

A comparative corpus-based investigation of results sections of research articles in Applied Linguistics and Physics

Research Article

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Abstract: The present study sought to identify the generic structures of the results sections of scientific research articles (RAs) between Applied Linguistics and Physics. Following a manual search approach, a total of 200 RAs in the field of Applied Linguistics and Physics from different top prestigious journals randomly were singled out and analyzed. In addition to offering a tentative template for the rhetorical organizations of results sections, the findings revealed shared and non-shared rhetorical units as well as obligatory and optional steps in the results sections (RSs) of research articles between the disciplines. The findings also indicated that RA writers organize the contents of the RSs around certain rhetorical resources (i.e., M1, M2, M3, M4, and M5) to present key experimental and factual analytical results of their studies. The findings further suggested the existence of common core of rhetorical resources in writing RSs between the disciplines, albeit there are a set of certain steps playing an essential part in distinguishing textual features of each discipline as well as depicting how RSs of individual discipline are developed. The findings generated from the study can offer a number of important pedagogical implications for teaching EAP and ESP courses, especially for Applied Linguistics and Physics teachers and students.

Keywords: *rhetorical resources • results sections • Applied Linguistics • Physics • genre analysis*

1 Introduction

Research articles (RAs) play a central role across various academic disciplines in scientific discourse. Being the “pre-eminent genre of the academy” (Hyland 2009: 67), RAs are nowadays recognized as main channels of communication within academic fields whereby new scientific knowledge is widely disseminated. Among the different sections of the RA (i.e., Introduction, Method, Results, and Discussion – IMRD), results section is one of main central report sections of an article (Glasman-Deal 2010) and is deemed an undoubtedly indispensable component of the RAs in which empirical research data can be typically transformed into knowledge and presented in the form of valid and meaningful statements to researchers, readers, and other members of a professional discourse community.

In this section, writers may objectively present statistical evidence to support or reject an initial aim or a hypothesis, and highlight significant (meta) data. In writing the results section, writers are generally expected to bring together various parts of study being reported, such as presenting significant research findings, judging the correct strength of opinion, verifying core research findings, offering information on the measurement of data, variables, treatments, citing adequate set of statistics, explaining the appropriateness of a specific statistical method, and providing evidence for the robustness of the statistical method that is applied (Cargill and O'Connor 2009; Glasman-Deal 2010; Paltridge and Starfield 2020; APA 2020). This can, therefore, make such a section a driving force of an article and can attach great importance to the results section of a RA in numerous academic fields. In this regard,

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numerous researchers have endeavored to demystify the results section and have offered similar move models for the rhetorical structure of the section (e.g., Brett 1994; Williams 1999; Ruiying and Allison 2003; Kanoksilapatham 2005, 2007; Lim 2010). Despite phraseological and configurational differences, the existing models for RSs present certain rhetorical conventions (moves and steps) including reporting results, commenting on results, explaining findings, and evaluating findings. Although the most commonly occurring rhetorical resources have been discovered, few studies appear to have examined how rhetorical resources are comparatively crystalized in the results sections (RSs) of research articles between diverse academic disciplines.

With this in mind, this study aims to investigate how rhetorical resources are comparatively realized between soft science (SS) and hard science (HS) disciplines. To this end, one academic discipline from SS, that is, Applied Linguistics and one from HS, that is, Physics were selected to identify the potential existence of (inter) disciplinary move structure variation. I explore RSs to draw a comparison between above-stated academic disciplines in order to ascertain similarities and differences of what choices of the rhetorical move types RA writers deploy in RSs of research articles. Doing this may, firstly, help determine the key components where potential disciplinary variations exist to target at in the academic writing instruction in that the disciplinary variations can give rise to specificity in the macro and micro structures of the academic writing such as RA (Hyland 2009). The potential similarities and differences that occur between academic disciplines can also exert an influence over the ways via which scientific knowledge is imparted and presented to its target audience in scientific communities. Secondly, RS is an environment in which the writers exploit different modes (i.e., verbal and non-verbal) and is where the synergy of writing texts and numerical visual representation of data are symbiotically employed. Therefore, it is expected to ascertain a wide variety of communicative purposes of rhetorical choice more complex than other sections due to its multimodality. Finally, exploring the possible (inter) disciplinary variations between the above-named academic disciplines with reference to rhetorical units may be instructively informative to ESP practitioners teaching relevant research article writing courses and may further our understanding of potential disciplinary variations especially those that may problematize current dichotomies such as SS and HS disciplines.

2 Literature review: Previous studies of results sections

Several studies have thus far investigated rhetorical resources of RSs of research articles. However, these studies analyzed either a fairly limited number of RAs or examined RAs only from one academic discipline. For example, Brett (1994) found, analyzing the result sections of 20 sociology RAs, that in the results section new and core findings are highlighted, explained, and commented on by writers. Likewise, Thompson (1993) argued that the RSs plays a crucial constituent in the experimental RA by offering the fresh scientific knowledge in a specific way. In another study on the results sections of medical RAs, Williams (1999) analyzed eight medical RAs applying a modified version of Brett's model of communicative categories. He found, on the one hand, that Brett's model was an adequate basic model for the rhetorical categories of the results sections for interdisciplinary genre analysis. On the other hand, Williams stated that the cyclical fashion reported by Brett was rather uncommon in biomedical articles since the RSs in the field of study is generally arranged linearly. Another relevant research to mention here is Ruiying and Allison (2003). Having analyzed the results and discussions sections of 20 Applied Linguistics RAs, they propounded a six-move structure framework for the RSs (see Table 1).

The first three moves were viewed as "dominant moves" and move 2 was considered an obligatory move, while other moves were optional. However, this study has been criticized for a limited number of texts that Ruiying and Allison examined (Kanoksilapatham 2015) despite valuable contributions to our understanding of some complex and related sections of the RA. Kanoksilapatham (2007) described the results sections of 60 biochemistry articles consisting of four moves which might occur cyclically. She found that the four move types of the RSs are very similar in their linguistic characteristics (see Table 2).

Table 1. Move structure suggested by Ruiying and Allison (2003: 374).

<i>Preparatory information</i>	<i>Move 1</i>
<i>Reporting results</i>	<i>Move 2</i>
<i>Summarizing results</i>	<i>Move 3</i>
<i>Commenting on results</i>	<i>Move 4</i>
<i>Evaluating the study</i>	<i>Move 5</i>
<i>Deductions from the research</i>	<i>Move 6</i>

Table 2. Move structure in Biochemistry recommended by Kanoksilapatham (2007: 79).

<i>Restating methodological issues</i>	<i>Move 1</i>
<i>Justifying methodological issues</i>	<i>Move 2</i>
<i>Announcing results</i>	<i>Move 3</i>
<i>Commenting on results</i>	<i>Move 4</i>

Table 3. Commentary steps proposed by Lim (2010: 284).

<i>Explaining the findings</i>	<i>Move 1</i>
<i>Evaluating the findings</i>	<i>Move 2</i>
<i>Comparing findings with previous literature</i>	<i>Move 3</i>
<i>Making recommendations for future research</i>	<i>Move 4</i>

Lim (2010), in a genre-based investigation, comparatively examined commenting on research results in Applied Linguistics and Education. Lim reported four types of commentary steps in the results section as Table 3 shows. Nonetheless, the criticism leveled at Lim's study, as also suggested by Basturkmen (2012), is that the findings reported are based on the texts analyzed from only two related academic disciplines which are viewed as "occasionally overlapping academic disciplines" (Lim 2010: 282).

Swales and Feak (2012: 324), moreover, suggested that some regularities and organizational patterns occur in the organization and structure of the results sections. They pointed out that the constituents presented below, in general, are recycled; sometimes an entire cycle comprises a paragraph and then the cycle recurs. Swales and Feak outlined the findings of the studies in Sociology (Brett 1994), Applied Linguistics (Ruiying and Allison 2003), and Biochemistry (Kanoksilapatham 2005) in Figure 1.

Overall, several move analysis studies have thus far been carried out on the RSs as reviewed earlier; however, to the best of my knowledge, few studies have examined the rhetorical resources of the RSs of Applied Linguistics and Physics. Thus, in order to fill this gap and to throw more light on the intricate nature of rhetorical functions of RSs in the soft science and hard science disciplines, the following research questions are formulated:

- 1: What are the schematic structures of the results sections (RSs) of Applied Linguistics and Physics scientific papers?
- 2: What interdisciplinary move structure variations can be drawn between Applied Linguistics and Physics?

Sociology	Applied Linguistics	Biochemistry
location- statement	preparatory information	restating methods
finding	reporting results	justifying methodology
further support for finding	commentary	announcing results
commentary	commenting on results	

Figure 1. Outline of results sections in three fields (adapted from Swales and Feak 2012: 324).

3 Method

3.1 Research design

In relation to the above-stated research questions, a mixed methodology of both quantitative and qualitative paradigms was exploited. Descriptive statistics was used to obtain the necessary information in terms of computing and showing the frequencies (i.e., the number of times a move occurs in all RSs) in the corpora. On the other hand, qualitative data was found to be useful to afford a detailed description of the rhetorical conventions of the texts analyzed.

3.2 Selection of disciplines

Based on Becher's (1994) taxonomy of disciplines, two differing academic fields including Applied Linguistics and Physics as sub-branches of the Humanities and Natural Sciences respectively were selected. While the hard disciplines primarily refer to the natural and mathematical sciences, the soft disciplines are generally defined as the humanities and social sciences (Gao 2016). The main motivations upon which the academic disciplines of choice were singled out were, firstly, that Applied Linguistics is still virtually under-explored compared with other academic fields (Le and Harrington 2015), and secondly, that only a limited number of studies have comparatively investigated the aforementioned disciplines, to date. On the other hand, commonly known as the most fundamental of the sciences, Physics benefits from a unique and variegated style of structuring and expressing knowledge that makes it a distinctive academic discipline (Doran 2018). For this reason, a proper understanding and a deeper appreciation of the role that rhetorical resources may play in Physics seems to be of value for its entire discipline.

3.3 Selection of journals and research articles

The corpus data for the present study consisted of a total of 211 empirical RAs randomly selected from 11 established journals playing leading roles in Applied Linguistics and from 13 scientific journals in Physics (Appendix A). The selection criteria of scholarly journals were based on 1) journal high impact factor/value, 2) Scimago Journal Rank Indicator, 3) areas of specialization of the journals, 4) representativity of the related field, and 5) the disciplinary insiders' recommendation (Ruiying and Allison 2003; Kanoksilapatham 2005, 2015; Le and Harrington 2015).

In the process of selecting the empirical RAs, four main criteria were followed to control comparisons. Firstly, only original and empirical RAs were included to avoid potential genre variations in schematic structures. Therefore, other types of RAs, namely, meta-analysis, special editions, editorials, book reviews, theoretical articles, and article reviews were excluded since they may represent different genres, generic constructions, and communicative categories. Secondly, considering the potential dynamicity of genres (Swales 1990; Lim 2010), only the RAs published in 2014–2019 were downloaded to reflect the present-day rhetorical conventions and genre features of academic texts. An IMRD format of each empirical RA was the third selection criterion to consider in order to control the potential variations, functions, and organizational structures. Fourthly, to minimize the influence of individual peculiarity, only one article from every author was selected and the authors' mother tongue was not taken into consideration.

Based on Brett's (1994) model, the RSs indicating various section heading names (e.g., Findings and Analysis and Results) were regarded as the RSs in each academic discipline. Moreover, it was noticed that the majority of the selected RAs had conventional as well as recognizable IMRD sections

Table 4. Various heading labels found in Physics corpus.

Alternative heading labels	No	Alternative heading labels	No
<i>Numerical analysis</i>	4	<i>Simulation results</i>	1
<i>Numerical results</i>	2	<i>Basic equations and results</i>	1
<i>Analysis and results</i>	2	<i>Experiments and results</i>	1
<i>Experimental analysis</i>	2	<i>Experimental setup and results</i>	1
<i>Benchmarks results</i>	2	<i>Numerical results and interpretation</i>	1
<i>Results from statistical analysis</i>	2	<i>Design of experiments and results</i>	1
<i>Experimental results</i>	2	<i>Model results</i>	1
<i>Results and analysis</i>	2	<i>Method and results</i>	1
<i>Results and benchmarks</i>	1	<i>Preliminary results</i>	1
<i>Analysis</i>	1	<i>Analysis of results</i>	1

Table 5. Descriptive details of the size of RSs.

Disciplines	No of results sections	Minimum text length in words	Maximum text length in words	Sum	Mean	Std. deviation
Physics	100	291	4596	157554	1575.54	940.562
Applied Linguistics	100	400	5303	187916	1879.16	1167.586

while several RAs did not perform the functions of the IMRD patterns denoting other variants including ILMRD, IMRDC, and ILMRDC; nevertheless, these all included an explicit separate section labeled as the results section. Merged headings (e.g., Results and Discussion) were also left out due to the possible disparities in the communicative purposes of these sections. However, while analyzing the datasets qualitatively, it was found that the section heading labels of the RSs show greater variability, especially in Physics (Table 4). These varied heading labels were further screened by a disciplinary informant invited to the study to ensure the content headings and to avoid any mismatch with the goals of the study. Therefore, these labels were all examined under the umbrella term of RSs.

The diverse section headings could be ascribed to the fact that the RA macrostructures (i.e., headings) are not generally pellucid or fixed, and can have heading variations, depending on the policy of a journal or the authors' personal preferences or assumptions to tag the segment based on the communicative function it characterizes. After applying the above-stated rigid and uniform standards, 203 empirical RAs that met the criteria remained. In order to attain an equal distribution in each discipline, we finally included 200 RSs of research articles in our final corpora. Table 5 shows the size of our dataset.

3.4 Eliciting specialist informants' viewpoints

In order to benefit from the viewpoints of disciplinary informants, two faculty members who had prolifically published papers (inter)nationally were recruited to cooperate with the present study before, during, and after the in-depth textual analysis. They were from the two above-stated academic disciplines and were invited for three reasons, i.e., 1) to select leading journals of their disciplines, 2) to help us understand physics content and validate our identification/analysis, and 3) to enable us to evaluate the appropriacy of each move/step category.

3.5 Data analysis procedure

Once the target RSs had been identified, the researcher commenced examining schematic structures employed in corpora via multiple subsequent stages. Firstly, each RA was individually assigned a separate number (e.g., L1-L100 for Applied Linguistics and P101-P200 for Physics corpora respectively) for accurate recognition. Secondly, attempts were made to scrutinize pertinent and significant studies in which textual move organization of RSs was identified (e.g., Brett 1994; Williams 1999; Ruiying

and Allison 2003; Kanoksilapatham 2005, 2007; Lim 2010). Thirdly, the whole corpus was thoroughly examined so as to gain a deep insight of the text structures, patterns, and communicative/functional categories of the texts (Biber et al. 2007). Finally, it was endeavored to collect move-step schemata such as representative selection of examples as well as appropriate functional categories of schematic structures of earlier analyses in a single file in order to borrow or adapt the possible names for rhetorical categories for the datasets, and to develop an initial framework for the analysis.

No previous move-step models for the RSs were applied primarily due to numerous reasons: 1) the present study was of an exploratory-descriptive nature, 2) many studies were not recent and writing norms for academic disciplines might have changed over a lengthy time period, 3) I was unable to locate a move-step model in earlier studies specifically developed for rhetorically-directed analysis of RSs of Physics, and 4) a plethora of studies provided frameworks for analyzing moves regarding conflated sections such as Results-Discussion sections without noticing that each of them embraces different communicative functions (Sheldon 2013). Being aware of such problematic issues, I set a reasonable goal to develop a move-step schema for the target corpora.

3.6 Move analysis: Pilot study

Following the general analytical steps recommended by Biber et al. (2007), five percent of the corpus files were initially selected to operationalize the pilot analysis. One of the subject specialists was then invited to our office and a brief negotiation was conducted on how to determine rhetorical functions of text segmentation, demarcate move-step categories based on both salient rhetorical functions and linguistic clues, and tally move-step occurrences per text. This was done to attain maximum comparability and consistency between coders. Drawing on Swales' (1990, 2004) and Moreno and Swales' (2018) description of moves and steps, we developed a protocol for move identification based on which semantic function of propositions was considered the main unit; the task also involved considering clear definitions and examples of move-step descriptors.

The communicative purposes of a move were also a central notion. By definition, a move is "a discursal or rhetorical unit that performs a coherent communicative function in a written or spoken discourse whose linguistic realizations may be very variable in length and in other ways" (Swales 2004: 228–229). On the other hand, moves generally include multifarious submoves or steps which, when conflated, fulfill the move (Swales 1990). These submoves serve the purpose of the move they belong to. After that, each of us read, analyzed, and coded the selected RSs in the margins of the texts separately in session. Following this, a number of preliminary classification and definitions of moves and steps for each discipline were produced from the first pilot analysis. These were 36 and 39 categories for Physics and Applied Linguistics respectively (Appendix B).

A note on how we created the names and labels is also in order. These were named based on either prior names/labels obtained from the literature or on coders' reflection and experience. For example, if the identified moves or steps were comparable with those discovered in earlier studies, an attempt was made to utilize the same labels. In cases of new moves and steps, new labels were used by considering the salient communicative purpose they conveyed. Therefore, naming and labeling the segments of data was conducted to identify similarities and differences in the datasets and led to the development of tentative categories albeit they were later refined and reduced as the analysis process proceeded.

It goes without saying that such resultant pilot schemes would be unsuitable and unmanageable; we, therefore, resumed negotiations to reclassify and reconceptualize the obtained categories into more overarching moves and steps, making it a workable coding scheme. To achieve this, we reviewed, rearranged, and refined the first tentative categories following qualitative analysis methods proposed in the literature. We applied the three steps of data analysis suggested in grounded theory (i.e., open coding, axial coding, and selective coding) as well as a constant comparative method of analysis (Ary et al. 2019). This means that as we examined the data, categories emerged and were created, additional data were sorted into these categories, and finally the categories were compared and modified. We moved back and forth between the data and the theoretical interpretations with simultaneous comparison of all units of rhetorical choices obtained (Ary et al. 2019). The researchers compared categories and

Table 6. Moves and steps identified in Applied Linguistics dataset.

1. Move (1): Presenting preparatory information Step 1: Explanatory note to set the scene Step 2: Providing background about research aims and methods Step 3: Restating research questions or hypotheses Step 4: Providing background information: reference to previous research 2. Move (2): Restating methodological issues; listing procedures or methodological techniques Step 1: Citing established knowledge of procedure Step 2: Restating statistical procedures or methodological techniques 3. Move (3): Reporting results Step 1: Indicating the location of the data Step 2: Describing/Explaining the facts (with/without providing statistical evidence) Step 3: Cataphoric reference-explanation deferred Step 4: Giving examples to clarify the current findings (<i>exemplification</i>) Step 5: Using (in)direct quotations from the participant(s) Step 6: Participant/Context description 4. Move (4): Commenting on results Step 1: Referring to previous research (for comparison/contrast or gaining support) Step 2: Interpreting the current findings Step 3: Evaluating the current findings 5. Move (5): Summarizing results Step 1: Re-explaining the current finding
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Table 7. Moves and steps identified in Physics dataset.

1. Move (1): Presenting preparatory information Step 1: Explanatory note to set the scene Step 2: Providing background about research aims and methods 2. Move (2): Restating methodological issues; listing procedures or methodological techniques Step 1: Citing established knowledge of procedure Step 2: Restating experimental procedures or methodological techniques 3. Move (3): Reporting results Step 1: Indicating the location of the data Step 2: Describing/Explaining the facts Step 3: Cataphoric reference-explanation deferred Step 4: Mathematical equation/formula 4. Move (4): Commenting on results Step 1: Referring to previous research (for comparison/contrast or gaining support) Step 2: Interpreting the current findings Step 3: Evaluating the current findings Step 4: Noting limitations
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grouped them with similar categories. When there were no similar units of rhetorical structures, we created a new category. This resulted in merging, rearranging, and reducing the large number of suggested individual categories into a manageable set of categories. As a result of this, the first viable coding scheme consisting of five moves and sixteen steps for Applied Linguistics corpus and four moves and twelve steps for Physics was specified (Tables 6 and 7). Thus, the first coding scheme was settled.

After fine-tuning the initial pilot analysis on example texts, an attempt was made to apply the obtained tentative move-step schema for the second round of analysis (the next five percent of the corpora). The reason for this decision was to continue gathering and analyzing data in an iterative and dynamic process until we reached a point where no more significant category was acquired from the target data (see Ary et al. 2019). Equally important were the reduction of coders ambiguity and the early identification of error in coding decisions. Therefore, the emerged tentative move-step schema was applied to the second five percent of the corpus in session. Each coder commenced individual coding on the materials and manually annotated per text at sentence-level for moves. Subsequent to this, we shared the texts in which moves/steps were highlighted and annotated. There existed a very limited number of cases over which a disagreement arose; to resolve this, close reading, negotiation and clarification of the criteria were used to settle the disagreement.

A further complication was some cases where the communicative purpose of a unit text was not totally clear due to the flexibility of language used by writers, serving dual or multifunctional purposes in the context, and carrying more than one move in a sentence. A common practice is that such cases can be

analyzed according to the move and step that appeared to have the most salient function the sentence represented. The last difficulty we faced was when there were numerous rhetorical structures and the contents containing highly technical information, especially in Physics. In these cases, expert informant's opinions were sought to resolve the issue. However, we did not identify any new categories of moves and steps except for numerous sporadic categories in the second round of analysis. This indicated that data generation could cease when data saturation occurred in our data analysis. Therefore, it was felt the preliminary coding scheme could be no longer modified or refined by any further data collection.

Having conducted the second pilot coding, we randomly selected a subset of 20 percent of the whole datasets and equally distributed between the researcher and the invited coder. After about three weeks interval, we convened the third round of meetings and the researcher and the coder shared texts in which rhetorical schemas were manually analyzed and labeled. We compared and discussed RSs in a series of discussions before moving on to the next phase. The divergent notions on moves were negotiated and discussed until a clear consensus of opinions emerged. However, there were a few cases of move-step categories for which we consulted an expert native speaker.

Following Ary et al.'s (2019) suggestion, an attempt was made to perform inter-coder reliability between the coders' work. For this purpose, inter-coder reliability procedure was conducted to measure the degree of agreement and consistency between the coders and show that the moves were identified with a high degree of accuracy. Therefore, Cohen's Kappa (k) was run. The Kappa coefficient for moves was 0.89, which indicated that the agreement between the coders was substantial. Thus, the emerged move-step framework was set as a benchmark for the next 70 percent of the corpora.

4 Results

This section shows a frequency count (i.e., the number of times a move occurs in all RSs) of the rhetorical moves and associated steps used in the RSs of research articles between academic disciplines (Appendix C). In order to classify and determine the potential status of a move or step (i.e., obligatory or optional nature of each move), there generally exist two sets of criteria; the first criterion is when a move or step appears in 100 percent, 51–99 percent, and in less than 50 percent of the texts, it can be recognized as “obligatory”, “quasi obligatory”, or “optional”, respectively (Lim 2014: 70) while the second criterion is in the event that a move and step occurs in 100 percent, 60–99 percent, and in less than 60 percent of the texts, it can be considered “obligatory”, “conventional”, and “optional”, respectively (Kanoksilapatham 2015: 78). There is an element of ambiguity in the second set of criteria. According to Ye (2019: 11), if a move or step is “obligatory”, it could also be interpreted as “conventional”. Hence, we followed the criteria suggested by Lim (2014) in which the definition between “obligatory” and “quasi-obligatory” is easier to distinguish.

4.1 Frequency of moves and steps

Move (M) 1 “*Presenting preparatory information*” – normally occurring at the beginning paragraph of the results section – is a typical opening move and its communicative function is to prepare the target readership for the reporting of results that follow. This move is commonly employed as a linking device between sections, providing a panoramic view of the section as well as giving pertinent information for the presentation of results. Occurring at a frequency of 62 percent in the Applied Linguistics corpus and 55 percent in the Physics corpus, this move is recognized as a quasi-obligatory component in the writing of both groups (Figure 2) (Appendix C). As a result, this finding can provide support for previous studies (e.g., Brett 1994; Ruiying and Allison 2003; Kanoksilapatham 2005; Wannaruk and Amnuai 2016; Paltridge and Starfield 2020) in which M1 was found.

Despite being a prevalent move in both corpora, a closer examination revealed that there were subtle differences in this move in terms of steps between the two disciplines. It was found that M1 is realized by four steps in the Applied Linguistics corpus while the Physics dataset revealed only the first two steps (see Table 8).

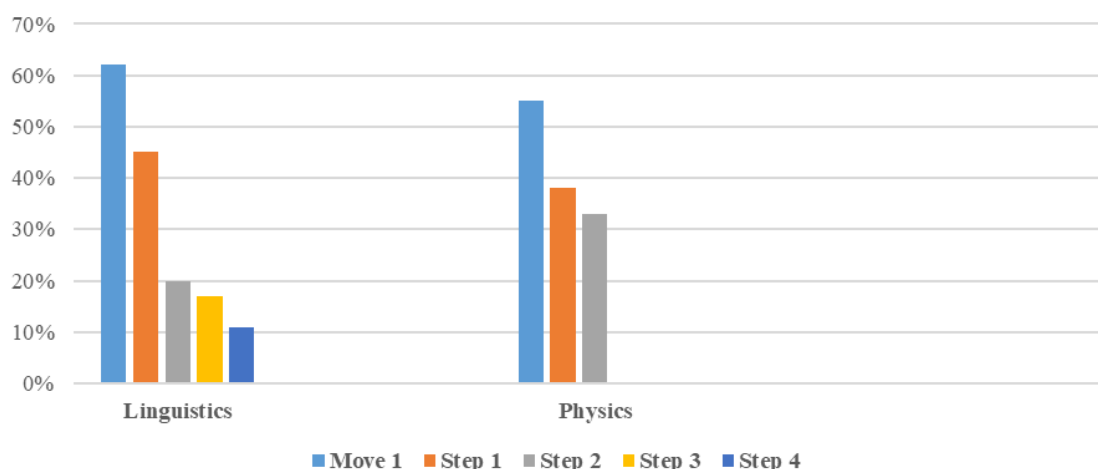


Figure 2. The frequencies of move 1 and its associated steps between disciplines.

Table 8. A snapshot of M1 and its associated steps in Applied Linguistics and Physics.

M4 (Presenting preparatory information) in Applied Linguistics and Physics	<i>Step 1: Explanatory note to set the scene</i>
	<i>Step 2: Providing background information of research aims and methods</i>
	<i>*Step 3: Restating research questions (found in the Applied Linguistics dataset only)</i>
	<i>*Step 4: Providing background information: reference to previous research (found in the Applied Linguistics dataset only)</i>

Step 1: *Explanatory note to set the scene*. As the name of the step implies, this step functions as a scene setter to the RSs in which a brief note is made to begin the section or clarify a point. Its frequencies were found to be 45 percent and 38 percent in Applied Linguistics and Physics corpora, respectively. It is, therefore, regarded as an optional step in both corpora. Examples (1) and (2) illustrate this step, and the code at the end of the example shows the RAs from which the text excerpts have been taken:

- (1) In this section, we will present quantitative and qualitative findings, first on the three questions globally.... (Applied Linguistics, 55)
- (2) In this section, we perform the numerical analysis of some observables, i.e., the deviation in the *hhh* coupling at ... (Applied Linguistics, 119)

Step 2: *Providing background information of research aims and methods*. It generally appeared at the beginning of the section; this step provides the most relevant theoretical, empirical, or informational background to help the audience to follow the findings. In other words, readers are reminded briefly of known information of research purposes and methods. While its frequency was found to be 20 percent in the Applied Linguistics, it was 33 percent in the Physics corpus. Similar to Step 1, this step can therefore be recognized as an optional one. Examples (3) and (4) illustrate this step:

- (3) The present study aims to identify the writing-specific psychological profiles of secondary school L2 students and to investigate the process of change in these profiles during a genre-based L2 writing course... (Applied Linguistics, 16)
- (4) Firstly, we investigate how the evolutionary fate of the classic peer punishment strategy is altered by Secondly, we provide case studies to Thirdly, we tackle whether (Physics, 146)

Step 3: *Restating research questions or hypotheses*. Explicitly absent from Physics texts, this step performs its communicative function by readdressing a research question or hypothesis in the Applied Linguistics corpus, where it crystallized in merely 21 percent of the texts included in the study. It thus

holds an optional status. Showing interdisciplinary difference, the total lack of this step in the Physics corpus might be closely related to disciplinary epistemologies in hard sciences in which research questions are not explicitly stated (Gray 2015: 80). It might also be considered a discursive practice to reacquaint the target readers with the significance of their research goals and purposes. Following is a representative example of this step taken from Applied Linguistics dataset:

- (5) With regard to the overall results to the three open attitudinal questions, we proposed the following hypotheses:
 Hypothesis 1: BrE will still overall be rated as ... of informants.
 Hypothesis 2: FE will be more likely named as 'best' variety.
 Hypothesis 3: The reported usage... is expected to be BrE. (Applied Linguistics, 55)

Step 4: *Providing background information: reference to previous research.* This step is different from a review of research in the introduction section of a RA in terms of communicative intentions. This step reports previous research germane to the topic being discussed in order to facilitate the intended readers' comprehension of the results and of research background (Lim 2011). Using this communicative strategy, RA writers implicitly show the familiarity with the relevant work falling within the domain as well as establish rapport with discourse community members. Similar to Step 3, this step was also exclusively used by Applied Linguists, where it occurred in merely 11 percent of the data. This step is exemplified in (6):

- (6) In this study, we investigated the writing qualities ... and identified links between writing qualities and interaction patterns (Applied Linguistics, 52).

Move (M) 2, "*Restating methodological issues; listing procedures or methodological techniques*", is utilized to show how the data of the study have been generated. Recapitulating the aims, theory or method exploited in the study, M2 informed the expected readers of how the research was carried out and what techniques or instruments were utilized in the experiments. Preparing the target readership for the main results of the study, this move encompasses further information on materials, laboratory equipment, technical procedure, conditions required for the study, the treatments given, and the steps taken in the experiment. Its frequencies in Applied Linguistics and Physics corpora were found to be 87 percent and 93 percent, respectively, thereby making it a quasi-obligatory communicative function as well as the second most frequent move discovered in both corpora (Figure 3).

The high frequency of M2 can be explicable in terms of the fact that the validity and reliability of empirical data can be rested totally upon a justified methodology as well as the selectivity and sensitivity of techniques, instruments, data collection, research design, treatments exploited in experimental research. M2 is realized by the use of two steps in both corpora. The steps include Step 1: *Citing established knowledge about procedure*, and Step 2: *Restating statistical procedures or methodological techniques*.

Step 1: *Citing established knowledge about procedure.* In this step, RA writers make the rhetorical effort to cite and recount the well-established experimental procedure of the topic generally known to the researchers in the field. Having convincing impacts, this step justifies the technique or procedure exploited and assures the target readers that the procedure adopted is well thought-out and legitimate (Kanoksilapatham 2007, 2015). Through this step, RA writers boost the international credibility of the procedure adopted and afford an opportunity to future researchers to reproduce or refine the study. Further, this is the step where the researcher strives to establish a direct link between their knowledge claims and the previous established knowledge of the other members of discourse community in order to meet the goals and to find acceptance (Lim 2011).

M2S1 was found to comprise 41 percent in Applied Linguistics whereas it appeared in 52 percent of Physics texts. Therefore, it can be concluded that the step holds an optional status in Applied Linguistics while it is quasi-obligatory in the Physics discipline. The disciplinary variation identified here seems to advocate Hyland (2009), who avers that hard science writers tend to emphasize the method, equipment, and procedure employed in their study to spotlight the experimental basis of their research for their target audience. Realizations of this step in our datasets are exemplified in (7) and (8):

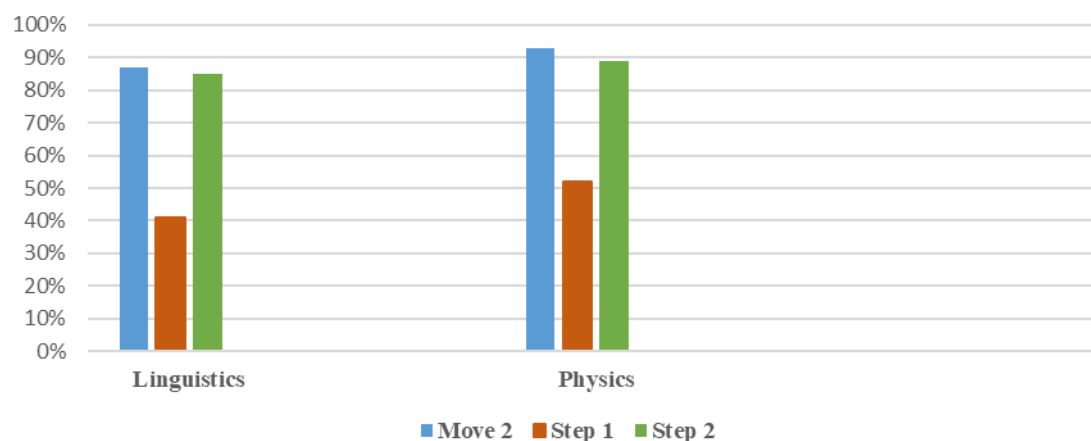


Figure 3. The frequencies of move 2 and its associated steps between disciplines.

- (7) Signal detection measures (Green and Swets, 1966; Macmillan and Kaplan, 1985) were used to provide an unbiased estimate of listeners' sensitivity ... (Applied Linguistics, 66)
- (8) The experimental procedures performed in this work are the same as those described in detail by Wolff et al. [41,47]. (Physics, 103)

Step 2: *Restating statistical procedures or methodological techniques.* The rhetorical function of this step is to restate the methodology already established in RA method sections. The various categories in M2S2 including statistical/experimental procedures afford RA writers a wide range of choices to represent their research practice (Kanoksilapatham 2007; Sheldon 2013; Paltridge and Starfield 2020). Using this step, RA writers also allude to the methodology they employed and attempt to ensure the target reader about the validity of the research findings. While this step was found to comprise 85 percent in Applied Linguistics, it occurred in 89 percent of the Physics texts. The step is, therefore, classified as a quasi-obligatory rhetorical element as well as the second most frequent step in generating RSs between disciplines. Examples (9) and (10) illustrate M2S2:

- (9) Since we only have nominal data for which we cannot assume a normal distribution, we did not conduct common t-tests, but used the approximate binomial distribution (null hypothesis $m_1 = m_2$) (Applied Linguistics, 3)
- (10) We first calculate the one-dimensional (1D) Hubbard model with the periodic boundary condition (PBC). The conventional MPS improves the accuracy about two orders of magnitude from $D = 2$ up to $D = 12$. However, even with $D = 12$, the error is nearly 10^{-3} . On the other hand, the conventional mVMC method ($D = 0$) already achieves ... (Physics, 149)

Move 3, “Reporting results” was found to be the first most frequent and prevalent move in both corpora as well as an invariable rhetorical feature of the results sections of RAs as its frequency was 100 percent in the entire datasets (Figure 4). The purpose of this move is to present key experimental and factual analytical results of the study mainly via presentation of relevant examples, numerical values as well as visual materials in the form of tables, figures, graphs, charts, diagrams or some other types of infographics.

Being a governing obligatory and ubiquitous component in producing communicative functions in RSs, this move can be, therefore, evaluated as the locus of the section. The occurrence of M3 in 100 percent of the texts is congruent with the findings reported in the literature (e.g., Ruiying and Allison 2003; Kanoksilapatham 2007, 2015; Le and Harrington 2015; Wannaruk and Amnuai 2016; Alamri 2017; Ye 2019; Paltridge and Starfield 2020). Furthermore, M3 is manifested in the Applied Linguistics corpus by the use of six steps, while its counterpart revealed merely four steps as shown in Tables 9 and 10.

Step 1: *Indicating the location of the data.* The function of this step is to show the position where the results are displayed in the form of tables, graphs, figures, or some non-verbal information (Lim

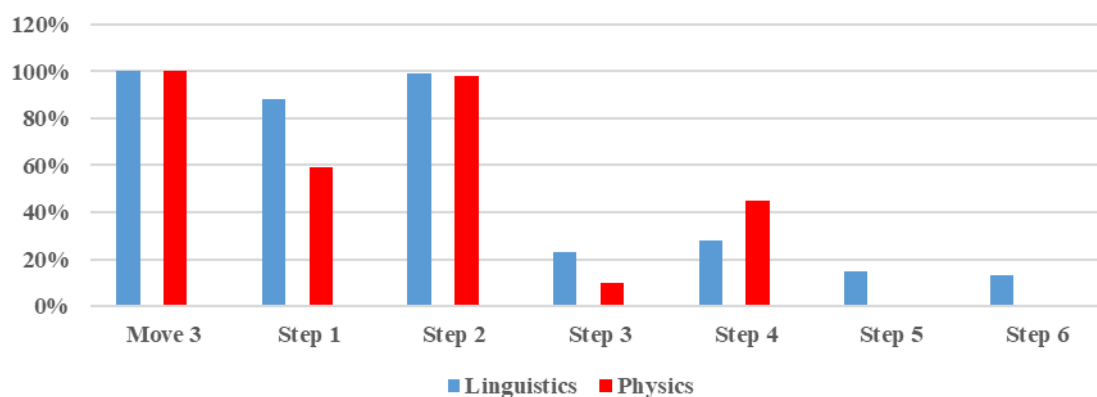


Figure 4. The frequencies of move 3 and its constituent steps between disciplines.

Table 9. A snapshot of M3 and its associated steps in Applied Linguistics dataset.

M3 (Reporting Results) in Applied Linguistics	Step 1: Indicating the location of the data
	Step 2: Describing/Explaining the facts (with/without providing statistical evidence)
	Step 3: Cataphoric reference-explanation deferred
	Step 4: Giving examples to clarify the current findings(exemplification)
	Step 5: Using (in)direct quotations from the participant(s)
	Step 6: Participant/Context description

Table 10. A snapshot of M3 and its associated steps in Physics.

M3 (Reporting Results) in Physics	Step 1: Indicating the location of the data
	Step 2: Describing/Explaining the facts (with/without providing statistical evidence)
	Step 3: Cataphoric reference-explanation deferred
	Step 4: Mathematical equation/formula

2011; Swales and Feak 2012). While this step occurred in 88 percent of the Applied Linguistics texts, it crystallized in 59 percent of the Physics corpus, thereby making the step a quasi-obligatory element for both disciplines. While analyzing the datasets manually, it was noted that among the various infographics used to report the results visually, tables and figures were the most frequent ones in Applied Linguistics whereas Physics writers incorporated figures, formulae, and tables respectively. This variety in using infographics may indicate the nature of the disciplines in which Applied Linguistics writers tend to describe and analyze texts while writers in Physics are inclined to report several experiments through formulae, reaction mechanisms, and physical objects and substances. This is illustrated by examples (11) and (12) taken from the corpora:

(11) Figure 1 reveals that there was a relatively ... (Applied Linguistics, 10)

(12) Figure 3 shows the nature of constraint on ... (Physics, 158)

Step 2: *Describing/Explaining the facts (with/without providing statistical evidence)*. Being the most frequent step, the main objective of this step is to provide legitimate reasons and (alternative) explanations for why the outcomes were obtained. M3S2 seems to function as a complementary role for M3S1 (i.e., indicating the location of the data) since it provides information that assists the intended reader in absorbing displayed outcomes. Being central for M3, this step comprised 99 percent and 98 percent in Applied Linguistics and Physics, respectively, thus making it a quasi-obligatory rhetorical device. Examples (13) and (14) illustrate this step:

- (13) There was a significant Group $\times$ Stimulus Comparison interaction, $F(3, 66) = 41.832$, $p < 0.001$, which suggests that the groups behaved differently with respect to their ability to perceive F3 differences across stimulus contrasts. (Applied Linguistics, 66)
- (14) Figure 12 focuses on a single particle. It illustrates the fact that a particle in the bunch, first accelerated and then dephased, ... (Physics, 101)

Step 3: *Cataphoric reference- explanation deferred*. This step has not to the best of the researcher's knowledge been reported in previous genre-based research and is the first newly identified step which refers to an explanation that will be provided later in the text. It appeared solely in 23 percent of the texts in the Applied Linguistics corpus while it occurred in 10 percent of the Physics texts. Therefore, this step is considered optional as exemplified in (15) and (16):

- (15) We will address the productions of speakers 3M and 5M in greater detail later upon providing additional evidence ... (Applied Linguistics, 69)
- (16) This issue will be discussed in detail elsewhere (K. Nakamura et al., in preparation) ... (Physics, 156)

Step 4: *Giving examples to clarify the current findings or using mathematical equation/formula*. While bearing the different names, this step performs similar communicative functions in both disciplines. RA writers use this step to move through a series of mathematical formulae as well as a subset of examples to support claims, explanations, arguments, and findings. RA writers might also use Step 4 to justify and underpin the validity of their findings via concrete examples and formulae. This further shows that written academic discourse is evidence-based in order to persuade the readership and may indicate that the findings of SS and HS are construed differently. While Step 4 appeared in 28 percent of the Applied Linguistics texts, it occurred in 45 percent of its counterpart, thus making it an optional feature as none reached the cut-off point of 51 percent. Examples (17) and (18) illustrate this step:

- (17) Examples from the cognitive and non-cognitive approach groups are as follows:
A member of JOC believes that Country A will get 50 gold medals. (CA)
I predict two students will participate in the overseas program. (NA)
The expected number of students may be about 5. (CA) This prediction may be false.
(Applied Linguistics, 9)
- (18) This is a good indication that the results and uncertainties are robust. We obtain an estimate of the Q_2 parameter given by

$$Q_2 = (3 \pm 3) \times 10^{-27} \text{ S}^{-2}$$

(Physics, 136)

Step 5: *Using (in) direct quotations from the participant(s)*. This is the second newly identified step in Applied Linguistics texts. While being absent from the Physics texts, it was only present in Applied Linguistics, occurring at a proportion of 14 percent. It can, therefore, hold an optional status. The complete lack of Physics writers' inclination of using this rhetorical strategy can be attributed to disciplinary factors and the nature of data or evidence in that Physics enjoys the laboratory-based nature. Example (19) is given to illustrate M3S5:

- (19) She often mentioned her group members and the group atmosphere as additional factors: "A good group atmosphere existed in my group because each member had a good idea, creative idea, we did the task in a good mood." (Applied Linguistics, 39)

Step 6: *Participant/Context description*. Occurring at 13 percent of the Applied Linguistics texts, Step 6 is to describe the participants as well as the context of the research study. Similar to Steps 3 and 5, this step is not reported in earlier studies and seems to be disciplinary-specific. For example, explicit description of participants might reflect psychological circumstances of the participants during the process of empirical data collection (Lim 2019). Example (20) is given for illustration:

- (20) What is especially evident is that she entered the Group 2 task with a much lower anticipation of success as well as a lower degree of confidence ... Her emotional state was also considerably lower in Group 2, and she began the task feeling ... (Applied Linguistics, 50)

Table 11. A snapshot of M4 and its associated steps in Applied Linguistics and Physics.

M4 (Commenting on results) in Applied Linguistics and Physics	<i>Step 1: Referring to previous research (for comparison/contrast or gaining support)</i>
	<i>Step 2: Interpreting the current findings</i>
	<i>Step 3: Evaluating the current findings</i>
	<i>*Step 4: Noting limitations (found in Physics dataset only)</i>

With regard to Move (M) 4 “Commenting on results”, it was found to be the third most frequent move discovered in both corpora, comprising four steps, the last of which was identified only in the Physics datasets (Table 11 and Figure 5). M4 is used to make comments on the results, interpret the results, compare with the related literature, and point out the strengths and limitations of the results. This move also enables RA writers to voice their opinions on the results. Furthermore, the analysis showed that RA writers draw upon four steps to realize this move.

While the frequency of M4 was found to be 83 percent in the datasets of Applied Linguistics, it occurred in 88 percent of its counterpart. It is, therefore, considered a quasi-obligatory move in both corpora. The high frequency of occurrences of this move might reflect the major role of elaborating and discussing research findings in both disciplines. Yet, despite being in agreement with some previous studies (e.g., Alamri 2017; Brett 1994; Kanoksilapatham 2015), presenting results and simultaneously discussing and commenting on them is not synonymous with the guideline suggested by the Publication Manual of the American Psychological Association (2020).

Step 1: Referring to previous research (for comparison/contrast or gaining support). The main objective of this step is to accentuate similarities or differences compared with past research, to associate the results of study with the existing established body of tacit knowledge, and to provide background information that buttresses the rationale for a research assumption or argument. Additionally, RA writers may cite earlier studies in order to broaden the realm to incorporate other supportive or conflicting research activities in the field and express their solidarity with a particular community or orientation (Swales 1990).

While this step appeared with 49 percent in Applied Linguistics texts, it occurred with 63 percent in Physics texts. It is, therefore, an optional rhetoric device in the Applied Linguistics texts whereas it achieves a quasi-obligatory status in Physics texts. The variations observed here may be the results of RA writers’ disciplinary norms and suggest the significance of intertextual links to past research in Physics. Another possible explanation is that scientific knowledge-building in the hard disciplines (e.g., Physics) is generally viewed as a cumulative endeavor which is directly based on earlier studies to improve it. While this finding is in contrast to previous studies (e.g., Ruiying and Allison 2003; Lim 2011; Wannaruk and Amnuai 2016; Alamri 2017) in which this step was evaluated as optional, it is in agreement with Ye (2019) who reports this step as quasi-obligatory. The occurrences of M4S1 are displayed in examples (21) and (22):

- (21) ... Such a position is supported by Australian style guides—for example, Peters (1995: 607) describes the proscription as... For instance, in Lee’s (2002) study of attitudes towards disputable usages, she found (Applied Linguistics, 57)
- (22) This effect, the time-of-flight dependence on transverse amplitude, is of great importance [References] for proposed accelerators... [References], where chromaticities are generally large, as well as for PRISM [Reference].... (Physics, 153)

Step 2: Interpreting the current findings. Being realized by tentative statements (i.e., verbs such as *suggest, indicate, explain*), this step allows RA writers to provide speculation on what the research findings mean. In other word, RA writers use their own viewpoints and understandings to inject meaning to data. This step, which may encompass information as well as interpretations that go beyond the objective presentation of the results (Sheldon 2013; Ruiying and Allison 2003), was found to occur at a rate of 71 percent in Applied Linguistics texts, whereas it appeared in 68 percent of the Physics samples. Examples (23) and (24) illustrate the interpretive statements of RSs:

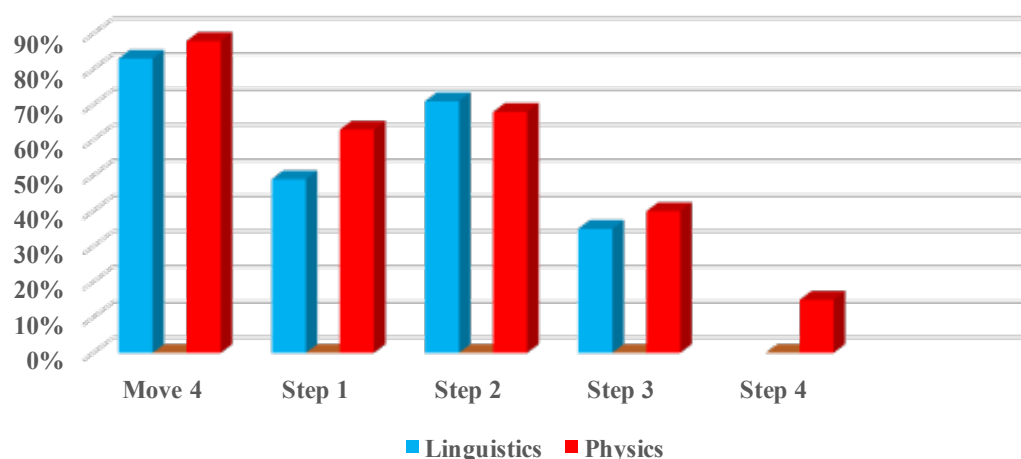


Figure 5. The frequencies of Move 4 and its corresponding steps between disciplines

- (23) It can be interpreted that a greater number of negative comments are associated with attention, control, and sense of.... (Applied Linguistics, 10)
- (24) The results can be interpreted in the context of the constrained ... with four top quarks in the final state. (Physics, 122)

Step 3: *Evaluating the current findings.* As the name of the step indicates, this is utilized to directly assess the results of the study by expressing the strong and weak points of the results (Wannaruk and Amnuai 2016), and by highlighting the implications and contributions the study made. This step is also an appraisal comment based on RA writers' subjective judgment and comments on research findings (Lim 2010). M4S3 occurred in 35 percent and 40 percent of Applied Linguistics and Physics datasets, respectively, thereby making it an optional rhetorical resource as well as the least frequent step in M4. Thus, this is in good agreement with previous studies which reported the step as optional (e.g., Ruiying and Allison 2003; Alamri 2017). Note examples (25) and (26):

- (25) Taken altogether, the findings reported in Tables 3 and 4 indicate that lexical LREs produced in small group interaction were as **beneficial** for learning as those produced in pair interaction,... The qualitative analysis of the data confirmed that learners participating as observers could also **benefit** from the LREs. (Applied Linguistics, 48)
- (26) It can also provide some insight on the initial conditions of electron injection that determines the type of trajectory. (Physics, 101)

Step 4: *Noting limitations.* Being present only in Physics datasets, this step is used to exhibit the researcher's viewpoint on the limitations of the study based on the research findings. Using this step, RA writers can aid other researchers to circumvent comparable shortcomings. Therefore, it is not expected that every research project requires discussing limitations on findings, methodology issues, or claims (Sheldon 2013). While being absent from Applied Linguistics datasets, this step appeared in merely 15 percent of the Physics texts. Example (27) illustrates the step utilized by the expert writers in the Ras:

- (27) As mentioned previously, it is difficult to reproduce experimental data of both ... and therefore we cannot quantitatively predict ... (Physics, 164)

Move 5 "Summarizing results" – the last move or a closing move in the RSs – is mainly employed to afford a short account or summary of the key findings of the study at the end of the section. While being absent in the Physics dataset, it occurred in 29 percent of the Applied Linguistics texts. Therefore, it serves as an optional communicative function in RSs and is in line with findings from other investigations (e.g., Ruiying and Allison 2003; Wannaruk and Amnuai 2016; Alamri 2017). Yet it can run counter to previous studies

Table 12. An overview of the distribution of the rhetorical moves and constituent steps.

Moves	Steps	Applied Linguistics(AL)	Physics(P)	Percentage		Status	
				AL	P		
M1: Presenting preparatory information	Step 1: Explanatory note to set the scene	ø	ø	45%	38%	Optional	
	Step 2: Providing background about research aims and methods	ø	ø	20%	33%	Optional	
	Step 3: Restating research questions or hypotheses	ø	-	21%	-	Optional	
	Step 4: Providing background information: reference to previous research	ø	-	11%	-	Optional	
M2: Restating methodological issues; listing procedures or methodological techniques	Step 1: Citing established knowledge of procedure	ø	ø	41%	52%	Optional in AL	Quasi-obligatory in Physics
	Step 2: Restating statistical procedures or methodological techniques	ø	ø	85%	89%	Quasi-obligatory	
M3: Reporting results	Step 1: Indicating the location of the data	ø	ø	88%	59%	Quasi-obligatory	
	Step 2: Describing/Explaining the facts (with/without providing statistical evidence)	ø	ø	99%	98%	Quasi-obligatory	
	Step 3: Cataphoric reference-explanation deferred	ø	ø	23%	10%	Optional	
	Step 4: Giving examples to clarify the current findings(AL)/ Mathematical equation/ formula(Physics)	ø	ø	28%	45%	Optional	
	Step 5: Using (in) direct quotations from the participant(s)	ø	-	14%	-	Optional	
	Step 6: Participant /Context description	ø	-	13%	-	Optional	
M4: Commenting on results	Step 1: Referring to previous research (for comparison/contrast or gaining support)	ø	ø	49%	63%	Optional in AL	Quasi-obligatory in Physics
	Step 2: Interpreting the current findings	ø	ø	71%	68%	Quasi-obligatory	
	Step 3: Evaluating the current findings	ø	ø	35%	40%	Optional	
	Step 4: Noting limitations	-	ø	-	15%	Optional	
M5: Summarizing results	Step 1: Re-explaining the current findings	ø	-	29%	-	Optional	

Asterisk (*) displays the presence of the move or step in two disciplines.

in which M5 is reported as a quasi-obligatory rhetorical device (e.g., Kanoksilapatham 2015; Ye 2019).

While analyzing the corpora qualitatively and manually, we noticed that the majority of RAs in Physics – whether mandated by journal policy or disciplinary writing conventions – comprised a section called *Summary*. Having different section heading labels, this label ranged from *Summary*, *Summary and Outlook*, *Discussion and Summary*, *Summary and Discussion*, to *Summary and Conclusion* to present a brief summary of the research findings followed by the results section. This can be the reason for the absence of M5 in Physics datasets. Example (28) illustrates this step:

- (28) To summarize, the analyses showed no significant posttest differences in sensitivity to the target structures investigated across the groups... (Applied Linguistics, 33)

In sum, Table 12 illustrates an overview of the distribution of rhetorical moves and constituent steps in order to offer a clear picture of the generic structures of the RSs in the two disciplines.

5 Discussion

5.1 What are the schematic structures of the results sections (RSs) of Applied Linguistics and Physics scientific papers?

In response to the first research question, the results revealed that Applied Linguistics writers exploited five moves and sixteen steps to construct RSs, while writers in Physics used four moves and twelve steps to consolidate their findings. M3 and M2 were found to be the most frequent and prevalent rhetorical units respectively, while M5 was the least frequently employed move in the studied texts. The high incidence of M3 can suggest the view that this is the central rhetorical move of results sections of different disciplines whereby RA writers reproduce the data and present the novel core research findings while M5 is the least frequent as compared to the structures of RSs, indicating that RA writers do not necessarily furnish a brief synopsis of the main findings of the study at the end of the results sections. This finding can support earlier studies in other disciplines in which M3 was the most frequent as well as an obligatory move in the results sections (Brett 1994; Ruiying and Allison 2003; Kanoksilapatham 2015; Wannaruk and Amnuai 2016; Ye 2019).

Among the constituent steps of M3, the occurrence of M3S2 (i.e., “Describing/Explaining the facts with/without providing statistical evidence”) stood out as the most frequent among disciplines while M3S6 (i.e., “Participant /Context description”) was found to be the least prevalent one. This finding can corroborate Lim’s (2010, 2011) findings on four types of commentary steps in the results section. Another move that was highly favored in both corpora was M2. This move can establish acceptability and creditability for the outcomes obtained and afford enough information on how the study was conducted in order for the target readers to evaluate the obtained results and examine whether the results actually mean what the author claims they mean (Cargill and O’Connor 2009). It can also demonstrate that RA writers do not present research findings in a purely descriptive and factual reporting fashion but that they exploit a wide range of rhetorical tactics (moves and steps) to proclaim the validity of scientific information and strengthen new knowledge claims (Paltridge and Starfield 2020). The high frequency of this move in RSs may further emphasize the communicative functions of reporting and consolidating the major research findings, and indicate that the boundary line between methods and results sections is becoming more flexible in some academic disciplines (Kanoksilapatham 2015).

As a main rhetorical tactic predominating the whole empirical research reports, reiterating methodological issues seems to be imperative in RSs as the target readership requires to obtain information on the methods to better understand and assess the results presented. This mainly arises from the varied nature of the research problems such as a wide array of research methods and paradigms (Lim 2011). Our findings can further suggest that M2 is essential among disciplines, and that student writers need to pay attention to the importance of this move when writing RSs. Moreover, this finding confirms the findings of Lim (2019) who characterizes justifications of experimental procedure as a major rhetorical category in experimental studies. Revisiting the research methodology in the results section might be interpreted as a communicative strategy to implicitly defend the validity and reliability of empirical data before presenting principal findings as well as avoiding any challenge or uncertainty with respect to the method’s scientific legitimacy (Thompson 1993). Reiterating methodological choices, last but not least, can serve as grounds for the ensuing interpretations as justifiability of the empirical results can be arguable (Thompson 1993) and as RA writers are commonly expected to justify their methodological issues more than once, especially in RSs.

All in all, the results section is commonly structured around four stages in RAs. It commences with stage one (i.e., M1) whereby RA writers present preparatory information about the research topic through setting the scene, provide background about research aims and methods, regenerate

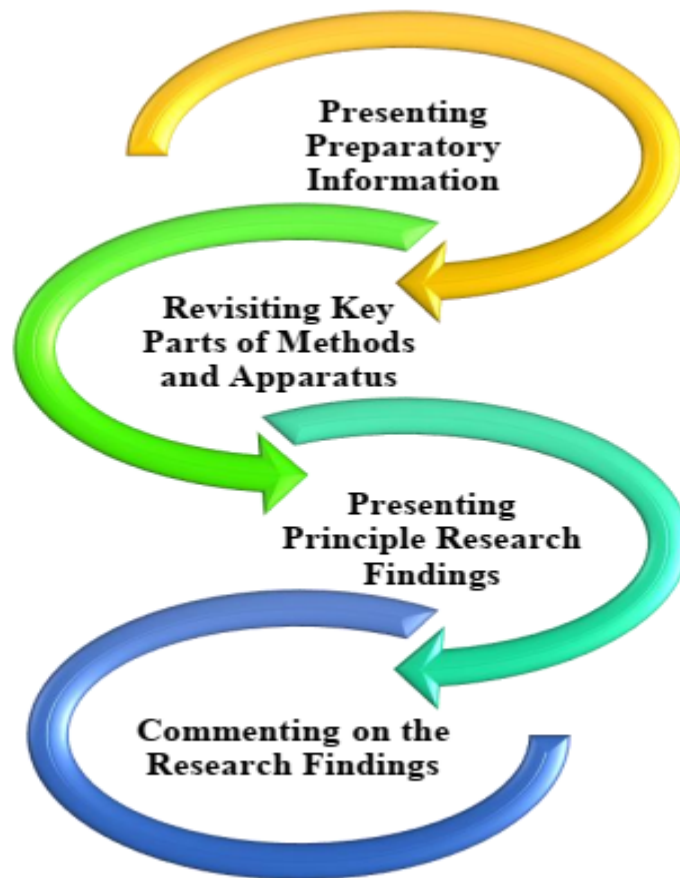


Figure 6. Four stages commonly deployed by RA writers in results sections.

research questions and hypotheses as well as cite previous studies. RA writers then cite the existing accredited knowledge and reiterate methodological issues (i.e., M2) prior to announcing their principal findings. Having prepared the ground, RA writers proceed to report empirical research findings, that is, an essential rhetorical move of results sections. Following this, RA writers make comments followed by interpreting the results, comparing with the earlier studies, as well as stating the strengths and limitations of the results (see Figure 6).

Furthermore, the coexistence of the conglomeration of rhetorical moves and associated steps each of which represented in various RA sections can make the results sections of RAs versatile enough to function as the epicenter of RAs. For example, M2, M4, and M5 and their constituent steps basically appear in Method, Discussion, and Conclusion sections respectively, but the findings of this study demonstrated that RSs can be a multilayered or multifaceted segments where the above-stated rhetorical units are legitimately incorporated. This may underline the rich repertoire of text organization of RSs as an independent identity and suggest that reporting results is not merely the function of this section.

5.2 What interdisciplinary move structure variations can be drawn between Applied Linguistics and Physics?

Regarding the second research question, the results revealed discursive similarities and differences between the two corpora. It was found that RSs in Applied Linguistics are represented as a five-move

structure comprising one obligatory move and sixteen optional steps while its counterpart revealed a four-move construction consisting of one obligatory move and twelve optional steps. The interdisciplinary differences between academic disciplines emerging from the analysis were more prevalent especially in the use of rhetorical steps (i.e., M1S3, M1S4, M3S5, M3S6, M4S4 and M5). For example, one of the noticeable variations at the step level between the two disciplines was connected with M1S3. The conspicuous absence of this step in Physics texts could be associated to disciplinary epistemologies or expectations in which writers of some hard science disciplines (e.g., Physics) rely on implicit research questions (Gray 2015), while regenerating a research question or hypothesis in Applied Linguistics may be strategically used to create circumstances for facilitating RA readers' understanding, reintroducing the overall purposes of study, and presenting research outcomes (Lim 2011).

This variation may also suggest that the demands and discursive peculiarities of the discourse community of each discipline frame their academic texts. The diversity of steps employed in Applied Linguistics can further show that the results sections in such a discipline are more diverse, elaborative, and complex compared to its counterpart whose results sections encompass fewer steps. This might suggest that the examination of steps can be a better index of (inter)disciplinary variation in research reporting genres even though an amalgam of step and move analysis may be a more powerful indicator (Basturkmen 2012; Moreno and Swales 2018). The findings can further reinforce the notion that disciplinary differences are to a great extent situated at the step level choices as well as suggesting the appropriacy of the step for examining function-form gap (Basturkmen 2012; Kanoksilapatham 2015; Moreno and Swales 2018; Ye 2019). The findings derived from this study can provide additional evidence for Moreno and Swales' (2018) recent suggestions. They opine that move analyses might acquire more informative outcomes if RAs were annotated from the step perspective. The findings of this study may also suggest that even texts from totally different disciplines can roughly correspond. Yet, further studies are required to investigate this.

As for similarities, the results of this study demonstrate that there exists a large degree of overlap in terms of communicative functions (i.e., moves) utilized in RSs and suggest that RA writers, irrespective of their disciplines, prefer to communicate the accepted rhetorical units in results sections of RA in similar ways. This may also show that the results sections are constructed similarly between disciplines, indicating that the disciplines share the same goals in introducing their research findings. The interdisciplinary similarities were observed in the use of moves. For example, M1, M2, and M4 were recognized as quasi-obligatory, and M3 held obligatory status between disciplines. This means that four out of the five moves were similarly utilized. Among identified moves, M3 "reporting results" was the frequently used move in both Applied Linguistics and Physics, presenting key findings obtained in the study. This finding is in line with the results of the studies carried out in this domain (e.g., Ruiying and Allison 2003; Basturkmen 2012; Ye 2019).

The similarities in terms of moves can provide further evidence to the fact that moves in one academic discipline can be commonly identified in another discipline (Basturkmen 2012). It seems that rhetorical devices utilized in results sections of Applied Linguistics can be broadly comparable to those of Physics and that both discourse communities structure their results sections similarly albeit these two disciplines belong to soft and hard sciences respectively. Therefore, the findings of this study are congruent with the results of existing literature and might indicate that RA writers follow the accredited conventions of the international scientific communities in general.

6 Conclusion and pedagogical implications

The present study sought to identify the generic structures of the results sections of scientific RAs between the disciplines of Applied Linguistics and Physics. In addition to offering a tentative template for the rhetorical organizations of RSs, this study identified shared and non-shared rhetorical units as well as obligatory and optional steps in the results sections between the two disciplines considered. The findings of the study also indicated that RA writers organize the contents of the results sections around

M1, M2, M3, M4, and M5 to present key experimental and factual analytical results of their studies. While M3 was the most preferred rhetorical strategy and could be the heart of RSs, M5 was found only in Applied Linguistics texts. M2 was another worthy-of-mention finding which was found to be the second most frequent move between the disciplines.

The findings generated from the study can offer a number of important pedagogical implications for teaching EAP and ESP courses, especially for Applied Linguistics and Physics teachers and students. Firstly, the findings indicated the existence of common core of rhetorical resources in writing RSs between the disciplines, albeit there are a set of certain steps playing an essential part in distinguishing textual features of each discipline as well as depicting how the results section of individual discipline are developed. The models encapsulating both moves and steps, although by no means thorough, can provide EAP as well as ESP teachers with certain rhetorical units favored by particular discourse communities. The model illustrated in this study can help student writers marshal data and ideas in congruent with disciplinary discourse. This can help instructors to draw upon these findings in order to familiarize their students with discursive practices in the relevant discourse community and to make them aware of rhetorical resources which are viewed as obligatory in the intended genres.

As with any research, the current study has several limitations, some of which can be addressed in future studies. Firstly, the present study did not carry out interview surveys to support the assumptions regarding RA writers' intentions. Conducting interviews with disciplinary informants may therefore help obtain more specific information regarding the rhetorical move used in RSs as well as the language employed in move concerned. Another limitation of this study was exploring only the results sections of RAs. There are possibilities for more comprehensive studies which could involve the four sections of RAs. Therefore, the entire research articles would merit further investigation.

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Appendix A

Information on Applied Linguistics Journals

No	Journals	No of RAs	IF
1	<i>Journal of Second Language Writing</i>	12	3.53
2	<i>Applied Linguistics</i>	10	5.74
3	<i>Language Learning</i>	12	1.65
4	<i>TESOL Quarterly</i>	9	2.25
5	<i>The Modern Language Journal</i>	16	2.78
6	<i>Language Teaching Research</i>	10	3.89
7	<i>Journal of English for Specific Purposes</i>	4	1.36
8	<i>Memory and Language</i>	3	3.059
9	<i>Studies in Second Language Acquisition</i>	10	2.83
10	<i>Language, Cognition, and Neuroscience</i>	6	2.33
11	<i>Journal of English for Academic Purposes</i>	8	2.17

Information on Physics Journals

No	Journals	No of RAs	IF
1	<i>Physical Review A</i>	6	3.14
2	<i>Physical Review B</i>	17	4.06
3	<i>Physical Review C</i>	4	3.30
4	<i>Modern Physics Letter A</i>	5	1.33
5	<i>Physics Letters A</i>	9	1.86
6	<i>Physical Review D</i>	14	5.29
7	<i>Nuclear Physics</i>	8	1.99
8	<i>Journal of Physics: Applied Physics</i>	4	2.37
9	<i>Journal of Applied Physics</i>	11	2.17
10	<i>The European Physical Journal C</i>	4	5.17
11	<i>Physical Review Letter</i>	6	9.16
12	<i>Nuclear Physics B</i>	4	3.28
13	<i>Progress of Theoretical and Experimental Physics</i>	8	2.29

Appendix B

Initial categories found in the results sections of Physics and Applied Linguistics corpora

Physics	Applied Linguistics
1. Restating research questions	1. Restating research questions
2. Explanatory note to elucidate the issue(s)	2. Explanatory note to elucidate the issue(s)
3. Explanatory note to set the scene	3. Explanatory note to set the scene
4. Providing an overview	4. Providing an overview
5. Providing background about research aims and methods	5. Providing background about research aims and methods
6. Describing research aims and methods	6. Describing research aims and methods
7. Providing background information: reference to previous research	7. Providing background information: reference to previous research
8. Review of research purposes, theory, and methodology	8. Review of research purposes, theory, and methodology
9. Review of the methodology	9. Review of the methodology
10. Explaining data analysis	10. Explaining data analysis
11. Explaining data analysis; Referring to previous research	11. Explaining data analysis; Referring to previous research
12. Describing statistical procedures	12. Describing statistical procedures
13. Citing established knowledge of procedure	13. Citing established knowledge of procedure
14. Describing procedures or methodological techniques	14. Describing procedures or methodological techniques
15. Detailing procedures	15. Detailing procedures
16. Restating hypotheses	16. Restating hypotheses
17. Interpreting statistical evidence	17. Interpreting statistical evidence
18. Indicating the location of the data	18. Indicating the location of the data
19. Referring to previous research	19. Referring to previous research
20. Describing statistical procedures	20. Describing statistical procedures
21. Explaining/interpreting the findings	21. Explaining/interpreting the findings
22. Evaluating the current findings	22. Evaluating the current findings
23. Stating difficulty in interpretation of findings	23. Giving examples to clarify the current findings(<i>Exemplification</i>)
24. Invalidating the current findings	24. Using direct quotations from the source
25. Explaining findings	25. Using indirect quotations from the source
26. Reference to previous research	26. Stating difficulty in interpretation of findings
27. Unexpected findings	27. Participant /Context description
28. Demonstrating the location of the data	28. Invalidating the current findings
29. Evaluating the current finding	29. Explaining findings
30. Reference to previous research	30. Reference to previous research
31. Noting Limitation	31. Unexpected findings
32. Claiming the value	32. Demonstrating the location of the data
33. Further research question raised by findings	33. Evaluating the current finding
34. Recommendation for future work	34. Reference to previous research
35. Cataphoric reference- explanation deferred	35. Noting Limitation
36. Mathematical Equation/Formula	36. Claiming the value
	37. Raising question to set the scene
	38. Further research question raised by findings
	39. Invalidating the current findings

Appendix C

Frequency Table of Moves and Steps

M1				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	38	38.0	38.0	38.0
	62	62.0	62.0	100.0
	100	100.0	100.0	
Physics	45	45.0	45.0	45.0
	55	55.0	55.0	100.0
	100	100.0	100.0	

M1S1				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	55	55.0	55.0	55.0
	45	45.0	45.0	100.0
	100	100.0	100.0	
Physics	62	62.0	62.0	62.0
	38	38.0	38.0	100.0
	100	100.0	100.0	

M1S2				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	79	79.0	79.8	79.8
	21	21.0	20.2	100.0
	100	100.0	100.0	
Physics	67	67.0	67.0	67.0
	33	33.0	33.0	100.0
	100	100.0	100.0	

M1S3				
Applied Linguistics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	83	83.0	83.0	83.0
	17	17.0	17.0	100.0
	100	100.0	100.0	

M1S4				
Applied Linguistics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	89	89.0	89.0	89.0
	11	11.0	11.0	100.0
	100	100.0	100.0	

M2				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	13	13.0	13.0	13.0
	87	87.0	87.0	100.0
	100	100.0	100.0	
Physics	7	7.0	7.0	7.0
	93	93.0	93.0	100.0
	100	100.0	100.0	

M2S1				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	59	59.0	59.0	59.0
	41	41.0	41.0	100.0
	100	100.0	100.0	
Physics	48	48.0	48.0	48.0
	52	52.0	52.0	100.0
	100	100.0	100.0	

M2S2				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	15	15.0	15.0	15.0
	85	85.0	85.0	100.0
	100	100.0	100.0	
Physics	11	11.0	11.0	11.0
	89	89.0	89.0	100.0
	100	100.0	100.0	

M2S3				
Applied Linguistics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	46	46.0	92.0	92.0
	4	4.0	8.0	100.0
	50	50.0	100.0	

M3				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	100	100.0	100.0	100.0
Physics	100	100.0	100.0	100.0

M3S1				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	12	12.0	12.0	12.0
	88	88.0	88.0	100.0
	100	100.0	100.0	
Physics	41	41.0	41.0	41.0
	59	59.0	59.0	100.0
	100	100.0	100.0	
M3S2				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	1	1.0	1.0	1.0
	99	99.0	99.0	100.0
	100	100.0	100.0	
Physics	2	2.0	2.0	2.0
	98	98.0	98.0	100.0
	100	100.0	100.0	
M3S3				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	77	77.0	77.0	77.0
	23	23.0	23.0	100.0
	100	100.0	100.0	
Physics	90	90.0	90.0	90.0
	10	10.0	10.0	100.0
	100	100.0	100.0	
M3S4				
Applied Linguistics vs Physics	Frequency	Percent	ValidpPercent	Cumulative percent
Applied Linguistics	72	72.0	72.0	72.0
	28	28.0	28.0	100.0
	100	100.0	100.0	
Physics	54	54.0	54.5	54.5
	46	46.0	46.5	100.0
	99	99.0	100.0	
M3S5				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	86	86.0	86.0	86.0
	14	14.0	14.0	100.0
	100	100.0	100.0	
M3S6				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	87	87.0	87.0	87.0
	13	13.0	13.0	100.0
	100	100.0	100.0	

M4				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	17	17.0	17.2	17.2
	83	83.0	83.8	100.0
	100	100.0	100.0	
Physics	12	12.0	12.0	12.0
	88	88.0	88.0	100.0
	100	100.0	100.0	

M4S1				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	51	51.0	51.0	51.0
	49	49.0	49.0	100.0
	100	100.0	100.0	
Physics	37	37.0	37.0	37.0
	63	63.0	63.0	100.0
	100	100.0	100.0	

M4S2				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	29	29.0	29.0	29.0
	71	71.0	71.0	100.0
	100	100.0	100.0	
Physics	32	32.0	32.3	32.3
	68	68.0	68.7	100.0
	100	100.0	100.0	

M4S3				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	65	65.0	65.0	65.0
	35	35.0	35.0	100.0
	100	100.0	100.0	
Physics	60	60.0	60.0	60.0
	40	40.0	40.0	100.0
	100	100.0	100.0	

M4S4				
Physics	Frequency	Percent	Valid percent	Cumulative percent
Physics	85	85.0	85.0	85.0
	15	15.0	15.0	100.0
	100	100.0	100.0	

M5				
Applied Linguistics	Frequency	Percent	Valid percent	Cumulative percent
Applied Linguistics	71	71.0	71.0	71.0
	29	29.0	29.0	100.0
	100	100.0	100.0	
M5S1				
Applied Linguistics vs Physics	Frequency	Percent	Valid percent	Cumulative percent
Linguistics	71	71.0	71.0	71.0
	29	29.0	29.0	100.0
	100	100.0	100.0	