrast, the predominant move structures in SLW research were reported to be M1-M2-M1-M3 (40%) and M1-M3 (30%). Ozturk claimed that those variations might be justified by considering that SLA research is an established field of inquiry, whereas SLW research is an emerging one.

Likewise, Stoller and Robinson (2013) analyzed the organizational features of Chemistry RAs and converted them into some easy-to-interpret move structures to be effectively used in classrooms as a pedagogical tool to raise Chemistry students' consciousness of the predominant organizational patterns in the RAs they read and help them with their writing. With regard to M1 (Establishing the territory) in RAIs, for instance, they found that authors commonly established the importance/centrality of the research topic and made reference to previous research in order to provide background information, connect their work to earlier work, and contextualize the article. Likewise, regarding M2 (Establishing a niche), they found that all Chemistry authors referred to a gap in the literature to provide justification for their work. In fact, research gap was found to be indicated by authors through some rhetorical sub-steps including the identification of a step that needed to be taken, a question that needed to be

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answered, or an area that needed to be better understood. They also observed that M3 (Presenting the present work) was realized through introducing the current work and its purpose (Step 1), and previewing key findings (Step 5). They argued that although "Describing procedures" was also used by Chemistry authors, it generally occurred in the Methods section rather than the introduction. It was also observed that listing research questions explicitly (Step 2) was uncommon in Chemistry. They also argued that Chemistry RAIs never concluded with outlines of the remainder of the article (Step 7).

Lim (2012) asserts that niche establishment (M2) is an important rhetorical move in RAs because it is employed by writers to justify the need to conduct research in a given area. In this regard, analyzing 30 Management RAIs regarding their niche establishment using Swales' (1990, 2004) CARS model, Lim found complete cycles (consisting of M1, M2, and M3) in the majority of the Management RAs. Concerning the second step (Adding to what is known), he argues that writers are required to state directly and overtly the need to continue a research tradition through the use of specific linguistic mechanisms. He adds that it is possible for both steps realizing M2 (Niche establishment) to co-exist without disrupting the logical flow of the message. As Lim (2012) argues, this rhetorical combination gives writers a chance to establish a connection between their study and previous studies in the literature. It is usually done by either emphasizing a shortcoming in previous research to indicate a gap or highlighting another research study that engages other recently published studies in order to persuade readers to accept that there is a need for continuing the research direction in an alternative, but increasingly established way.

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As one of the optional steps for realizing M3, presenting research questions (RQs) have recently been perceived to be an important rhetorical step in RAIs that guides the development of a research report or dissertation (Feak & Swales, 2011; Lim, 2014). Lim (2014) argues that in spite of the importance of RQs in experimental research dissertations, the language used in RQ formulation has not been adequately addressed in previous studies (e.g., Ozturk, 2007; Sheldon, 2011) and that "we are relatively uncertain (i) how these questions are rhetorically linked with other key communicative moves, and (ii) the ways in which they are realized syntactically to achieve their communicative functions" (p. 68). He asserts that "Presenting research questions" is more frequently used in cases, where little is known about a phenomenon.

The way the rhetorical structure of RAs is analyzed and interpreted is another significant factor which contributes to the reliability and dependability of the results obtained through genre analysis of various sections of RAs. In this regard, as Lim (2012) argues, many genre analysts who have analyzed RAIs (e.g., Saz-Rubio, 2011; Ozturk, 2007; Samraj, 2002, 2005) have paid attention to move sequences (e.g., M1–M2–M3, M1–M2–M1–M3, etc.) and the frequency of occurrence of moves, steps, and sub-steps. However, a few studies (e.g., Lim, 2012; Cortes, 2013; Shehzad, 2008) appear to be interested in supporting the linguistic features of the moves. Shehzad (2008), for instance, investigated the linguistic indicators to indicate a gap in Computer Science RAIs and found that the move was generally realized through the use of contrastive statements (e.g. 'however', 'although', 'but', 'rather than', etc.), negatives (e.g. 'none of', 'not been', 'no work/data/research/study', etc.), and quantifiers/quasi-negatives (e.g. 'limited', 'few', 'little'). In his genre analysis of Management RAIs, Lim (2012) also identified prominent linguistic features (lexical items and

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syntactic structures) used to perform various communicative functions in establishing research niches. He argued that investigating these linguistics features might provide information on how writers use strategies in various situations related to their discipline, which can help novice researchers write articles acceptable to disciplinary gatekeepers (e.g., journal editors and reviewers). Also, in her genre analysis, Cortes (2013) identified the lexical bundles in a corpus of RAIs from various academic disciplines and classified them both grammatically and functionally, the details of which are beyond the scope of this paper.

Bhatia (2004), however, goes beyond the lexico-grammatical and functional features of the text and proposes an ethnographic approach to genre analysis involving features which "constrain the construction of genre from the point of view of factors such as the impressions, beliefs and perceptions of experts associated with a particular genre, the processes of its construction, choice of modes available, etc." (pp. 132-133). He argues that discourse as genre accounts for both the way text is constructed and the way it is interpreted, used, and exploited in specific professional contexts to achieve specific disciplinary goals. As Bhatia (1993) maintains, genre might be viewed as a natural tendency for innovation and change, which is exploited by experts of a given discourse community to create new forms in order to respond to novel rhetorical contexts or to communicate 'private intentions' within the socially recognized communicative purposes, often resulting in genre mixing and embedding. Bhatia (2004) maintains that considering today's interdisciplinary and dynamic world of work, it is almost impossible to keep the individual generic boundaries intact. Thus, considering Bhatia's (2004) ethnographic perspective, it seems essential that the beliefs and perceptions of experts be carefully taken into account by genre analysts when discussing the common rhetorical structure of a specific

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genre. For instance, experts can help the genre analyst explain why authors in one discipline might use a specific move/step more than the others and/or why a move/step is frequently used by the authors in one discipline, but it is completely absent in another one.

1.3. The study

This study investigated cross-disciplinary variations in the rhetorical structures of ALs and Chemistry RAIs drawing upon Swales' (2004) framework. This framework was utilized since it is relatively comprehensive in comparison with other existing frameworks and models and is by far the most commonly used framework accounting for the structural organization of RAIs in such diverse disciplines as ALs, Psychology, Chemistry, Wildlife Behavior, Conservation Biology, Management, etc. (Ozturk, 2007). However, in order to make use of the new insights proposed by recent related research, the findings of Bhatia (2004), Lim (2012, 2014), and Shehzad (2008) were also taken into account.

In this study, one discipline was chosen from humanities and one from natural sciences, each with its own requirements and expectations, so that we could delve more deeply into the possible variation in the rhetorical structure of their RAs. ALs was chosen as an appropriate representative of humanities since it draws upon such diverse feeder disciplines as Linguistics, Psychology, Sociology, and some other branches. Likewise, Chemistry was chosen because, firstly, it is a typical example of natural and exact sciences in keeping with the purpose of the study as mentioned above. Secondly, to the best of our knowledge, very few studies so far have investigated the generic structure of Chemistry RAIs. Therefore, this genre-based study is expected to further our understanding of the generic structure

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of RAIs in ALs and offer new insights into the generic structure of Chemistry RAIs.

Another rationale behind the study was that although several studies have been undertaken to scrutinize the generic structure of ALs RAIs, only a few of them have taken into consideration recent research findings on rhetorical structures of RAIs (e.g., Bhatia, 2004; Lim, 2012, 2014; Shehzad, 2008). Thus, this study is significant in the field in that it does not limit its focus to only one commonly used framework (i.e., Swales', 2004) and that it utilizes the findings of recent research which has offered new and complementary insights into the framework. This study also employs the triangulation of the data by drawing upon Bhatia's (2004) ethnographic perspective to genre analysis and contributes significantly to the knowledge of the topic under investigation. Unlike most previous genre-based studies which based all their conclusions upon the analyses and interpretations of the quantitative data, the present study, in addition to quantitative data analyses, employed several semi-structured interviews with some experts in both disciplines in order to enhance the dependability of the results and to get a fuller understanding of the quantitative data by exploring why the differences existed between the two disciplines. Besides, the study might yield more dependable and generalizable results and add to the knowledge in the field since, in comparison with previous studies (e.g., Lim, 2012, 2014; Samraj, 2002, 2005), it draws upon a comparatively large corpus (104 RAs) to test the precision of recent frameworks. The following research questions were thus formulated for the present study:

1. What are the differences between the generic structures of RAIs in the two disciplines of Chemistry and ALs?

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2- Why are some specific moves and/or steps used less frequently in Chemistry and more in ALs and vice-versa?

2. Method

The corpus for the present study included 104 RAs from the two disciplines of ALs and Chemistry published from 2000 to 2015, which, in comparison to previous studies (e.g., Lim, 2010, 2012; Ozturk, 2007; Samraj, 2005; Saz Rubio, 2011; Stoller & Robinson, 2013), might be considered large enough to adequately capture the move structures used in RAIs. The four ALs journals from which we selected the articles to be scrutinized in this study were all recognized to be high impact journals which were mostly devoted to problems of foreign language teaching and learning and mainly published full-length quantitative research studies. The four Chemistry journals from which we selected the articles were also recognized to be high impact journals which were mostly devoted to empirical studies in the field and mainly published full-length quantitative research studies. All the RAs selected for analysis were empirical studies following the conventional Introduction-Method-Results-Discussion (IMRD) structure (Swales, 1990). Other types of RAs (e.g. review articles, or state-of-the-art papers) were excluded from the corpus as they belong to different genres and thus represent different generic structures. To be more precise, 52 empirical RAs were selected from four in ALs, including *Language Learning* (LL), *The Modern Language Journal* (MLJ), *Second Language Research* (SLR), and System, which were all comparable in terms of visibility, ranking, and impact. In fact, 13 RAs were randomly selected from each of the journals mentioned. Furthermore, 52 other RAs were also chosen in the same way as discussed above from four distinguished high impact journals in Chemistry, namely *Applied Catalysis B: Environmental* (ACBE), *Electrochemistry*

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Communications (ECC), *Journal of Power Sources* (JPS), and *Electrochimica Acta* (ECA), which were all also comparable in terms of visibility, ranking, and impact. It should be noted that the RAIs selected for analysis did not include any subsections such as 'Review of the Literature' or 'Objectives and Research Questions' because we intended to explore how authors included all rhetorical moves in the Introduction section which stood alone (i.e., without any subdivisions or subsections).

The data were analyzed through counting and tabulating the frequency of occurrence of each move and steps/sub-steps realizing them. Then, Chi-square analyses were run in SPSS to explore the interdisciplinary variations in the generic structures of RAIs in ALs and Chemistry. It should also be mentioned that all the three researchers of the present study analyzed the data separately to identify the moves, steps, and sub-steps in all selected RAIs by heeding not only their communicative functions, but also their linguistic realizations (Lim, 2012, 2014; Shehzad, 2008). Due attention was especially paid to the identification of discourse markers, lexical items, linguistic cues, move-step boundaries, and their sequencing and patterning. Besides, to make sure of the dependability of the analyses, the three researchers compared their results obtained and discussed them in a series of discussion sessions. Discrepancies (less than 5%) were negotiated until final compromise was reached. However, in order to minimize the likelihood of error in the analysis of RAs and to get a deeper understanding of the results, eight Chemistry teacher researchers and eight ALs experts were consulted. The Chemistry teacher researchers, who are all faculty members of one of the most prestigious universities of the country, have all published prolifically in peer-reviewed high-impact accredited international journals. Two of the Chemistry teacher researchers are, in fact, world-renowned researchers who have been nominated by Thomson Reuters as *scientists*.

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Besides, eight ALs teacher researchers, who were all faculty members of various universities across the country and who had published enormously both locally and internationally, were interviewed separately.

The interviews were, in fact, conducted based on Bhatia's (2004) ethnographic approach in order to ensure the dependability of the results and to get a fuller understanding of the quantitative data by exploring why the differences existed between the two disciplines. It took 30 to 45 minutes to interview each teacher. The interviews consisted of two sections. The first part included some questions requiring the experts to determine to what extent they agreed with a number of statements about writing RAs. The interviews also included a number of domain-specific information questions, the responses to which helped us explain why some moves/steps occurred more frequently in one discipline (e.g., AL) and were less likely to be used in another (e.g., Chemistry) and clarify some inferences we had made based on the analyses of the quantitative data. After obtaining the teachers' permission and consent, the interviews were audio-recorded for subsequent transcription and content analysis through which the experts' responses were scrutinized, their recurring themes and common patterns were identified, coded, subjected to frequency analysis, and finally tabulated (See Tables 4 and 5).

3. Results

3.1. Results of move analysis of ALs RAIs

As mentioned earlier, the data were first analyzed through counting and tabulating the frequency of occurrence of each move and the steps/sub-steps realizing them. Table 1 shows the frequency of occurrence of moves and the steps used to realize them in ALs RAIs.

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Table1

Frequency of occurrence of moves and steps in ALs RAIs

Moves and steps	**Frequency of occurrence**				**Total** (Out of 52)	**Percent**
	System (Out of 13)	**MLJ** (Out of 13)	**LL** (Out of 13)	**SLR** (Out of 13)		
M1	12	13	13	11	49	94.23%
Step 1	12	13	13	11	49	94.23%
Step 1a	10	12	7	7	36	69.23%
Step 1b	11	11	12	10	44	84.61%
M2	12	10	12	11	45	86.53%
Step 1A	10	10	11	11	42	80.76%
Step 1Aa	1	1	5	2	9	17.30%
Step 1Ab	7	6	3	4	20	38.46%
Step 1Ac	5	2	2	2	11	21.15%
Step 1Ad	7	5	7	6	25	48.07%

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Step 1B	12	9	8	9	38	73.07%
Step 2	2	0	1	0	3	5.76%
M3	11	13	12	11	47	90.38%
Step 1	11	11	12	11	45	86.53%
Step 2	5	1	6	2	14	26.92%
Step 3	4	4	1	1	10	19.23%
Step 4	1	1	4	2	8	15.38%
Step 5	0	1	0	0	1	1.92%
Step 6	1	1	1	0	3	5.76%
Step 7	1	1	0	3	5	9.61%

As indicated in Table 1, all the three moves in Swales' (2004) framework were observed in the ALs RAIs selected from the four journals mentioned earlier. M1 (Establishing a territory), which seemed to be obligatory, was incorporated in almost all of the RAs (94.23%) in ALs. ALs researchers were found to establish a research territory by providing background information about the research topic through making reference to previous research (84.61%), as well as emphasizing the centrality/importance of the topic (69.23%). Excerpts 1 and 2 below show how "Establishing the importance/centrality of the research topic" is used in ALs RAIs to establish a territory.

(1) Vocabulary learning is ***a crucial factor*** in second language acquisition... (*System* 41, 2013: 1056-1069).

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(2) One grammatical structure that sheds great light on such processing difficulties and has ***received considerable attention*** in the literature is the relative clause (RC) (*Language Learning* 53, 2003: 285-323).

Moreover, in relation to M2, the authors established research niches via Step1A (Indicating a gap) and Step1B (Adding to what is known). In other words, the existence of a gap in the literature was mostly established by ALs authors via *Stressing insufficient research in a specific aspect* (See excerpts 3, 4, 5, and 6 below) and/or *Contrasting conflicting previous research findings* (See excerpts 7 and 8 below).

(3) ***Very few studies*** have been conducted on the L2 acquisition of Spanish reflexive passives and reflexive impersonals (*Second Language Research* 22, 2006: 30-63).

(4) However, with ***a paucity of classroom research*** concerning whether technology actually enhances the learning and understanding of cultural information, we felt justified in executing the study below (*The Modern Language Journal*, 2002: 36-53).

(5) Among many such studies, a research issue which has ***received relatively less attention*** from researchers and has produced quite mixed results is whether output tasks better promote noticing and learning of a targeted linguistic form than non-output task conditions (*System 36*, 2008: 295-312).

(6) Although accent is generally believed to be one of the main features that has an impact on one's ability to understand spoken language, ***very little research*** has

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> rigorously measured the effects (*Language Learning 55*, 2005: 37-69).

> (7) In second language acquisition, ***the main body of research*** has been very much in response to Krashen's claim that learners only learn through unconscious acquisition ... ***Conversely, some other researchers*** (Ellis, 1991; Schmidt, 1990, 1994, 2001; Schmidt & Frota, 1986) believe that learner attention is essential for focus on forms to be beneficial to learners (*System* 37, 2009: 82-98).

> (8) ***Many researchers*** have suggested that knowledge of word meanings can mediate a learner's acquisition of a language's phonemic contrasts... ***However, recent research*** has provided evidence that listeners can learn to discriminate novel second language contrasts ***without any*** reference to word meaning... (*Second Language Research* 23, 2007: 65-94).

However, only a few (5.76%) of the authors presented "Positive justification" to establish a niche (See excerpt 9 below).

> (9) ***The rationale for the present study*** is based on the proposition that there is a possible connection between cooperation, social support, and positive class climate (*System* 35, 2007, pp. 229-240).

Also, *presenting the present work* (M3), which was apparently a quasi-obligatory move, was used by most of the researchers (90.38%) to present their work to the readers. This move was realized mainly via Step 1

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(86.53%), Step 2 (26.92%), and Step 3 (19.23%). That is, by *announcing present work descriptively and/or purposefully* (See excerpts 10 and 11 below), *presenting RQs or hypotheses* (See excerpts 12 and 13 below), and *definitional clarifications* (See excerpts 14, 15, and 16 below).

> (10) ***In the current study we explore*** issues of feedback and modified output in relation to age and type of interlocutor (*Language Learning* 53, 2003: 35-66).

> (11) With this query in mind, ***the present study explored*** the effects of grouping words in semantic and phonologically similar/disparate clusters (*System 41*, 2013: 1056-1069).

> (12) This study seeks to determine (a) ***whether*** the English and Chinese groups will differ in their ability to identify and discriminate Thai mid and low tones, (b) ***whether*** these groups will show different effects from training in tone discrimination, and (c) ***whether*** their performance will vary as a function of ISI (*Language Learning* 54, 2004: 681-712).
> (13) This study attempts to answer the following research questions:

> RQ1: **Is there** a difference between the effects of explicit correction and implicit correction in language learning?

> RQ2: **Is there** any difference between the effects of error correction on structures which are acquired early and those which are acquired later? (*System* 37, 2009: 82-98).

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(14) Output with access ***refers to*** 'activating the lexical items and grammatical forms necessary to express particular meanings' (VanPatten, 2003: 63) (*Second Language Research* 22, 2006: 487-497).

(15) Classroom climate ***is defined*** in the context of the present study as a multidimensional construct that encompasses the morphological and social climates (Van de Grift et al., 1997) (*System* 35, 2007: 229-240).

(16) Depth of processing ***refers to*** the level at which stimuli are cognitively processed... (*The Modern Language Journal 6*, 2006: 228-243).

However, only a few instances of Steps 5-7 (1.92%, 5.76%, and 9.61%, respectively) were observed in RAIs, suggesting that ALs researchers do not often tend to outline the structure of their paper or reveal their findings in the introductory sections of their RAs. Excerpts 17 and 18 below indicate how those few authors used Step 5 (i.e., Outlining the structure of their paper) to realize one of the purposes of M3.

(17) ***The first section*** of this article describes these three L2 vocabulary learning methods and compares the effect of such methods on retention of new words. ***The second section*** motivates the current study and presents the research questions and hypotheses. ***The next two sections*** describe the study and summarize the results. ***The final section*** discusses the theoretical and pedagogical implications of the findings (*The Modern Language Journal* 6, 2006: 228-243).

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> (18) ***The article is organised as follows***. ***Section II*** reviews the developmental research that has explored the Interface Hypothesis in different populations of bilingual speakers. ***Section III*** outlines some theories of language processing that have been proposed recently for the interpretation of subject pronouns and for anaphora resolution. ***Section IV*** describes the details of the experimental study and Section V reports the results. Finally, ***Sections VI and VII*** present a discussion of the results and the conclusions (*Second Language Research 22*, 2006: 339-368).

Furthermore, as is evident from Table 1, no crucial variation can be observed among RAs published in the four ALs journals in terms of the use of the three moves. However, they seem to differ slightly in the way they realize those moves via various steps. For instance, regarding M3, nearly 46% of the RAs selected from *Language Learning* realized the move via RQ formulation and/or hypothesis formation, while in *The Modern Language Journal*, only nearly 8% of the RAs used this step to realize M3.

3.2. Results of move analysis of Chemistry RAIs

The results of frequency analysis of moves and the steps used to realize them in Chemistry RAIs is presented in Table 2.

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Table 2
Frequency of occurrence of moves and steps in Chemistry RAIs

Moves and steps	**Frequency of occurrence**				**Total** (Out of 52)	**Percent**
	JPS (Out of 13)	**ECC** (Out of 13)	**ECA** (Out of 13)	**ACBE** (Out of 13)		
M1	13	13	13	12	51	98.07%
Step 1	13	13	13	11	50	96.15%
Step 1a	12	13	12	11	48	92.30%
Step 1b	10	8	9	8	35	67.30%
M2	12	10	11	12	45	86.53%
Step 1A	7	6	7	8	28	53.84%
Step 1Aa	2	2	2	1	7	13.46%
Step 1Ab	1	1	2	2	6	11.53%
Step 1Ac	4	2	2	3	11	21.15%
Step 1Ad	1	0	1	1	3	5.76%
Step 1B	4	4	4	5	17	32.69%
Step 2	2	1	1	0	4	7.69%
M3	13	13	13	13	52	100%
Step 1	13	13	13	13	52	100%
Step 2	0	0	0	0	0	0%
Step 3	0	0	0	0	0	0%
Step 4	4	4	2	3	13	25%
Step 5	2	3	4	2	11	21.15%
Step 6	0	1	0	0	1	1.92%
Step 7	0	0	0	0	0	0%

As Table 2 indicates, Chemistry researchers employed all the three moves in their RAIs. M1 seemed to be obligatory in Chemistry RAIs (98.07%). Chemistry researchers established a research territory mostly by emphasizing the importance/centrality of the research topic (92.30%). Also, more than half of them (67.30%) provided background information about the research topic through making reference to previous research. Excerpts 19 and 20 below show how *Claiming centrality* is employed by Chemistry authors to establish a territory.

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(19) Zinc ***is widely used*** as a high capacity anodic material for primary and secondary alkaline batteries because of its high specific energy, low cost and non-toxicity (*Journal of Power Sources*, 128, 2004: 97-101).

(20) Solvent free polymer electrolytes ***have gained wide attention*** as potential replacements for liquid electrolytes that currently limit the thermal stability, energy density and safety of commercial secondary lithium cells [1] (*Electrochimica Acta* 52, 2007: 1983-1989).

Furthermore, they established research niches (M2) via *indicating a gap* (53.84%) and by claiming that their study adds to the existing literature (32.69%). Gap indication, in fact, was mainly established via *revealing a limitation in previous research* by Chemistry authors (See excerpts 21, 22, and 23 below).

(21) Our previous work on the development of Pt-free electrocatalysts has focused on the preparation of oxide promoted Pd electrocatalysts [19, 20] ... However, the mechanism of the ethanol oxidation on Pd-based electrocatalysts is ***not clear*** (*Electrochimica Acta* 52, 2006: 1087-109).

(22) Tungsten carbide can also be used as the electrocatalyst for hydrogen evolution reaction [25, 32]. However, tungsten carbide alone ***cannot be directly used*** for HER due to the fact that HER has a high overpotential on it, consequently leading to the high electricity consumption, which makes the process

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economically unattractive... (*Journal of Power Sources* 166, 2007: 310-316).

(23) A method based on a cementation technique has been reported [6] where silver is recovered by the addition of copper sulfate solution after nitric acid leaching. All these methods ***suffer the drawbacks*** of: (i) emission of toxic gases, which damage the environment; (ii) higher energy consumption; (iii) loss of active materials; (iv) difficulty in dismantling the components of small cells; (v) low purity of the silver metal reclaimed (*Journal of Power Sources 161*, 2006: 1463-1468).

Nevertheless, comparatively fewer authors (7.69%) used *positive justification* to establish a niche (See excerpts 24 and 25 below).

(24) Both cases lead to fast stack degradation, and ***for this reason***, it is ***of great importance to minimize*** Cr vaporization (*Journal of Power Sources 297*, 2015: 217-223).

(25) Obviously, it is an ***imperative*** task to ***solve the voltage valley problem*** for high power pulse batteries and the understanding of the cause of the voltage valley is apparently of significance to zinc-silver batteries in general (*Journal of Power Sources* 104, 2002: 253-259).

Also, *presenting the present work* (M3) was found to be an obligatory move in Chemistry RAIs, which was used by all the authors (100%). This move was realized via Step1 (i.e. Announcing the present work descriptively and/or purposefully) by all the researchers (See excerpts 26 and 27 below).

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(26) ***The objective of the present work*** is to develop an effective Pd-based ORR catalyst with minimal Pd loading (*Electrochimica Acta* 55, 2010: 4506-4511).

(27) ***The aim of the present work*** is to develop novel electrocatalysts based on tungsten carbides for hydrogen evolution in acid solution (*Journal of Power Sources 166*, 2007: 310-316).

Step 4 (i.e., Summarizing methods) and Step 5 (i.e., Announcing principal outcomes) were also found to play an almost important role in presenting the work by Chemistry authors (See excerpts 28 and 29 below).

(28) Both polymer II and PTHF were found by differential scanning calorimetry (DSC) to exhibit a high melting point phase (Tendo ∼95–110 ◦C) when doped with LiClO4 or LiBF4, which does not re-crystallize readily on cooling, indicating that an amorphous phase with high salt content is present at ambient temperatures after heat treatment (*Electrochimica Acta 52*, 2007: 1983-1989).

(29) **The presented results indicate that** dosing of different gases can lead to passivation layers with profoundly different electronic and elastic properties (*The Journal of Power Resources 296*, 2015: 150-161).

However, it was observed that step 2 (i.e., Presenting research RQs or hypotheses) occurred in none of the Chemistry RAIs, neither did Step 3 (i.e., Definitional clarifications) and Step 7 (i.e., Outlining the structure of the paper).

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3.3. Comparing and contrasting the results of move analyses of ALs and Chemistry RAIs

In order to investigate the disciplinary variations in the move structure of RAIs in ALs and Chemistry, Chi-square analysis was employed, the results of which are illustrated in Table 3.

Table 3

Chi-square analysis comparing the move structure of ALs and Chemistry RAIs

Moves and steps	**Percentage**		**Chi-Square analysis**		
	ALs	Chemistry	Chi-square Value	*P*	Cramer ’s V Value
M1	94.23%	98.07%	1.04	.30	.10
Step 1	94.23%	96.15%	.21	.64	.04
Step 1a	69.23%	92.30%	8.91	.00	.29
Step 1b	84.61%	67.30%	4.26	.03	.20
M2	86.53%	86.53%	.00	1.00	.00
Step 1A	80.76%	53.84%	8.56	.00	.28
Step 1Aa	17.30%	13.46%	.29	.54	.05
Step 1Ab	38.46%	11.53%	10.05	.00	.31

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Step 1Ac	21.15%	21.15%	.00	1.00	.00
Step 1Ad	48.07%	5.76%	23.65	.00	.47
Step 1B	73.07%	32.69%	17.01	.00	.40
Step 2	5.76%	7.69%	.15	.69	.03
M3	90.38%	100%	5.25	.02	.22
Step 1	86.53%	100%	7.50	.00	.26
Step 2	26.92%	0%	16.17	.00	.39
Step 3	19.23%	0%	11.06	.00	.32
Step 4	15.38%	25%	1.49	.22	.12
Step 5	1.92%	21.15%	9.42	.00	.30
Step 6	5.76%	1.92%	1.04	.30	.10
Step 7	9.61%	0%	5.25	.02	.22
Total			30.00	.00	.86

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As shown in Table 3, the two disciplines showed variation in the frequency with which they used the steps and sub-steps to realize M1 and M2. The Chi-square analysis also revealed significant disciplinary variations between ALs and Chemistry RAIs in the use of M3 (p= .02, V= .22).

With regard to the steps adopted to realize M1, a significant difference was found in the use of Step 1a (Centrality claims) (p= .00, V= .29) and Step 1b (Providing background information) (p= .03, V= .20) between the two disciplines. While most Chemistry authors (92.30%) emphasized the importance/centrality of their research topic to establish a territory, the majority of ALs researchers (84.61%) provided background information by making reference to previous research. As shown in the excerpts 1, 2, 19, and 20 above, authors show a tendency to employ phrases containing adjectives of necessity/urgency followed by a noun (e.g., a crucial factor, considerable/wide attention, of crucial importance, a central role, etc.) to emphasize the centrality of their research topic.

In relation to niche establishment (M2), it was observed that both disciplines employed this move with the same frequency (86.53%). However, they were found to be significantly different in the use of Step 1A (i.e., Indicating a gap) (p= .00, V= .28) and Step 1B (i.e., Adding to what is known) (p= .00, V= .40). In fact, gap indication was used more frequently in ALs (80.76%) than Chemistry RAs (53.84%). It was also found that the existence of a gap in the literature was mostly established by ALs authors via *stressing insufficient research in a specific aspect* and/or *contrasting conflicting previous research findings*, while it was mainly established via *revealing a limitation in previous research* by Chemistry authors.

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As seen in the excerpts 3, 4, 5, and 6 above, authors tend to emphasize the paucity of research concerning their research topic by employing phrases containing quantifiers referring to small numbers/amounts such a 'very few studies', 'only a few number of studies', 'very little research', 'less attention', or by using phrases containing a noun connoting insufficiency such as 'paucity of research'. Excerpts 7 and 8 indicate that ALs authors also display a tendency to employ conjunctive adverbs showing contrasting information (e.g., however, conversely, nevertheless, on the contrary, in contrast, etc.) and concessive conjunctions (e.g., although, even though, despite, in spite of, etc. to discuss conflicting previous research findings. On the other hand, gap indication was observed to be mainly established via *revealing a limitation in previous research* by Chemistry researchers. Excerpts 21, 22, and 23 indicate that Chemistry authors tended to use negative verb phrases (e.g., 'cannot be directly used', 'is not clear', 'are not yet well-understood', 'suffer the drawback of') expressing a limitation in previous studies. However, a number of authors preferred to use a positive verb followed by an adjective connoting negativity (e.g. 'remains unclear').

Furthermore, it was observed that the frequency of occurrence of *indicating a gap* in both disciplines was more than "Adding to what is known". Moreover, only a few cases of *positive justification* were observed in ALs (5.76%) and Chemistry (7.69%) RAIs. As is evident in the excerpts 9, 24, and 25 above, authors in both disciplines sometimes provided positive reasons for conducting their research (after indicating a gap in the literature). However, most ALs authors directly stated the value of and the rationale for their study, while Chemistry researchers tended to imply the value of their study by highlighting the fact that the outcome of their research would solve a problem in the real world.

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As an obligatory move in Chemistry used by all the authors, M3 was found to be quasi-obligatory in ALs. Moreover, the two disciplines were found to be significantly different in their use of M3, specifically regarding Step 1 (i.e., Announcing present work) (p= .00, V= .26), Step 2 (i.e., Presenting RQs or hypotheses) (p= .00, V= .39), Step 3 (i.e., Definitional clarifications) (p= .00, V= .32), Step 5 (i.e., Announcing principal outcomes) (p= .00, V= .30), and Step 7 (i.e., Outlining the structure of the paper) (p= .02, V= .22).

It was observed that *announcing present work descriptively and/or purposefully*, which was incorporated in 86.53% of ALs RAIs, was found to be obligatory in Chemistry RAIs and was employed by all the researchers. As excerpts 10, 11, 26, and 27 above indicate, the lexical phrases frequently employed by authors to realize this step in both disciplines included 'in the current study, we explore...' and 'the objective of the present work is...' among others (e.g. 'The present empirical study examines...', 'In the present study, we aimed to explore...', 'We focused in the present study on...'). Our analyses indicated that few authors used personal pronouns (e.g. 'I' and 'we') to announce their work, and they did so by using both present and past tenses.

Surprisingly, *question raising and/or hypothesis formation*, which was used by more than one fourth (26.92%) of ALs authors, was not observed in any of the Chemistry RAIs. The results indicated that ALs authors tended to employ *question-raising* (nearly 78%) much more than hypothesis formation (nearly 21%). Moreover, they tended to use indirect questions (nearly 63%) more than direct questions (nearly 36%).

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Other steps observed only in ALs were *definitional clarifications* and *outlining the structure of the paper*, which were found to be non-existent in Chemistry RAIs. That is, they were employed by 19.23% and 9.61% of ALs researchers, respectively. As excerpts 14, 15, and 16 indicate, almost all ALs authors employed the verbs ‘define’ and ‘refer’ to clarify the meanings of technical terms frequently used in their RAs. Also, as excerpts 17 and 18 indicate, to outline the structure of their paper, the authors directly mentioned different sections of the paper (e.g., section I, section II, etc.) followed by verbs, such as 'describes', 'presents', 'discusses', 'reviews', 'outlines', etc.

Finally, Step 5 (i.e., Announcing principal outcomes), which was employed by 21.15% of Chemistry authors, was not observed at all in any of the ALs RAIs. As indicated by excerpt 29, Chemistry authors realized this step by using a noun phrase (e.g., the results of the present study…) followed by verbs such as 'show', 'indicate', etc.

3.4. The results of the interviews conducted with Chemistry and ALs experts

As mentioned earlier, a number of semi-structured interviews were conducted with experts in both disciplines in order to ensure the dependability of the results and to get a fuller understanding of the quantitative data by exploring why the differences existed between the two disciplines. As mentioned earlier, the interviews consisted of two sections. The first part included some questions requiring the experts to determine to what extent they agreed with a number of statements about writing RAs. Table 4 indicates the results of the content analysis of the first part of the interviews conducted with Chemistry experts (CEs) and ALs experts (ALEs).

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Table 4

The results of the first part of the interviews conducted with CES and ALEs

Questions	**Responses given by CEs** (N= 8)			**Responses given by ALEs** (N= 8)		
To what extent do you think…	To a limited extent	To some extent	To a great extent	To a limited extent	To some extent	To a great extent
1- familiarity with RA genre is necessary to postgraduate students and novice researchers?	0(0%)	0(0%)	8(100%)	0(0%)	1(12.5%)	7(87.5%)
2- writing the introduction section of an RA is challenging?	1(12.5%)	2(25%)	5(62.5)	1(12.5%)	3(37.5%)	4(50%)
3- raising students' genre awareness is essential to their success in producing effective RAs?	1(12.5%)	0(0%)	7(87.5%)	0(0%)	1(12.5%)	7(87.5%)
4- publishing RAs in international journals is important to postgraduate students, university teachers, and researchers?	0(0%)	0(0%)	8(100%)	0(0%)	1(12.5%)	8(100%)

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As indicated in Table 4, the experts in both disciplines asserted that it was absolutely necessary for postgraduate students and novice researchers to get familiar with the generic structure of various types of RAs in their academic discipline. Furthermore, the majority of the CEs (62.5%) and half of the ALEs reported that RAIs were challenging in terms of writing although many of them emphasized that writing the Discussion section was much more difficult. In relation to the third question, the majority of the experts in both disciplines (87%) asserted that raising students' genre awareness was essential and that it contributed to their success in writing effective RAs. Moreover, all experts in both disciplines emphasized that publishing RAs in international journals was important to postgraduate students, university teachers, and researchers. In this regard, some CEs stated that a chemist must be familiar with how to share his/her knowledge with the members of the academic community. Emphasizing the importance of publications, one ALs expert asserted that PhD students were required to have some publications to graduate. However, one of the CEs argued that it was their scientific responsibility to share the results of their research with members of their community of practice and that the purpose of conducting research must not be publishing for promotion.

As mentioned before, the interview also included a number of domain-specific information questions, the responses to which helped us explain why some moves/steps occurred more frequently in one discipline (e.g., AL) and were less likely to be used in another one (e.g., Chemistry) and clarify some inferences we had made based on the analyses of the quantitative data. The results of the content analysis of the responses provided by both CEs and ALEs are presented in Table 5.

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Table 5
The results of the content analysis of the responses to domain-specific information questions

Experts	**Interview questions and the responses**			
	5- ***What are the most important moves/steps that should be included in RAIs?***			
	"Proving background information by making reference to previous research"	"Announcing present work descriptively and/or purposefully"	"Indicating a gap"	"Adding to what is known"
CEs	7(87.5%)	7(87.5)	6(75%)	0(0%)
ALEs	7(87.5%)	7(87.5%)	6(75%)	4(50%)
	6- ***How do authors usually refer to a research gap in their RAIs?***			
	By highlighting the complete absence of research	By referring to a limitation in previous research	By contrasting conflicting results in the literature	By referring to inadequate research in a specific area
CEs	4(50%)	4(50%)	0(0%)	1(12.5%)
ALEs	1(12.5%)	2(25%)	6(75%)	5(62.5%)
	7- ***How important is arguing in RAIs that the present research adds to what is known?***			
	Very important	Important	Not very important	Not important at all
CEs	0(0%)	2(25%)	6(75%)	0(0%)
ALEs	5(62.5%)	3(37.5%)	0(0%)	0(0%)
	8- ***What do you think of the inclusion of research questions in RAIs?***			
	The objectives and procedures are often mentioned descriptively and the inclusion of direct research questions is unnecessary.	Research questions are essential in experimental research but not necessary in descriptive studies.	It is important that problem be identified and introduced to the reader before discussing any other points in RAs.	Presenting research questions can be used as a guide for the author to follow and organize the paper accordingly.
CEs	8(100%)	0(0%)	0(0%)	0(0%)
ALEs	0(0%)	2(25%)	2(25%)	4(50%)
	9- ***What do you think of defining technical terms in RAIs?***			
	It is redundant and unnecessary.		It is sometimes necessary that some very specialized terms be clarified or defined.	
CEs	8(100%)		0(0%)	
ALEs	0(0%)		8(100%)	

As shown in Table 5, Question 5, *proving background information by making reference to previous research* was reported by the majority of

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the experts in both disciplines (87.5%) as the most important step that was expected to be included in RAIs. Another important step was found to be *announcing present work descriptively and/or purposefully* mentioned by 87.5% of the experts in both disciplines. Also, *indicating a gap* was reported by 75% of the CEs and 62.5% of the ALEs to be an important move used to realize the goals of RAIs in both fields. Finally, half of the ALEs referred to *adding to what is known* as one of the important steps, while it was mentioned by none of the CEs.

The responses to Question 6 indicate that *indicating a gap* plays a very important role in realizing the goals of introductions in both disciplines. As shown in Table 5, most CEs stated that they generally referred to a limitation in previous research (50%) or highlighted the complete absence of research (50%) to indicate a research gap, while most ALEs asserted that they usually referred to inadequate research in a certain area (62.5%) or contrast conflicting results reported in the literature (75%) to indicate a gap, which corroborated the results of the quantitative data analysis.

Regarding Question 7, arguing that the present work adds to what is known was not considered important by most CEs (75%), whereas it seemed to play an essential role in ALs RAIs as asserted by all ALEs (100%). The results of the analyses of the quantitative data in this regard were completely consistent with the experts' assertions in both disciplines.

In relation to Question 8, all CEs considered *question raising* in Chemistry RAIs as an unnecessary step and asserted that they often told the readers descriptively what they wanted to do (i.e., objectives and procedures). On the other hand, all ALEs confirmed the usefulness of

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including RQs, specifically in experimental studies (25%), since they believed presenting RQs could be used not only to guide the author to follow and organize the paper accordingly (50%) but also to help the reader to know what to expect next from the very beginning of the paper (i.e. by giving them a kind of mental framework) (25%).

Finally, concerning Question 9, all CEs corroborated the results of the quantitative data analysis by arguing that *definitional clarification* was an unnecessary and redundant step because RA is not written for novices, but is directed to readers who are experts and thus familiar with the technical terms in the field. The results were also confirmed by ALEs who asserted that it was sometimes necessary for some very specialized terms to be clarified or defined in ALs RAIs.

4. Discussion

Drawing upon Swales' (2004) framework and considering the more recent research findings (Bahtia, 2004; Lim, 2010, 2014; Shehzad, 2008), we investigated the cross-disciplinary variations in the generic structure of the introduction sections of ALs and Chemistry RAs. To analyze the rhetorical structure of the RAs in the present study, we not only paid attention to move sequences, but we also took into account the frequency of occurrence of the moves, steps, and sub-steps. Furthermore, since we were also interested in the supporting linguistic features of the moves, like Lim (2012), Cortes (2013), and Shehzad (2008), we paid attention to the identification of prominent linguistic features (i.e., lexical items and syntactic structures) used to perform the various communicative functions of each move, step, and sub-step. Moreover, following Bhatia's (2004) ethnographic approach, we conducted a number of semi-structured interviews with some CEs and

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ALEs in order to ensure the dependability of the results and to get a deeper understanding of the quantitative data by exploring why the differences existed between the two disciplines. Comparing the results obtained through the analysis of the quantitative data with those obtained via the content analysis of the interviews, we concluded that considering move sequences and the frequency of occurrence of the moves, steps, and sub-steps and paying attention to the supporting linguistic features of the moves, as proposed by Lim (2012), Cortes (2013), and Shehzad (2008), contribute to the dependability of the results obtained through genre analysis of various sections of RAs. Besides, using qualitative data obtained by interviewing experts can not only be a support for the results obtained through the analysis of the quantitative data, but also a way of understanding and accounting for why authors in a given discipline might use a specific move/step more than the others or why a move/step was frequently used by authors in one discipline, but completely absent in another.

In view of the results of the move analysis reported above, we might be able to argue that there are disciplinary variations between structural organization of RAIs in ALs and Chemistry. The findings indicated that although the disciplines were significantly different in the degree to which they used M3 in their RAIs, many more variations were observed in the way they used the steps and sub-steps to realize the three moves. As mentioned previously, the Introduction section provides the rationale for the study (Swales & Feak, 1994) and is necessary to be written in a way that appeals to the disciplinary community. As one of the steps realizing M1, *claiming centrality*, seems to be central in establishing a territory and is commonly employed by authors in various disciplines. This is in line with the results of Samraj's (2002) genre analysis of RAIs in the two disciplines of Conservation Biology and Wildlife Behavior and, as the experts interviewed

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in the current study also asserted, is justified by the fact that it is essential for researchers to design their RAs in a way which is appealing to their discourse community if they wish to publish in the mainstream journals in their field. This argument is also emphasized by Swales (1990, p. 144) who maintains centrality claims are "appeals to the discourse community whereby members are asked to accept that the research to be reported is part of a lively, significant or well-established research area". However, it was found that the frequency of occurrence of this step (Step 1a) in Chemistry RAIs (92.30%) was apparently more than those reported by Samraj (2002) in Wildlife Behavior (50%), Saz Rubio (2011) in the subfields of Agricultural Sciences (50%), and authors (in the present study) in ALs (69.23%). Another important finding in relation to M1, as highlighted by Swales (2004), was that authors in both disciplines used citations and made references to the literature to provide background information and/or stress the importance of the topic.

In relation to niche establishment (M2), it was observed that gap indication was used in most of the ALs RAs, but only in half of the Chemistry RAs, which is in contrast with the findings of Stoller and Robinson (2013) who found gap indication in all the Chemistry RAs they analyzed. We also found that the existence of a gap in the literature was mostly established by ALs authors via *stressing insufficient research in a specific aspect* and/or *contrasting conflicting previous research findings* using conjunctive adverbs showing contrasting and concessive conjunctions, a result which is in line with the findings of Lim (2012). In fact, most of the experts mentioned that gap indication was one of the most important steps expected to be incorporated in RAIs in both disciplines. As argued by most of the CEs, authors might refer to a gap when the previous studies do not provide answers to their questions or when they want to introduce a new

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procedure/method or report a discovery (e.g., the chemical substances in a newly-discovered planet). One CE argued that Chemistry authors often referred to a limitation in the previous research to realize gap indication when they think their work has advantages over the previous ones. On the other hand, most ALEs asserted that they mentioned a research gap because they were uncertain about the previous research findings as a result of conflicting results reported in the literature. As asserted by other ALEs, they indicated a research gap by arguing that the previous studies have failed to find a correlation or cause-and-effect relationship between the variables. The four various ways of indicating a research gap mentioned by the experts interviewed in the present study (See Table 5) provide support for Lim's (2012) categorization of the steps realizing gap indication in RAIs and confirms the dependability of the updated CARS model displayed in Figure 1.

Furthermore, we found that the frequency of occurrence of *indicating a gap* in both disciplines was more than *adding to what is known*, which is comparable to niche establishment in Management RAs as reported by Lim (2012). In this regard, the CEs interviewed in the present study believed it was not necessary to directly state that their work adds to what is known, whereas the ALEs argued it was necessary for the authors to remind the reader that their work followed a recent research trend, which provides support for the results of the quantitative analyses. We also found only a few cases of *positive justification* in ALs (5.76%) and Chemistry (7.69%) RAIs which is almost comparable to Conservation Biology (0%) as reported by Samraj (2002); however, it is in contrast with Wildlife Behavior (41.66%) reported by Samraj (2002) and the subfields of Agricultural Sciences (46.4%) reported by Saz Rubio (2011). Also, in relation to *positive justification*, it was found that ALs authors directly stated the value of and

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the rationale for their study, which is comparable to the findings of Samraj (2002) regarding Wildlife Behavior. Chemistry researchers, on the other hand, implied the value of their study by highlighting the fact that the outcome of their research would solve a problem in the real world.

As mentioned earlier, the most significant disciplinary variations between ALs and Chemistry RAIs were found in the use of M3. It was observed that *announcing present work descriptively and/or purposefully*, which was incorporated in 86.53% of ALs RAIs, was found to be obligatory in Chemistry RAIs and was employed by all the researchers, a finding which is in line with the results of Stoller and Robinson (2013). It was also mentioned by almost all experts interviewed as an important step to be incorporated in RAIs in both disciplines. On the other hand, *presenting RQs or hypotheses*, which was used by more than one fourth of ALs authors, was not employed at all in any of the Chemistry RAIs, which provides support for Stoller and Robinson's (2013) assertion that listing RQs explicitly is uncommon in Chemistry. As Feak and Swales (2011) and Lim (2014) argue, RQs have been recently perceived to be an important rhetorical step in RAIs that guide the development of a research report or dissertation. However, we found that only 26.92% of the ALs authors included RQs in their RAIs. This might suggest that question-raising is an optional step in ALs RAs, while it is quasi-obligatory in ALs dissertations (Lim, 2014). The finding of the present study in relation to this step, as used by ALs authors, support those presented by Ozturk (2007) and Lim (2014); however, the findings for Chemistry RAs in this regard suggest that this tendency does not seem to be generalizable to all disciplines. This finding corroborates that of Stoller and Robinson (2013) who also found that question raising rarely occurred in Biochemistry RAs and was not observed at all in the Chemistry RAs they analyzed. The results of the interviews conducted with CEs

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contribute to our understanding of the reason why question raising was not employed by Chemistry authors, while it was commonly used by ALs authors. As argued by CEs interviewed, Humanities deal with people and seek answers to questions about human behavior and personality, whereas Chemistry, as one of the branches of natural sciences, deals with chemical substances and materials. They maintained that although they might descriptively mention the objectives and procedures of their study in the Introduction section, the inclusion of direct RQs seems unnecessary. On the other hand, half of the ALEs believed that since research usually starts with a question, it is important that problems be identified and introduced to the reader before discussing any other points, particularly in experimental research. Emphasizing the important role played by RQs in directing research studies, other ALEs asserted that RQs can be used as a guide for the author to follow and organize the paper accordingly, and it helps the reader to know what to expect next from the very beginning of the RA. Thus, considering the results of analyzing the quantitative and qualitative data, we might be able to argue that question-raising, an optional but common move in ALs RAs, is almost absent in Chemistry RAs.

Other Steps observed only in ALs were *definitional clarifications* and *outlining the structure of the paper*, which were found to be non-existent in Chemistry RAIs. This is in accordance with Stoller and Robinson's (2013) findings that no Chemistry authors in their study concluded their introductions with outlining the structure of their RAs. Regarding the absence of *definitional clarifications* in Chemistry RAs, almost all the CEs interviewed maintained that the RAs are often read by the members of the community who are experts in the field and are already familiar with the technical terms, hence defining them seems redundant and unnecessary. However, they maintained that definitions are given only when

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the author introduces a totally new term coined by the researcher. On the other hand, regarding the prevalence of RQs in ALs RAIs, almost all ALEs argued that since ALs draws upon various feeder disciplines (e.g. Linguistics, Psychology, Sociology, etc.), we cannot expect the reader to be familiar with all the technical terms used in the RA. Therefore, it is sometimes necessary that some very specialized terms be clarified or defined in RAIs.

Finally, Step 5 (i.e., Announcing principal outcomes), which was employed by 21.15% of Chemistry authors, was not observed at all in any of the ALs RAIs. Swales and Najjar (1987) investigated the frequency of occurrence of this move in two different disciplines (i.e., Physics and Educational Psychology) from two leading journals (i.e., *Physics Review* and *Journal of Educational Psychology*) and found that while about half of the articles they analyzed in *Physics Review* contained *announcing principal findings*, few RAs in *Journal of Educational Psychology* included such a step. Considering the results obtained in the present study and in Swales and Najjar's (1987) findings, we might be able to argue that this move is more likely to be observed in RAs related to natural and exact sciences, such as Physics and Chemistry, but it is rarely employed in humanities.

5. Conclusion

This investigation yielded a number of key findings in relation to genre analysis of ALs and Chemistry RAIs. The updated version of Swales' CARS model, the graphical presentation of which is displayed in Figure 1, was very successful not only in describing the overall framework of the Introduction section of RAs in both disciplines, but also in the detailed definition and description of the individual steps and sub-steps realizing the

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moves. It was also concluded that considering the move sequences and the frequency of occurrence of moves, steps, and sub-steps as well as paying attention to their supporting linguistic features contribute to the dependability of the results obtained through genre analysis of various sections of RAs. Moreover, we concluded that the use of the qualitative data (e.g., obtained via interviewing experts in a particular discipline) can be not only a support for the results obtained through the quantitative genre analysis of the RAs, but also a way of understanding and accounting for why authors in a given discipline might use a specific move/step more than others or why a move/step is frequently used by authors in one discipline, but completely absent in another.

As the results indicated, cross-disciplinary variations were found in the generic structures of RAIs in the two disciplines, particularly in the way each move was realized by the authors in each discipline. Therefore, as also emphasized by Basturkmen (2012), variations in the generic structures of different disciplines could not be identified by the mere comparison of the moves, yet careful analysis of steps and sub-steps and how they are combined also needed to be conducted. These differences in the generic structure of the two disciplines can be ascribed to the different requirements, expectations, and norms of the two academic disciplines defined and specified by the members of each community of practice.

The present study might promise a number of implications for postgraduate students and novice researchers in the disciplines of Chemistry and ALs, who wish to share their findings internationally with their discourse community by publishing their works. Due to the variations observed, it is thus deemed necessary that postgraduate students and novice researchers get acquainted with the RA genre, rhetorical moves, steps and

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sub-steps typically adopted by authors in their fields. They are also recommended to pay attention to prominent linguistic features used to perform the various communicative functions of each move, step, and sub-step in order to appropriately fulfill the purpose of each section of RAs, particularly the Introduction section which is commonly considered by the researchers to be rhetorically complex and difficult to write.

Another implication of the present study might be addressed to genre analysts and researchers, particularly those specializing in Chemistry and ALs. Analyzing the generic structure of RAs in a particular discipline within any framework, the analyst might be able to explain and account for the general structure of the RA. However, due to the complex and unpredictable nature of world realities in general and human behavior in particular, they should be ready to expect discrepancies or even the total absence of some steps and sub-steps in specific disciplines. Therefore, it is recommended that the established frameworks be used only as a point of departure while analyzing the rhetorical structure of RAIs to give the analyst hints as to what to expect and focus on. After the meticulous analysis of RAs, they might sometimes come up with a new and updated framework which is more applicable to their academic discipline. Furthermore, to obtain more reliable results, it is recommended that they pay attention to not only move sequences and the frequency of occurrence of moves, steps, and sub-steps, but also prominent linguistic features used to perform various communicative functions. Finally, to enhance the dependability of the results of genre analysis, we recommend that the experts in the field check the results and that these results be interpreted in light of their specialized knowledge and perspectives.

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The study might also have some pedagogical implications for EAP teachers specializing in teaching writing to Chemistry and ALs students. Using the findings of the study, teachers might be able to raise their students' awareness of the conventions and expectations of their discourse community, familiarize them with the actual communicative practices of their disciplines, and highlight for them the genre and move structure delicacies specific to their discipline in order to help them become better writers. In fact, this is not to say that there is only one fixed and correct way of behaving within a specific genre, but to suggest that in order to become an independent writer and develop a personal and idiosyncratic way of writing within the framework of the academic discipline, one first needs to get familiar with the disciplinary conventions and expectations of their discourse community, as also highlighted by Hyland (2006).

Finally, it seems essential that novice researchers in both ALs and Chemistry be trained to establish a territory in their RAIs by providing background information about the research topic through making reference to previous research as well as highlighting the centrality/importance of the topic. They should also be advised to incorporate a research gap in their RAIs by referring to inadequate research in a specific area or a limitation in previous research. A research gap can also be mentioned by highlighting the complete absence of research or contrasting conflicting results in the literature. Students and novice researchers, particularly those in ALs, must be taught that incorporating RQs in their RAIs when possible can help them follow and organize the paper accordingly and helps their readers to know what to expect next from the very beginning of the paper. Besides, ALs researchers should be reminded that it is sometimes necessary to define or clarify some very specialized terms in their RAIs, particularly when

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conducting interdisciplinary research and using technical terms from various disciplines.

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