EMPIRICAL RESEARCH ARTICLES IN APPLIED MATHEMATICS AND ECONOMICS: TWO UNDER-RESEARCHED DISCIPLINES

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Abstract

This study reports on a genre analysis investigating the rhetorical structures, specifically the Results, Discussion and Conclusion sections of empirical research articles from two under-researched disciplines, Applied Mathematics and Economics. Twenty articles were compiled for each discipline, making 40 research articles in all. Interview data were collected from authors of the articles and also specialists within each discipline (n=32). In this study, discourse analytical and ethnographically-oriented approaches were integrated for the validity of the findings. A two-level rhetorical structure (Moves and Steps) was proposed in light of specialists' contributions as actual authors of the articles in the corpus. The principal finding was the different role of Discussion in the target disciplines, which was difficult to analyse in Applied Mathematics in contrast to Economics. The findings showed the significant need for consulting specialist informants in genre analysis, which differs from the claim made by Askehave and Swales (2001) who argue that having specialist informants check the genre analysis may complicate the process.

1. Introduction

The term *genre* is interpreted in various ways with many definitions available in the literature, although there is some overlap. Genres are dynamic rhetorical responses identified on the basis of recurring rhetorical situations (Miller 1984). In the present study, we used Berkenkotter and Huckin's (1995: 477) restricted definition of genre with its emphasis on the disciplinary cultures and authors' use of genre strategically, which is compatible with the context of the present research:

> "[….] genres are inherently *dynamic rhetorical structures* that can be manipulated according to conditions of use. [Genre knowledge] is […] a form of situated cognition **embedded in disciplinary cultures**. **For writers to make things happen, that is, to publish, to exert an influence on the field, to be cited,** and so forth, they must know how to **strategically** use their understanding of genre" (emphasis added).

Swales' (1981) seminal genre analysis of Introduction sections has had profound effects on the description of academic writing. A large body of research has been conducted with the intent of identifying overall organizational patterns of research articles (RAs). There is a growing interest in studying part-genres, i.e. different sections of the article, such as Introduction sections (Alotaibi 2016). In this study, we investigated the relationship between the Results, Discussion and Conclusion sections in RAs regarding disciplinary variations by extending Yang and Allison's (2003) study in Linguistics in three ways: we broadened the scope of textual analysis by comparing Applied Mathematics and Economics, which is very little investigated (but see McGrath 2016 for an open-access research blog in Pure Mathematics); we contacted researchers who were the actual writers of the research articles in our study using e-mail interviews concerning their publications and we also conducted face-to-face interviews with academics to triangulate our data. This study will allow for a better understanding of the integration of three part-genres from two disciplines and will provide relevant information for pedagogical practice regarding the rhetorical structures of these three part-genres and other additional sections in the world of discourse. In line with our research aim, we reviewed previous studies on *Results, Discussion* and *Conclusion* sections below.

1.1 *Previous research regarding Results sections*

Results sections concentrate on new knowledge that contributes to the literature by presenting representative data, describing important findings and often featuring figures/tables. The Results sections should report the data and focus on describing the actual results which are "a scientist's description of natural reality [.…] a reflection of reality" (Swales 1990: 112). Day (1989) argued that authors should not start writing Results sections with the description of the methods. Instead, Results sections should describe "the manipulation of the data obtained from the process described in the methods section and give the empirical results from such manipulation" (Hill *et al.* 1982: 336). If authors do not have a separate Discussion section, the Discussion can be embedded in the Results, which allows authors to have more variety and flexibility (Woodford 1968). Swales and Feak (2004) affirm that result sections may or may not have subsections. Thompson (1993) conducted a case study examining 16 RAs authored by eminent biochemist Arthur Kornberg between 1948 and 1990 and 20 current RAs by other biochemists to investigate whether contextual features in Kornberg's Results sections were unusual. The corpora comprised 36 experimental RAs, all of which had separate Results and Discussion sections. The study investigated whether the scientific discourse reported only the experimental findings or whether it attempted to persuade professionals in the shared community. The findings revealed that both Kornberg and his colleagues used a variety of rhetorical Moves. Surprisingly, scientists mainly described the data and methods they employed in the Results sections. A six-move scheme was identified in the Results section. Methodological justifications (94%) and Interpretations of results (88%) occurred most frequently (cf. Brett 1994). There were no moves that referred to future research. This analysis indicated that Results sections were written with many rhetorical moves to discuss the validity of the experimental data, including high frequency of justification, interpretation and evaluation of the statements.

Brett (1994) examined Results sections on 20 sociology RAs from five journals. Brett identified 16 communicative categories/Moves classified into three main categories

in Results:→Metatextual categories→Presentation categories→Comment categories. Further questions were raised by findings, Implications of finding and Summarizing. Brett's findings provided disciplinary variation in Results sections with a cyclical patterning of Moves and only one obligatory Move, Statement of Result, which is in accord with Hopkins and Dudley-Evans' (1988) results. The most frequent combination of Move sequences, which was present in all of the reviewed articles, was Pointer (to a figure or table)-Statement of Finding-Substantiation of findings and found in all articles. Surprisingly "about 30 percent of categories used are Comments, reflecting sociologists' need to urge and persuade the reader" (Brett 1994: 55). Comment categories were found more frequently in sociology than hard sciences. Thus, "new knowledge within sociology is not as easily or objectively substantiated as the 'hard' sciences" (*ibid.*: 50). Brett's study confirmed that the big difference was not in Introduction or Discussion sections but in Results sections.

Kanoksilapatham (2005) reported on 60 selected RAs from five top biochemistry journals. The inter-reliability was 95.03%. Kanoksilapatham argued that if a Move occurred in 60% of the appropriate sections of a corpus, it was conventional. However, if the frequency of a Move was below 60%, it was optional. With Moves and Steps, Kanoksilapatham posited a 4-move scheme for Results sections. Four Moves were conventional: →Stating procedures (95%)→Justifying procedures or methodology (72%)→Stating results (100%)→Stating comments on the results (91%). In accordance with Thompson's (1993) and Brett's (1994) findings, Kanoksilapatham's study revealed that Results sections both report and comment on the data.

1.2. *Previous research examining Discussion and Conclusion sections*

We combined Discussion and Conclusion sections into one section given that the similarities between these two sections are partly conventional, depending on traditions in particular fields and journals (Swales and Feak 1994). Conclusions are regarded as part of the Discussion in which authors discuss and interpret the results of their studies, compare the results with previous studies, discuss theoretical implications and practical applications of their research and state their conclusions (Day 1989). According to scientists, particularly scientists in the life sciences, long discussion sections may mean that the Methods and Results sections are weak, whereas social scientists tend to think the opposite. Given that the Discussion section follows the Introduction, Methods and Results sections, authors assume that readers already have a shared knowledge on the research topic. Therefore, many authors choose what topic to focus on in the Discussion section (Swales and Feak 2004).

Peacock (2002) analysed the Discussion section of 252 RAs from the following seven disciplines: Physics, Biology, Environmental Science, Business, Language and Linguistics, Public and Social Administration and Law (36 from each discipline). Adopting Dudley-Evans' (1994) Move scheme, Peacock proposed the following nine-move scheme. There was no obligatory Move. The inter-rater and intra-rater agreements were both over 90%. The three highest frequency Moves were Claim (90%), Finding (84%) and Reference to previous research (73%). Important interdisciplinary differences were found. RAs in Physics and Environmental Science made significantly fewer References to previous research, Limitations and Recommendations Moves. The information Move was more frequent in Biology and Physics and less frequent in Environmental Science

and Language and Linguistics. Move 5 was more common in Language and Linguistics, which suggests that in sciences the cycle (un)expected outcome[s]+explanation is much more important than reference to previous research+claim in the sciences (Peacock 2002). This finding is in contrast with Hyland's (1998: 449) suggestion that "to a greater extent than soft disciplines, new hard-pure knowledge is typically generated by linear growth, building on prior research [...]. More than writers in applied linguistics and marketing it seems, scientists must not only present the relevant facts".

1.3. *Studies of multiple sections of research articles and the present study*

Although there is a high level of interest in part-genres, very few empirical studies have investigated the integration of or relationship between three sections of RAs. Yang and Allison (2003) reported the findings of the study that focused on the rhetorical choices of possible Results, Results and Discussion, Discussion, Conclusion, and Pedagogic Implications sections to identify organizational choices within each section. Each section was identified on the basis of communicative purposes after making reference to headings to reveal what the authors are trying to achieve in the relevant sections. Two levels of textual organization – Moves and Steps – were used. The data comprised 20 empirical RAs which were chosen randomly from four established journals of applied linguistics, *Applied Linguistics, TESOL Quarterly, English for Specific Purposes* and *English Language Teaching Journal*. They proposed a three-Move scheme comprising: Preparatory information, Reporting results and Commenting on results. The analysis revealed that both Move 2 with an average occurrence of 7.9 per section and Move 3 with 1.75 per section are obligatory Moves. Yang and Allison (*ibid.*) suggest that the Results section is cyclical across the four journals and the occurrence of five Results sections with the heading 'Results and Discussion' could be a sign of reporting the results and commenting on the results. The Moves and Steps they suggest in the rhetorical structure are consistent with the previous research (e.g. Brett 1994). On the structure of Discussions, they put forward a seven-move scheme: Background information- Reporting results-Summarizing results-Commenting on results-Summarizing the study-Evaluating the study and Deduction from the research. They posit that Commenting on results is obligatory and Reporting results can be quasi-obligatory for it occurs in all Discussion sections but one. The existence and recycling of the most frequent Moves in the Discussion sections are in line with the previous studies (Hopkins and Dudley-Evans 1988). 13 out of 20 RAs have a Conclusion section. Yang and Allison (2003) suggested a three-move scheme: Summarizing the study, Evaluating the study and Deductions from the research. These three Moves in the generic structure all are available in the Discussions. The Moves in Discussions are on the result of the study. However, the Moves in Conclusion focus on overall results and evaluation of the study. The Moves and Steps in Pedagogic Implications sections overlap with those in the Discussion and Conclusion sections. They propose a four-move scheme: Summarizing the study, Dealing with pedagogic issues, Evaluating the study and Deductions from the research.

As reviewed above, when we examined the empirical studies, there are various rhetorical structures for each part-genre which tend to be built based on available move-schemes with some modifications considering the specific characteristics of the target texts. For example, in Results sections authors tend to both announce results and inter-

pret results, which seems to be common in most disciplines. However, there are some variations between the disciplines on the rhetorical structure of Results sections that characterize the discipline itself (Brett 1994; Holmes 1997). For example, Berkenkotter and Huckin (1995) showed that in the Discussion sections authors not only refer to their own study but also include previous studies in the field, whereas Peacock (2002) suggested that the cycle (un)expected outcome+explanation was more important than reference to previous research for particular disciplines.

Previous studies are highly insightful. However, there are significant points that remain interesting and unresolved. Firstly, relatively little is known about how three sections, Results, Discussion, Conclusion and other additional/substituted sections are arranged. Secondly, little attention was given to exploring the reason for this variation, especially in disciplines such as Applied Mathematics and Economics. Thirdly, surprisingly, very few empirical studies (but see Bruce 2009) have evaluated the effectiveness of collaboration between specialist informants through including the voices of the authors of the texts themselves and genre analysts to ensure the reliability and validity of the findings. Also, to our knowledge, there is no genre study on Applied Mathematics.

Given the gaps discussed above, this study reports on a genre analysis investigating the relationship between the Results, Discussion, Conclusion and other additional sections of empirical research articles from the soft and hard sciences: Applied Linguistics, Applied Mathematics and Economics to reveal disciplinary variations.

2. Methods

In this study, the corpora consisted of the Results, Discussion and Conclusion sections of the RAs from Applied Mathematics and Economics (Table 1). After consulting the specialists in Economics and Applied Mathematics, we chose *Journal of Global Optimization* and *The American Economic Review* because the British university where this study was conducted had a subscription for these journals, so we had access to full texts of the research articles. We should highlight that while choosing empirical research from Economics, we had to collaborate with PhD candidates in the UK universities because of our limited content knowledge regarding the discourse in Economics.

No.	Title of the Journal	Abbreviation	Discipline each journal represents	No. of RAs	Running words (tokens)
1.	Journal of Global Optimization	JGO	Applied Mathematics	20	45,700
2.	The American Economic Review	AER	Economics	20	92,332
Total				**40**	**138,032**

Table 1. An overview of the corpora

2.1. *Genre analysis*

The RAs were examined twice to investigate move-step sequences. We should note that, surprisingly, there is no consensus as to the precise frequencies needed to differ-

entiate obligatory and optional moves (John Swales, personal communication, April 11, 2011). The following sentences, cited from three studies provide evidence:

> 1. "there was only one obligatory move, Statement of Result, which occurred several times, almost always…" (Hopkins and Dudley-Evans 1988: 117).
> 2. "Specifically, to be recognized as a conventional move, a move must occur in 60% of the appropriate sections in the corpus" (Kanoksilapatham 2005: 272).
> 3. "the presence of (R) Move 1, 'Preparatory information', at an average frequency of 1.65 per section, indicates that it is a frequent element in the Results section. However, it is not obligatory because there are Results sections that do not have this Move" (Yang and Allison 2003: 374-375).

There are other studies, including Holmes' (2001) and Peacock's (2002) research, which did not indicate a clear percentage for the obligatory moves:

> 4. "It seems that no move is completely obligatory. The most common moves are Move 6, Generalization, and Move 2, statement of results, but even these are omitted from four or six articles respectively" (Holmes 1997: 328).
> 5. "There was no move that appeared in all 252 RAs…Three seems to be virtually obligatory, appearing in 59% of RAs" (Peacock 2002: 489).

Given the problem discussed above, the frequency of each move was counted to identify which moves were obligatory, quasi-obligatory or optional. After personal consultation with John Swales in 2011, obligatory, quasi-obligatory and optional moves in this study were classified as follows: to be regarded as an obligatory move, a move occurred in 80% of the RAs; if it occurred in 60-79%, it was quasi-obligatory, if the move was in fewer than 59%, it was considered optional. To our knowledge, the precise frequencies needed to differentiate obligatory and optional moves have not been critically addressed in ESP so far.

Move analysis was conducted as a top-down approach with a focus on communicative purposes. In contrast to previous studies, in this study the authors' opinions and suggestions in the research articles analyses were considered while describing a move, which is a methodological contribution to the study of genre analysis. For example, one of the informants suggested that the questions in the RAs in Economics, which are followed by a clear answer, are didactic devices that prompt a question to focus the attention of the reader. The embedded moves (when two or more moves are embedded in the same sentence, they have a mixture of communicative purposes: see Bhatia 2002: 10) were not coded to keep the analysis explicit. Interestingly, the embedded moves were a combination of a shortcoming of the study and recommendation for further research as indicated in the following example:

> Unfortunately, <u>our empirical analysis is unable to distinguish between</u> the "politician preference" and…, but we hope these results are the basis for <u>further research</u> into this question. [AER10]

Here, the authors attempted to realize two purposes strategically in one sentence, indicating shortcomings and recommending future research. We sent an email to the author of the article and specifically asked what they were trying to do when building

the sentence. The author confirmed that it was a conscious choice and this sentence had two aims: indicating a shortcoming and suggesting future research. We focused on only one purpose, recommending further research, assuming that the shortcoming had been used to alleviate the negative effects and authors used it as an opportunity.

2.2. *Ethnographically-oriented approach*

Bhatia (1993) suggested that genre analysis attempts to answer the following question "Why do members of a specialist community write the way they do?" by focusing on the communicative purposes of texts, particularly the organization of texts to rationalize conventional aspects of genre construction and interpretation. Indeed, this question justifies examining the rhetorical structures of texts from different disciplines, which supports the need for genre analysis and the necessity to collaborate with the specialist informants to answer this question. As a part of ethnography, Swales's (1998: 112) *textographic* approach to genre analysis elucidates the form and formation of written texts through "exploration of their contextually embedded discursive practices". Given the importance of specialists in the literature, complementary to discourse analysis, the present research uses an ethnographically-oriented approach of academic discourse with interview data. Bhatia's (2004: 18-19) emphasis on the discourse surrounding the text is noteworthy: he states that there are four worlds of discourse: "the world of reality (i.e. the world of discourse in action), the world of private intentions (i.e. exploitations of discourse by expert and established writers), the world of analysis (the role of analytical tools), and the world of applications". Drawing on Bhatia (2004) and Swales (1998), in this study, our aim was to understand how members of a particular discourse community perceive academic writing in their discipline given that researchers should have the "passion to swim in the stream of the [informant's] experience" (Geertz 1983: 58) to access the discourse community. In this study, ethnography involved consulting specialist informants regarding journals from their disciplines; cooperating with specialist informants through face-to-face interviews; collaborating with authors of the RAs for member-checking and email interviews; and training a second-coder for inter-rater reliability regarding analyses and returning to the informants with the summary for the interview to check whether the interview data were accurately understood to provide an experimental validity check.

Informants	Department	Experience in higher education (years)	Number of publications	Working experience Journal editor
P.M.F.1	Mathematics	12	14	-
P.M.F.2	Mathematics	40	40	Editor
P.M.F.3	Mathematics	18	40	Editor
P.E.F.1	Economics	33	95	Founding editor
P.E.F.2	Economics	17	35	Co-editor
P.E.F.3	Economics	28	50	Editor
P.E.F.4	Economics	20	20	-

Table 2. Informants

2.3. *Interviews*

All interviews were audio-recorded with the informants' permission. Questions were divided into two parts. In the first part, three open-ended core questions were asked (Table 2). In the second part, four open-ended questions and one Yes/No question were asked regarding demographic information.

The second group was the authors of the RAs in the corpus. 25 authors contributed to the email interview (Table 3).

Department	Number of informants
Mathematics	9
Economics	16
Total	25

Table 3. Information about the authors

We used email interviews given their potential advantages as a research tool to reach the authors of the RAs in the corpora, who were geographically dispersed, and given the superiority of email over postal surveys with regard to response speed and cost efficiency in qualitative research (Table 4).

1. While writing your results and discussion sections do you prefer to combine them into one section or to write two separate sections (one results section and one discussion section)? Why?
2. What do you feel you always need to include in your conclusion section?

Table 4. Email interview questions

The face-to-face interview data from seven academics were transcribed and coded manually. The interview questions were strategically organized and planned (i.e. a given question within a given topic), which helped interviewees guess the next question, allowing the interviews to move fluently. Questions were divided into two parts. In the first part, five open-ended core questions were asked concerning the aim and research questions of the study. This open-ended part focused on the three-part genres, namely, the Results, Discussion and Conclusion sections due to its flexibility in (1) receiving in-depth information, (2) clarifying any misunderstanding, and (3) facilitating unexpected and unanticipated answers (Cohen *et al.* 2007). In the second part, four open-ended questions and one Yes/No question were asked regarding background/demographic information, which included their experiences teaching at higher education and the number of publication they had (see Table 5).

Salient themes were identified. As an experimental validity check, we returned to the informants with the summary to find out whether the interview data were accurately understood, and asked if the informants wanted to add further information to the already gathered data. Content analysis was employed for face-to-face and email interviews. To differentiate participants while presenting the results of our study, we used the letters E (email interview) and F (face-to-face interview). The abbreviations, such as Math=Mathematics, represent the participants' field and the third letter shows the data collection method i.e. P.Math.E.7=7th author/email interview; P.Eco.F.2=2nd academic/face-to-face interview.

A. Questions about our research

1. While you are reading an article, what is the first part that you look at after the title and abstract?

2. While writing an article, do you read the Guide to Authors part in the Journals which gives instructions about manuscript submission requirements?

3. While writing your *results and discussion* sections do you prefer to combine them into one section or to write two separate sections (one *results* section and one *discussion* section)? Why?

4. What do you feel you always need to include in your *conclusion* section?

5. Which part of the article is the most challenging for you to write: (i) the results section; (ii) the discussion section; or (iii) the conclusion section?

B. Demographic information

1. Years of experience of teaching in higher education:

2. Number of publications you have authored:

3. Experience as a Journal Editor: Yes   No   Since

    a.   If yes, in which journal(s)?

    b.   What are the most important criteria you use when deciding to accept or reject a submission for publication in your journal?

Table 5. Face to face interview questions

2.4. *Reliability and validity*

To improve reliability in the coding of the texts and to compensate for the paucity of the analyst's subject knowledge, genre analysis was validated with techniques, i.e. inter-rater reliability, member-checking and triangulation. For this study, a second-coder, maths teacher, was trained. Our cooperation involved working separately. The second-coder independently analysed the move structure of 25% of the texts, 10 RAs. Inter-reliability scores were calculated using Kappa and disagreements were discussed by comparing our analyses. The differences were mainly on the moves Interpreting results. The second-coder was provided with more analysis and we reached an agreement. The inter-rater reliability was sufficient (Table 6-7).

Section	Cohen's κ	Percentage
Results	0.88	93.9
Discussion	0.75	87.5
Discussion and Conclusions	0.78	88.9
Conclusion	0.78	88.9
Average	**0.80**	**89.8**

Table 6. Inter-coder reliability analysis of the four sections in five articles from JGO

Section	Cohen's κ	Percentage
Results	0.85	92.5
Discussion	0.77	88.7
Discussion and Conclusions	0.73	86.3
Conclusion	0.70	84.9
Average	**0.76**	**88.1**

Table 7. Inter-coder reliability analysis of the four sections in five articles from AER

3. Results and discussion

The rhetorical structures identified in this study are flexible and the number of rhetorical Moves and Steps may change in each section. Although the sequence of Moves and Steps in each cycle tends to follow the order of presentation in the tables below, variation in the order of both Moves and Steps is possible.

3.1. *Results sections*

The Results section is the largest section of the RAs in each discipline. In this study, the organization of the moves in the results section is cyclical across disciplines, but varies in the number of Moves, Steps and their frequencies (Table 8). The genre analysis in JGO gives the following seven rhetorical Moves: two obligatory, Preparatory information (100%) and Reporting results (100%); one quasi-obligatory, Referencing to previous studies (60%), and four optional Moves, Asking a didactic question to guide the reader (5%), Interpreting results (45%), Evaluating the study (40%), and Deductions from the research (10%). AER covers nine rhetorical Moves: four obligatory Moves, Preparatory information (100%), Reporting results (100%), Interpreting results (95%), and Referencing to previous studies (90%); Evaluating the study (65%) is a quasi-obligatory Move, and four optional Moves, Asking a didactic question to guide the reader (35%), Summarizing results (25%), Deductions from the research (10%), and Implications for the economy (5%).

3.1.1. *Characteristics of moves in the Results sections*

Move–Preparatory information functions as a connecting link between sections (Yang and Allison 2003), which can be seen as a guiding outline to readers. This Move can occur anywhere in the Results sections.

Step–Pointers guide the reader to other parts of the texts, including what the tables/figures/columns show and indicating the order of the content of the article.

> *Figure 1 provides a graphical display of performance differences on the two types of comprehension.*[TQ1]

Step–Foregrounding present research is defined as specific information on the study, including the aim and research questions of the study, hypothesis, denotations, procedures and methodological techniques, statistics, testing, exemplifying and setting

up experiments to contextualize the research. This term was borrowed from Holmes (2001) who uses 'Foregrounding present research' as a Move in his study.

> *We test and compare the performance of the proposed algorithm with those of the basic MS algorithm and Globsol.* [JGO3]

Step–Presenting background information is information that is generally known in the field.

> *Globsol is a well-known self-contained interval global optimization based FORTRAN 90 package to solve constrained and unconstrained global optimization problems.* [JGO3]

Step–Reminding the reader of information from the previous section reminds the reader of important/necessary information/interpretation from other parts of the article.

> *In the previous section we presented…*[AER6]

Move–Asking a didactic question to guide the reader is a didactic device that prompts a question to focus the attention of the reader, which is followed by a clear answer.

Move–Reporting results presents the findings objectively and does not include any comments of the author.

> *…by Theorem 2.1, we find a point x satisfying f (x)< f (x*☐*…*[JGO4]

Move–Interpreting results indicates the author(s)' subjective comment(s) on interpretation(s) of the results.

> *Perhaps another issue affecting trade dynamics in Korea and Thailand is that these devaluations did not really occur in isolation; …* [AER16]

Move–Referencing to previous studies provides relevant studies from the literature**.**

Step–Providing information from the literature

> *the solution of the system (4) can provide the correct coordinates of the atom only if these coordinates are also solution for the original system (3).* [JGO5]

Step–Comparing methods/approaches/algorithms with previous studies indicates the differences and similarities with the methods/approaches/algorithms that have been used before on the same topic.

> *The method we use for generating such instances is similar to the one proposed in [11].* [JGO5]

Moves	Steps	JGO Total number of moves or steps	JGO Average occurrence per section	AER Total number of moves or steps	AER Average occurrence per section
(R) Move—Preparatory information	Step-Pointer	134	6.7	360	18
	Step-Foregrounding present research	376	18.8	569	28.45
	Step-Presenting background information	24	1.2	50	2.5
	Step-Reminding the reader of information from the previous section	0	0	21	1.05
	Total in move	**534**	**26.7**	**1000**	**50**
(R) Move—Asking a didactic question to guide the reader		1	0.05	14	0.7
(R) Move—Reporting results		419	20.95	1345	67.25
(R) Move—Interpreting results		29	1.45	243	12.15
(R) Move—Referencing previous studies	Step-Providing information from the literature	15	0.75	16	0.8
	Step-Using a method /procedure from the literature	23	1.15	11	0.55
	Step-Using an example from the literature	3	0.15	0	0
	Step-Indicating the niche/gap	0	0	1	0.05
	Step-Comparing the approach /method with other approaches	24	1.2	0	0
	Step-Comparing the results with the literature	10	0.5	77	3.85
	Total in move	**75**	**3.75**	**105**	**5.25**
(R) Move—Evaluating the study	Step-Indicating significance/advantages	0	0	21	1.05
	Step-Indicating limitations	4	0.2	16	0.8
	Step-Presenting shortcomings	8	0.4	18	0.9
	Step-Indicating challenges/difficulties	4	0.2	8	0.3
		0	0	6	0.4
	Total in move	**16**	**0.8**	**48**	**2.4**
(R) Move—Implications for the economy		0	0	1	0.05
(R) Move—Deductions from the research	Step-Making suggestions	9	0.45	0	0
	Step-Recommending further research	4	0.2	2	0.1
	Total in move	**13**	**0.65**	**2**	**0.1**
	Total	**1087**	**54.35**	**2757**	**137.85**

Table 8. Frequency of Moves and Steps in Results sections in JGO and AER

Step–Using a method/procedure/algorithm from the literature shows the previous methods/approaches/algorithms the authors use from the literature.

> *This is based <u>on the approach proposed by Rajan and Zingales (1998)</u>, suitably adapted for our different level of aggregation.* [AER17]

Step–Indicating the niche/gap

> <u>*most of the extensive empirical literature on productivity cannot precisely distinguish productivity from capacity utilization*</u>. [AER1]

Move–Evaluating the study pinpoints the strengths and caveats of the study.
Step–Indicating significance/advantages

> *<u>the heuristic method has its advantage</u> when dealing with dense and larger networks.* [JGO10]

Step–Indicating limitations

> *<u>The main limitation of the algorithm is</u> the time consuming step of the completeness test.* [JGO6]

Step–Indicating shortcomings explicitly highlights possible problematic features/caveats/drawbacks of the method/algorithm used.

> *One <u>drawback</u> in the application of the above–mentioned algorithms comes from smooth and…*[JGO17]

Step–Indicating challenges/difficulties

> *The estimation of equation (1) with log (f h jkit) as the <u>dependent variable faces a few econometric challenges</u>,*[AER1]

Move–Implications for the economy announces a possible future effect or result of the study.

> *a large proportion of subjects…voted to remain in a prisoner's dilemma game is of interest and <u>has implications for the large political economy literature</u> on inefficient police.* [AER14]

Move–Deductions from the research extends beyond the results and often occurs at the end of the Results section.
Step–Making suggestions presents other alternative/possible ways (e.g. methods) to reinforce the applicability of an approach.

> *<u>alternative models to model</u> (18) <u>can be used for computing supported solutions</u>,* [JGO8]

Step–Recommending further research

> *The effectiveness of this proposal <u>could be investigated in a future research</u>*. [JGO10]

3.2. *Discussion sections*

An unexpected finding was that there is only one separate Discussion section in JGO, which was the most challenging text for us to assign a Move (Table 9). We hesitated as to whether the Discussion sections in Mathematics focus on simply presenting the Results or on interpreting them to the reader. We could not find a Move that could be assigned as Interpreting results. Thus, we examined the responses from the author in the email interviews and academics in the face-to-face interviews to find a clue. Surprisingly, the authors of the article pointed out they prefer to combine Results and Discussion in the email interview, even though the RA we analysed had two separate sections. Discussion sections in the words of the two authors:

> P.Math.E.13: … *a summary of the theoretic and numeric results…*
> P.Math.E.11: … *highlight the impact of the obtained results in connection to their possible applications or as starting point for possible further developments of the topic...*

Our perception matches the first author's perception but is different from that of the second author, who discusses "possible applications". To find an answer, we contacted the first author of the article for member-checking. The author examined our Moves with the description of each Move and responded with an email. In contrast to previous member-checks, in this article there were a few disagreements and the inter-reliability was the lowest among the nine member-checks (58.8%). When we examined the author's comments, all the Moves in the Results section and their descriptions were compatible with his intentions. However, as we expected, there were disagreements in the Discussion section. We examined our analysis again in light of the author's explanation during member-checking and agreed with the author of the article and corrected our mistake in our genre analysis. Below is a sample disagreement for member-checking:

> <u>*We observe that*</u> *concerning the number of boxes processed, number of bisections, and the computational time, the average percent reduction obtained with the proposed algorithm over the MS algorithm is 97.52, 97.52, and 79.7%....* [JGO3]

Our interpretation: Reporting results.
Author's comment: Not "reporting results". These are observations made on the results reported.

> *[…]* *concerning the number of boxes processed, number of bisections, and the computational time, the average percent reduction obtained with the proposed algorithm over Globsol is 77.01, 88.51, and 98.2%, respectively.*

Our interpretation: Reporting results.
Author's comment: Not "reporting results". These are observations made on the results reported.

We suggest that the Discussion section in Mathematics is not organized in a traditional way and contrasts with that of other disciplines; this needs to be researched further by consulting the specialists. This disagreement may indicate that a linguist may not be able to ascertain the intention of the author, and it is likely that a lack of subject knowledge/experience in the field is a reason for the disagreements, which shows the effectiveness of cooperation, particularly with the authors of the RAs, to provide accurate information to contribute to the literature. This finding is in line with Bhatia (1993) who highlights the need to consult specialists, in contrast to Askehave and Swales' (2001) claim.

Our findings show that Discussion sections in Economics have six rhetorical Moves (Table 8). There are three obligatory Moves, Preparatory information (100%), Reporting results (100%), and Interpreting results (100%); two quasi-obligatory Moves, Referencing to previous studies (66.6%), Evaluating the study (66.6%); and one optional Move, Asking didactic question to guide the reader (33%).

3.2.1. *Characteristics of moves in Discussion*
Move–Asking didactic questions to guide the reader

> *Given this observation, at minimum I can ask: <u>What degree of</u> systematic measurement error is necessary to reverse my results*? [AER12]

Move–Reporting results

> <u>*the hypothesis of risk preferences is rejected by the data*</u>. [AER8]

Move–Interpreting results

> *and principals and agents <u>may fine tune</u> their contract decisions to their individual distributional tastes.* [AER15]

Move–Referencing to previous studies
Step–Using a model/an approach from the literature

> *We use the following strongly consistent estimator suggested by <u>Christian Gouriéroux, Alain Monfort, and Alain Trognon (1984)</u>.*[AER8]

Step–Comparing the results with the literature

> <u>*A recent study by Sydnor (2006)*</u>*, however, <u>finds that</u> a variant of cumulative prospect theory…in which payments made for purchase are treated as negative gains …* [AER8]

Move–Evaluating the study
Step–Indicating significance/advantages
Step–Indicating limitations

Moves	Steps	JGO		AER	
		Total number of moves or steps	Average occurrence per section	Total number of moves or steps	Average occurrence per section
(D) Move—Preparatory information	Step-Pointer	2	0.1	40	2
	Step-Foregrounding present research	1	0.05	62	3.1
	Step-Presenting background information	0	0	8	0.4
	Total in move	**3**	**0.15**	**110**	**5.5**
(D) Move—Asking a didactic question to guide the reader		0	0	2	0.1
(D) Move—Reporting results		12	0.6	111	5.55
(D) Move—Interpreting results		0	0	20	1
(D) Move—Referencing to previous studies	Step-Using a model/an approach from literature	0	0	3	0.15
	Step-Indicating the niche/gap	0	0	1	0.05
	Step-Comparing the results with the literature	0	0	13	0.65
	Total in move	**0**	**0**	**17**	**0.85**
(D) Move—Evaluating the study	Step-Indicating significance/advantages	1	0.05	4	0.2
	Step-Presenting shortcomings	0	0	1	0.05
	Total in move	**1**	**0.05**	**5**	**0.25**
	Total	**16**	**0.8**	**265**	**13.25**

Table 9. Frequency of Moves and Steps in Discussion sections in JGO and AER

3.3. *Conclusion sections*

There are 16 RAs that have Conclusion sections in JGO with six rhetorical Moves (Table 9). There are two obligatory Moves, Summarizing the study (100%) and Summarizing the results (93.8%); one quasi-obligatory Move Evaluating the study (62.5%) and three optional Moves, Preparatory Information (6.3%), Referencing to previous studies (12.5%), and Deductions from the research (43.8%).

There are 18 RAs in the AER that have Conclusion sections with nine rhetorical Moves (Table 10). Three Moves are obligatory, Summarizing the study (83.3%), Summarizing the results (83.3%), and Evaluating the study (83.3%); two quasi-obligatory Moves, Referencing previous studies (72.2%), and Deductions from the research (72.2%), and five optional Moves, Preparatory information (16.7%), Asking a didactic question to guide the reader (27.8%), Interpreting results (22.2%), and Implications of the research (22.2%) are identified.

3.3.1. *Characteristics of moves in Conclusion*

Move–Interpreting results *…households <u>may have incorrect subjective beliefs</u> about their claim rates.* [AER8]

Referencing to previous studies
Step–Using a model/procedure

> *… we adopt the procedure <u>from Thierry Mayer and Soledad Zignago (2006), which is based on Keith Head and Mayer (2000)</u>…* [AER13]

Step–Indicating a niche/gap

> *… given the vigor of recent debates on biased technical change (Acemoglu 2002a) … disentangling these effects <u>has remained a key, unresolved matter</u>.* [AER18]

Step–Comparing the results with the literature

> *…while we have focused attention on…, <u>we also find, like Das, Roberts, and Tybout (2007) find</u> using Colombian manufacturing data,*[AER4]

Evaluating the study
Step–Indicating significance/advantages

> *<u>We have developed models that can be used to fully identify</u> the set of efficient solutions with respect to a given set of preferences.* [JGO8]

Step–Indicating the challenges/difficulties

> *<u>The obvious problem with this approach is that</u>, for practical purposes, the econometrician may not have good instruments and enough observations…*[AER18]

Step–Presenting shortcomings

The distances between the hydrogens that are given to the BP algorithm may not be so accurate, … <u>a few of these distances could be wrong</u>. [JGO5]

Move–Implications for economy

If individuals were fully informed, their choices would be given by the model estimated above, <u>but would satisfy three additional restrictions</u>: the coefficient on premiums is equal to that on expected outof-pocket costs… [AER2]

Move–Deductions from research
Step–Recommending further research

We hope to look <u>in part at this issue in future work</u> by studying whether the effect of democracy depends on the size of groups. [AER14]

3.4. *Other additional concluding sections*
Closing sections in AER are confined with Discussion and Conclusion, 4 and 2 sections respectively. When the results of Move analysis for each additional section are examined, it is evident that each specific section title represents the nature of the Moves to close the RA. For example, in Limitations and Implications sections*,* the dominant Step is Indicating the Limitations.

3.5. *Comparison of two disciplines*

3.5.1. *Results sections*
There are seven rhetorical Moves in JGO and nine in AER. The Move sequences and their frequencies in two disciplines are different, but they have five common Moves: Preparatory information, Reporting results, Interpreting results, Referencing to previous studies, and Deductions from the research. This study shows that Preparatory information and Reporting results are common obligatory Moves in each discipline in Results sections. Furthermore, Move Reporting results is usually accompanied by a pointer. Interpreting results is optional in JGO (45%) but obligatory in AER (95%).

When the RAs are examined, the authors in JGO and AER tend to write Results and Discussion sections together in the Results section, which may be a characteristic of the hard sciences to highlight the significance of Results by implicitly discussing findings. Authors tend not to allow the findings to speak for themselves and scientists "act not only as reporters but as rhetors by couching their experimental results in a variety of moves" (Thompson 1993: 109). The Results section is generally supposed to present findings objectively. However, we have observed that the results reported are accompanied by some interpretations. This finding confirms those of previous studies (Brett 1994; Bruce 2009; Kanoksilapatham 2005; Thompson 1993). Surprisingly, the Move Referencing previous research does not feature in most of the previous studies in Results sections (e.g. social sciences, Brett 1994; medicine, Williams 1999), but Thompson (1993) and Kanoksilapatham (2005) report that this Move is available in the Results sections of biochemistry RAs, and they stated that it is rather unique to biochemistry.

Moves	Steps	JGO		AER	
		Total number of moves or steps	Average occurrence per section	Total number of moves or steps	Average occurrence per section
(C) Move- Preparatory Information	Step-Pointer	1	0.05	2	0.1
	Step-Foregrounding present research	0	0	31	1.55
"	Step-Presenting background information	0	0	1	0.05
	Total in move	**1**	**0.05**	**34**	**1.7**
(C) Move-Asking a didactic question to guide the reader		0	0	5	0.25
(C) Move-Summarizing the study		47	2.35	70	3.5
(C) Move-Summarizing results		39	1.95	121	6.05
(C) Move-Interpreting results		0	0	10	0.5
(C) Move-Referencing previous studies	Step-Providing information from the literature	4	0.2	10	0.5
	Step-Using a model/an approach from literature	0	0	2	0.1
	Step-Indicating the niche/gap	0	0	3	0.15
	Step-Comparing the results with the literature	3	0.15	26	1.3
	Total in move	**7**	**0.35**	**41**	**2.05**
(C) Move-Evaluating the study	Step-Indicating significance/advantages	23	1.15	26	1.3
	Step-Indicating limitations	2	0.1	5	0.25
	Step-Indicating the challenges/difficulties	0	0	3	0.15
	Step-Presenting shortcomings	2	0.1	0	0
	Total in move	**27**	**1.35**	**34**	**1.7**
(C) Move 8-Implications (for the Economy)					
(C) Move 9-Deductions from the research		0	0	14	0.7
	Step-Recommending further research	13	0.65	25	1.25
	Total in move	**13**	**0.65**	**25**	**1.25**
	Total	**134**	**6.7**	**354**	**17.7**

Table 10. Frequency of Moves and Steps in Conclusion sections in JGO and AER

In contrast to Kanoksilapatham's (2005) findings, it is also particularly striking that this Move is available in each discipline in the corpora in the Results sections. Authors tend to refer to previous studies for different purposes, including comparing results with the literature, providing information from the literature using a method from the literature, and indicating a gap in the literature. There is a consensus on the interpretation of this Move among researchers that authors' citing of established research is rhetorical work to promote them and to find a place within the community (Gilbert and Mulkay 1984). They are implicitly attempting to situate their new findings (Berkenkotter and Huckin 1995), and they sometimes focus on a niche to justify their own research (Peng 1987; Swales 1990) to highlight the need for the study. This may be an indication that authors attempt to situate their research within the already established scientific community.

Some noteworthy differences are also found in the frequency of Moves. The frequency of Referencing to previous studies is high in the hard sciences. It is an obligatory Move in AER (90%) and it is quasi-obligatory in JGO (60%) in the Results sections. The analysis reveals that the authors in JGO and AER are referring to the literature for various purposes, including using a method/an example from the literature or comparing the approach/method with the literature. Moreover, in line with the observation by Hyland (1998), who suggests that authors in hard sciences build on previous studies, authors are referring to previous studies in Results section in JGO and AER.

The most notable difference is the presence of the Move Evaluating the study, which is identified in JGO and AER in the Results sections. The authors in JGO and AER start evaluating their studies when they announce their findings. What is interesting is that the authors in both disciplines do not concentrate on the significance of the study with a positive evaluation: instead their focus is a negative evaluation and shows limitations and shortcomings and discusses the challenges they face. This contrasts with Conclusion sections, which will be discussed later. A possible explanation for this could be the nature of the research topics the disciplines addressed, which mainly require using methods and algorithms that might have potential caveats. This attempt may be considered as an action to support the research by highlighting a potential problem. This has the effect of showing the real problems, with a likely ultimate goal of increasing the readers' confidence in the study.

Authors in AER mainly described the data and methods they employed in the Results sections in contrast with the authors in JGO, a result that would appear to give support to Thompson's (1993) and Holmes's (2001) findings that showed that scientists mainly described the data and methods they employed in the Results sections. However, in contrast with Thompson's (1993) findings, Results sections in JGO and AER include the Step Recommending future research.

3.5.2. *Discussion sections*

In JGO, there is only one separate Discussion, and in AER only three. This suggests that disciplinary variation is discernible and that authors are following the conventional practices in their disciplines, which are apparent even when looking at the format of the Discussion sections in the RAs. However, due to the small amount of data analysed, it is unclear at this point whether the rhetorical structure suggested in this study for the Discussion sections in Applied Mathematics and Economics mirrors the disciplines'

conventional practices. This raises the following question to investigate: Do authors prefer to implicitly embed their interpretations in the Results section?

In JGO and AER, the frequency of Move Interpreting the results outnumbers Reporting the results in Discussion sections. This finding corroborates previous studies (Basturkmen 2009; Hopkins and Dudley-Evans 1988; Kanoksilapatham 2005; Peacock 2002; Yang and Allison 2003). Surprisingly, in contrast to most of the previous studies cited above, the Moves in Discussion sections in Mathematics seem to focus on Reporting results. This result is consistent with the findings of Peng (1987: 104), who found that "Discussion answers the [research questions] and does not comment on wider implications of the results" in chemical engineering RAs. A possible explanation for this could be that the authors in Mathematics may be writing in such a way as to make their discussion credible and objective by focusing on the findings of the study. It is also noteworthy that there is a uniformity between the Reporting results (100%) and Interpreting results (100%) in the three separate Discussion sections in AER, which needs to be explained in future studies to justify this finding.

3.5.3. *Conclusion sections*

It is also particularly striking that when the frequencies of the Conclusion sections are compared, JGO and AER have high percentages. There are 16 RAs that have separate Conclusion sections in JGO and 18 in AER. Bunton (2005) suggests that Discussions are more common in the literature than Conclusions, which can be seen as an alternative name for the Discussion. On the contrary, our findings show that Conclusion sections have a special emphasis in JGO and AER. As one author from AER writes:

> P.Eco.E7: *"I think in the type of Economics I am doing a conclusion is necessary. The reason being is that it is clear that the analysis in my paper will be the last word on the topic…".*

The genre analysis shows that Conclusion sections JGO has eight rhetorical Moves, and AER has nine. The Move sequences in the two disciplines show that Conclusion sections summarize the research by highlighting the findings. Similarly, in the email interview, when we asked the actual writers what they always need to include in their Conclusion sections, in the email interview, 12 interviewees out of 16 focused on the summary of the results, which confirms the findings of the genre analysis. The Move Evaluating the study is obligatory in AER and quasi-obligatory in JGO. Evaluating the study is identified in the two disciplines in the Conclusion sections. In contrast with the Results section, authors often focus on the significance of the study.

We next compare the findings in the Results and Discussion sections to show the strategies the authors use. For example, when we look at the Conclusion Tables of AER, we see 14 sentences that highlight the significance and only three sentences that show limitations of the study, whereas the Results sections for the same Move concentrate on the negative aspects. One reason for this could be the preference to conclude the article with a successful evaluation rather than a negative one, highlighting the contribution of the study. We might also note that the findings in Conclusion sections reveal a strategic use of embedded Moves where authors in AER tend to combine a shortcoming of their study with a recommendation for a further research in a sentence. Alleviating the

negative effects of the caveats of the research probably is a reason for this rhetorical usage.

3.6. *Email and face-to-face interview analyses: Specialist informants' perspectives*

3.6.1. *Results and Discussion sections*
Data from the email interview showed that most of the authors, 11 authors in AER, prefer to combine Results and Discussion sections for various reasons, including saving space. Interestingly, authors in AER preferred to separate sections focused on each section's particular characteristics. One author stated:

> *P.Eco.E.28*: *Some discussion goes together [with] the results. More speculative ideas are in a separate section.*

Interestingly, both the authors in JGO and AER who preferred to separate sections focused on each section's particular characteristics. One author asserted:

> *P.Math.E.13*: *… because the results section is for numeric results/calculations including figures and tables. The discussion section is a summary of the theoretic and numeric results [and] an outlook to further research.*

In Mathematics, all the three academics agreed to combine Results and Discussion sections. However, they stated that they also separated, albeit occasionally.

> *P.Math.F.2*: *[T]he first stage putting together … because usually when we got some results.*

At first, academics in Economics stated that they found our question difficult to answer, so their answers exhibit variety. When we asked their personal choice, they all stated that they prefer Results and the interpretation of the Results to be presented in the same section.

> *P.Eco.F.1*: *Depends on what I am writing.*
> *P.Eco.F.2*: *In Economics, we do not have these distinctions between Results and Discussion. Typically, what we have these Results and then Conclusion or sometimes we call Discussion to Conclusion. But it is not tough.*

Authors and academics from both disciplines put a great deal of emphasis on combining Results and Discussion sections. However, one author noted including methodology as a contribution to the literature:

> *P.Math.E.15*: *I would like to always conclude with a few lines on the outcome of our research methodology and maybe add a comment on its potential.*

3.6.2. *Writing Conclusion sections*
The email interview data show agreement among the authors that the main findings of the study, contribution to the literature and future research, should be included in the Conclusion. When we asked for their personal choice, they highlighted that they

prefer Results and interpretation of the Results to be presented in the same section. Academics in Economics suggested that, while writing Conclusion sections, they focused on reporting main results, the contribution of the study, limitations, implications for the economy, shortcomings and future research. What emerged from the interview analysis is that authors and academics that have provided the insider knowledge have enriched our understanding of discourse community in two disciplines, which contrasts with Swales' (1990: 47) claim. Swales posited that insider knowledge is the main reason for the genre's complexities and the complexities may arise from various kinds of insider knowledge (Askehave and Swales 2001). The data collected from 32 informants do not support this claim. On the contrary, the interview data make sense of the Move analysis and deepen our understanding of why writers prefer certain Move structures. On the other hand, our findings can be a contribution to Swales' (1990) inquiry on Discussion sections. Specifically, our findings are in line with Swales' statement (*ibid.*: 170) that "even if a majority of RAs have closing Results and Discussion sections, others coalesce two, while even others had additional or substituted sections labelled Conclusions, Implications or Applications and so on". The findings showed us that the closing parts in AER do not include any other section at all, which suggests that it could be a characteristic of Economics or maybe of hard sciences. The analysis revealed that authors report the findings and interpret them in light of previous research in Results sections in AER. However, authors in AER tend to discuss their findings in Results section, which is even clear from the section titles. The main purposes of Conclusion are summarizing the study, highlighting main findings, evaluating the study and recommending further research.

4. Implications for future research

We examined the research articles in two under-researched disciplines: Applied Mathematics and Economics. To our knowledge, this study is the first attempt in the literature to triangulate both methods and data with inter-coder reliability and member-check the reliability and validity of the findings while conducting a genre analysis.

One of the key contributions of this study is the significance for collaboration with the specialists in the disciplines, given that learning a discipline implies learning a specialized discourse (Hyland 2006). The Discussion section in Mathematics may be a good example to show the positive effects of collaboration with specialists while addressing genre analysis. Our study showed that Bhatia (1993: 16) rightly pointed out that Swales (1981, 1990) "[may] underplay psychological factors [that reveals the cognitive structure], thus undermining the importance of tactical aspects of genre construction, which play a significant role in the concept of genre as a dynamic social process, as against a static one". Bhatia suggested the importance of consulting specialist informants to guide the analyst to describe and clarify the genres, which would provide validity of the findings as a psychological reality to the analysis. Askehave and Swales (2001) replied to Bhatia's (1993) criticism by arguing that having specialist informants check the findings/analysis may complicate the process by adding communicative purposes. Swales (1990: 47) stated that insider knowledge is the main reason for a genre's complexity and the complexities may arise from various kinds of insider knowledge. "[T]he spectres of strategic manipulation and private intentions are all too likely to add

further elements to the 'set' of communicative purposes and thus further complicate the ascription process" (Askehave and Swales 2001: 199). However, our collaboration with the specialists in Applied Mathematics and Economics were in contrast with Askehave and Swales' claim. The data obtained from this study can be used to provide valuable contributions for beginner students and academics and to design authentic materials in the mainstream classrooms.

Acknowledgements

References

Alotaibi H.S. 2016. The research gap in the introductions of Arabic research articles. *ESP Across Cultures* 13: 1-17.

Askehave I. and J.M. Swales 2001. Genre identification and communicative purpose: a problem and possible solution. *Applied Linguistics* 22: 195-212.

Berkenkotter C. and T.N. Huckin 1995. *Genre Knowledge in Disciplinary Communication: Cognition/culture/power*. Hillsdale, N.J.: Lawrence Erlbaum.

Bhatia V.K. 1993. *Analysing Genre: Language Use in Professional Settings*. London: Longman.

Bhatia, V.K. 2002. Applied genre analysis: a multiperspective model. *Ibérica* 4: 3-19.

Bhatia V.K. 2004. *Worlds of Written Discourse*. New York: Continuum.

Brett P. 1994. A genre analysis of the results section of sociology articles. *English for Specific Purposes* 13: 47–59.

Bruce I. 2009. Results sections in sociology and organic chemistry articles: a genre analysis. *English for Specific Purposes* 28: 105-124.

Bunton D. 2005. The structure of PhD conclusion chapters. *Journal of English for Academic Purposes* 4: 207-224.

Cohen L., L. Manion and K. Morrison 2007. *Research Methods in Education*. London: Routledge.

Day R.A. 1989. *How to Write and Publish a Scientific Paper*. Cambridge: Cambridge University Press.

Dudley-Evans T. 1994. Genre analysis: an approach to text analysis for ESP. In M. Coulthard (ed.). *Advances in Written Text Analysis*. London: Routledge: 219-228.

Geertz C. 1983. *Local Knowledge: Further Essays in Interpretive Anthropology*. New York: Basic Books.

Gilbert G.N. and M. Mulkay 1984. *Opening Pandora's Box: An Analysis of Scientists' Discourse*. Cambridge: Cambridge University Press.

Hill S., N. Soppelsa and G. West 1982. Teaching ESL students to read and write experimental research paper. *TESOL Quarterly* 16: 333-347.

Holmes R. 1997. Genre analysis and social sciences: an investigation of the structure of research article Discussion sections in three disciplines. *English for Specific Purposes* 16: 321-337.

Holmes R. 2001. Variation and text structure: the discussion section in Economics research article. *I.T.L. Review of Applied Linguistics* 131-132: 107-137.

Hopkins A. and T. Dudley-Evans 1988. A genre-based investigation of the discussion sections in articles and dissertations. *English for Specific Purposes* 7: 113-121.

Hyland K. 1998. *Hedging in Scientific Research Articles*. Amsterdam/Philadelphia: John Benjamin.

Hyland K. 2006. *English for Academic Purposes. An Advanced Resource Book*. London: Routledge.

Kanoksilapatham B. 2005. Rhetorical structure of biochemistry research articles. *English for Specific Purposes* 24: 269-292.

McGrath L. 2016. Open-access writing: an investigation into the online drafting and revision of a research article in pure mathematics. *English for Specific Purposes* 43: 25-36.

Miller C.R. 1984. Genre as social action. *Quarterly Journal of Speech* 70: 151-167.

Peacock M. 2002. Communicative moves in the discussion section of research articles. *System* 30: 479-497.

Swales J.M. 1981. *Aspects of Article Introductions*. Birmingham, UK: University of Aston Language Studies Units.

Swales J.M. 1990. *Genre Analysis: English in Academic and Research Settings*. Cambridge: Cambridge University Press.

Swales J.M. 1998. *Other Floors. Other Voices: A Textography of a Small University Building*. Mahwah, NJ: Erlbaum.

Swales J.M. and C.B. Feak 2004. *Academic Writing for Graduate Students: Essential Tasks and Skills* (2nd edition). Ann Arbor: The University of Michigan Press.

Thompson D.K. 1993. Arguing for experimental "facts" in science. *Written Communication* 10: 106-128.

Williams I. 1999. Results section of medical research articles. *English for Specific Purposes* 18: 347-366.

Woodford F.P. (ed.) 1968. *Scientific Writing for Graduate Students: A Manual on the Teaching of Scientific Writing*. New York: Rockefeller University Press.

Yang R. and D. Allison 2003. Research articles in applied linguistics: moving from results to conclusions. *English for Specific Purposes* 22: 365-385.