Communicative moves in the discussion section of research articles

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Abstract

This paper describes an analysis of communicative moves in discussion sections across seven disciplines—Physics, Biology, Environmental Science, Business, Language and Linguistics, Public and Social Administration, and Law. While introductions in academic writing have received attention recently, much less research has investigated discussion sections and there has been little investigation of their move structure, including interdisciplinary and NS/NNS variation. Findings in these areas have clear relevance for the teaching of ESP: the rapid growth in the number of research writers, and the need to teach them discipline-specific research writing, makes these factors increasingly important. Research articles (RAs) were analysed in terms of Dudley-Evans’s 1994 model. The total corpus was 252 RAs (36 from each discipline, 1.4 million words). A number of marked interdisciplinary and NS/NNS differences were found in the type and number of moves and move cycles. Conclusions are that the findings have relevance for the teaching of research writing. They may help ESP teachers inform learners of typical move sequences and also how much flexibility the genre allows regarding obligatory and optional moves and cycles, and the optimal order of moves. A revised model for the discussion sections is also put forward.

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1. Introduction

An increasing amount of attention has been paid to the structure of academic writing ever since Swales’s (1990) discussion of communicative moves in research
articles. This has often been motivated by pedagogic reasons, a factor that is becoming ever more important with the rapid growth in the number of research writers (particularly NNS). With this growth has come the need to teach students discipline-specific aspects of research writing. Among these aspects are the conventions of research writing, and in particular, the communicative moves that writers need to make to develop their main points and arguments.

While much work since 1990 has analysed moves in introductions, much less has investigated the important discussion section, and agreement is still lacking on their move structure. Additionally there has been little investigation of interdisciplinary variation or NS/NNS differences. Such research has obvious relevance for the teaching of ESP.

The research article (RA) is chosen for the present research because of its importance for the circulation of academic knowledge. Berkenkotter and Huckin (1995, p. 27) and Hyland (1996, p. 252) call it the key medium for the legitimating of claims and of disciplines.

Holmes’s (1997) definition of ‘move’ is used in this study: “a segment of text that is shaped and constrained by a specific communicative function”.

2. Previous research

A number of authors have proposed models for the move sequence in RA discussion sections since Adams Smith (1984) examined six medical RAs and reported the structure explain method → interpret results → refer to literature → implications. Hopkins and Dudley-Evans (1988, pp. 117–119) suggest there is only one obligatory move, statement of result, and an 11-move sequence: background information → statement of result → (un)expected outcome → reference to previous research → explanation of unexpected results → exemplification → deduction → hypothesis → reference to previous research → recommendation → justification. Swales (1990, pp. 172–174) suggests a list of eight moves as “a useful provisional framework”: background information → statement of results → (un)expected outcome) → reference to previous research → explanation → exemplification → deduction and hypothesis → recommendation. He also says “the existence of [move] cycles seems well-established”. Swales and Feak (1994, pp. 195–203) note that while discussion sections vary considerably, they normally contain three moves: consolidate research space → limitations → further research. They also say that move 1 is usually quite extensive and moves 2 and 3 quite short, and that many discussion sections run through the 1–2–3 sequence more than once. They make the useful point that results sections deal with descriptive facts, and discussion sections with interpretative points.¹

The most complete description of moves in RA discussion sections appears to be Dudley-Evans’s (1994, pp. 224–228)². In a modification (not, in this case, based on

¹ They partly base their comments on their analysis of “15 articles from a small U.S. regional journal of natural history research”.
² Also see Dudley-Evans and St. John (1998, pp. 90–93).
empirical data) of his previous work, he proposes the following nine-move sequence:

“Discussion sections have a three-part framework involving a series of move cycles combining two or more of these nine moves:

1. **information move** (background about theory/research aims/methodology)
2. **statement of result** (either a numerical value or reference to a graph or table)
3. **finding** (same as statement of result, but without a reference to a graph or table)
4. **(un)expected outcome** (a comment on whether the result is expected or not)
5. **reference to previous research**
6. **explanation** (reasons for unexpected results)
7. **claim** (a generalisation arising from the results: contribution to research)
8. **limitation**
9. **recommendation** (suggestions for future research).

The three-part framework and move cycle series are:

**I. Introduction** (moves 1, or 1 + 5, or 2/3)

**II. Evaluation** (the “key move cycles” here are 2/3 + 5, 7 + 5, or 5 + 7)

**III. Conclusion** (moves 3 + 7, or 9).

Several writers (notably Berkenkotter and Huckin 1995, pp. 40–41)³ claim the order of moves reverses the order in introductions. They maintain that the order is “typically” statement of principal findings → show how results respond to the larger issue stated in the introduction → implications of the study (and sometimes plans for future work). They propose that the function of this structure is to try to situate “novel findings within the body of knowledge previously accepted by their fellow specialists”, whereas introduction sections “[work] from outside in”—talk about the field as a whole, then progressively narrow the scope to talking about only the current investigation. That is, they suggest that while introductions [in Swales’s (1990) CARS model] have the structure Establish a territory → Establish a niche → Occupy the niche, discussion sections have the structure Occupy the niche → (Re)establish the niche → Establish additional territory.

Lewin and Fine (1996) analysed 12 psychology and sociology RAs, reporting a structure broadly similar to the Hopkins and Dudley-Evans model. Holmes (1997) analysed 30 History, Political Science, and Sociology RAs. He found no move “completely obligatory” in his corpus; the commonest moves were deduction and statement of result. Half the RAs opened with the latter, while common closing moves were recommendation and deduction. He notes that moves tend to occur in a predictable order and also in cycles. There was some interdisciplinary variation—there were more moves (10.9 units) and move cycles (3.5) in Political Science RAs, and fewer in History (4.5 and 2.7). In 2001, Holmes researched 43 Agricultural Economics RAs. The commonest moves were statement of result (in 100% of RAs), deduction (94%), recommendation (79%) and background information (60%). The commonest opening move was statement of result, and the commonest closing

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sequence was *deduction* plus *recommendation*. Holmes speculates (2001, p. 126) that the reason for current complex move cycle structures is that authors feel their work must stand out from their competitors’.

Nwogu (1997) analysed the discussion sections of 15 RAs from medical journals and identified three moves: *highlight overall research outcome* > *explain specific research outcome* > *state research conclusions*. Posteguillo (1999) examined 34 computer science RA discussion sections in terms of Swales’s model. They were built on two moves, *statement of results* (in 79% of RAs), and *recommendation for further research* (59%). Other moves appeared less frequently: 1 (38% of RAs), 3 (30%), 4 (32%), 5 (21%), 6 (29%), and 7 (30%). He says (pp. 154–156) that while his research found no systematic pattern for computer science, further research would “very likely” do so.

A number of authors have explored the differences between the discourse structure of the introductions of NS and NNS RAs. Ahmad (1997) employed Swales’s model to analyse the introductions to 20 Malay RAs. Thirty-five per cent did not have the move structure “commonly found” in introductions written in English. Duszak (1994) looked at 40 introductions (20 NS, 20 NNS), finding some differences in move structure. She hypothesised that NNS may “transmit discoursal patterns typical of their own tongue but alien to English”. Golebiowski in two studies (1998, 1999) also used Swales’s model to examine the introductions of 18 Psychology RAs, 8 in Polish and 10 by Polish authors in English. Her findings lead her to hypothesise (1999, pp. 238–239) that Polish authors writing in English “preserve their native style” and that we cannot apply existing discoursal frameworks to NNS authors writing in English. Taylor and Chen (1991, p. 332) analysed 31 science and engineering introductions and suggest that while there is an internationalisation of scientific discourse, it is heavily qualified by regional (and also disciplinary) cultures. Wood (2001, pp. 76–77) and others⁴ suggest that NNS writers of RAs have higher-level discourse problems and also difficulties publishing.

2.1. A rationale for research

Dudley-Evans (1994, p. 228) says the strongest argument for genre research is that it provides input for important and popular courses on academic writing, particularly for those who want to join the academic discourse community (similar calls have been made by many authors)⁵. Hopkins and Dudley-Evans (1988, p. 113, 120) say descriptions of text organisation help teachers and learners, particularly the notion of cycles. They add that ESP materials must be informed by genre research and that understanding disciplinary differences is necessary for preparing ESP courses. Swales and Feak (1994, pp. 200–202) and Paltridge (2001, pp. 66–67) advise

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students to examine the genre conventions of their own discipline, as these vary. Bhatia (1997a,b) says it is disastrous for authors to flout generic conventions. Berkenkotter and Huckin (1995, p. 29, 43) add that understanding genres is crucial to taking part in the practices of the relevant discourse community.

Several authors note that the area has not received the attention it deserves. Swales (1990, p. 173) calls his list of eight moves provisional and notes that further work on discussion sections is much needed, adding “However, we know little about disciplinary variation”. Dudley-Evans (1994, p. 220; 1997, p. 352) focuses on the discussion section because it is the section students have the greatest difficulty with and because it has received less attention than the introduction. Berkenkotter and Huckin (1995, p. 40) say the fact that little attention has been paid to RA discussion sections is an “unfortunate oversight” because this may be the most important section. Holmes (1997, p. 322), Hyland (1998a, p. 33) and Lockett (1999, pp. 49–51) all note that little research to date has looked at interdisciplinary variation, and call for more research. Lewin and Fine (1996, p. 424) agree and assert that no one has clearly described the rhetorical work needed in discussion sections. Lockett adds that “primary descriptive material” on interdisciplinary differences is lacking.

There have been several calls for NS/NNS comparison. Paltridge (1993, p. 175) asserts that research writing is particularly difficult for NNS, who need help joining the discourse community of international academic research. Cooley and Lewkowicz (1997, p. 118) found that Hong Kong postgraduate students had problems with discourse elements and conventions. Ventola (1992, p. 191) and Golebiowski (1999, p. 240) note that to teach academic writing to NNS, it is essential first to research NS/NNS differences, and that the results will feed directly into the design of such courses. Taylor and Chen (1991, p. 332) say a great deal more attention must be paid to discipline differences, taking account of NS/NNS differences, while Yakhontova (1997, p. 105) notes that the main difficulty of NNS research writers is unawareness of genre conventions, which differ in an L2. Ahmad (1997, p. 273) adds that this difficulty could be critical for NNS academics, who may not get published if their work is coded in the wrong rhetorical style. Vassileva (1997, p. 217) asserts that NS/NNS differences in academic writing result from deeply ingrained standards from the writer’s L1: it is “extremely difficult to overcome them irrespective of the degree of command of the foreign language”.

Lewin and Fine (1996, p. 424) and Holmes (2001, p. 110) suggest that there is no uniform agreement on the move structure of RA discussion sections. We agree and also propose that as previous studies have used a variety of models to examine only a small number of RAs from one or two disciplines, further empirical research is needed in this important area. We suggest that this work should use the best available model to examine a larger sample and also assess interdisciplinary variation across a wider range of disciplines. We also propose that the area of NS/NNS differences is

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7 Dudley-Evans (1994, p. 228) states that genre research also provides “concrete evidence [for] those working in the areas of rhetoric and sociology of science”. Also see Shaw (2000, p. 42).
8 Also see Salager-Meyer (1994, p. 166).
important and deserves further research; previous NS/NNS research has only looked at RA introductions. Research in these areas will improve our understanding of the nature of RAs and also have relevance for the study of academic writing and the teaching of ESP.

3. Methodology

This study examined communicative moves in 252 RA discussion sections across seven disciplines—Physics and Material Science, Biology, Environmental Science, Business (Marketing and Management), Language and Linguistics, Public and Social Administration, and Law. A preliminary step was taken before choosing a model for this analysis—a few RAs from each discipline were examined and the moves noted without applying any model. We then chose the model [Swales (1990), Dudley-Evans (1994), or Holmes (1997, 2001)]\textsuperscript{9} that best fitted these initial findings. Dudley-Evans was the best match and it was therefore adopted.

The aims of the research following this step were:

1. To analyse the RAs in terms of the Dudley-Evans model and improve it.
2. To examine interdisciplinary variation.
3. To examine NS/NNS differences and test the hypothesis (Taylor and Chen, 1991; Duszak, 1994; Golebiowski, 1998, 1999; Wood, 2001) that these differences exist.
4. To test the hypothesis (Berkenkotter and Huckin, 1995) that the moves in RA discussion sections reverse the order in introduction sections.\textsuperscript{10}

3.1. The RA corpus

The corpus was 252 published RAs, 36 from each of seven disciplines. The disciplines were selected for three reasons: (1) They represent a wide range of academic endeavour. (2) They contain a large number of research writers (almost all NNS) in this writer’s university, and no doubt also around the world. This increases the usefulness of this research for making recommendations for teaching. (3) Previous research into RA discussion sections seems not to have covered these disciplines.

Six leading refereed journals were chosen from each discipline (four from Law) on the basis of advice from experts—two separate informants from each discipline were asked to name ten leading journals in their field. The list of 40 journals (see Appendix) consists only of those named by both experts.\textsuperscript{11} Six RAs from 2000/2001 were randomly selected from each journal. Only empirical data-driven RAs were selected\textsuperscript{12} to allow comparison of communicative moves [and also because we agree

\textsuperscript{9} Holmes used a modified version of Hopkins and Dudley-Evans.

\textsuperscript{10} The RAs were also analysed in terms of this hypothesis as it has a different emphasis to Dudley-Evans’s model; it predicts overall structure, not individual moves and move cycles (as noted earlier).

\textsuperscript{11} Finalising the list involved further visits to two of the academic departments.

\textsuperscript{12} Review essays, discussions and RAs by writers already selected were not used.
with Hyland (1998a, p. 97) that this is an important genre. The corpus length was 1,470,525 words, much larger than in previous studies [the NS corpus was 106 RAs (609,589 words): the NNS corpus 146 RAs (860,936 words)]. NNS authors were distinguished from NS authors using Wood’s (2001, p. 79) “strict” criterion (not his less stringent “broad” criterion): authors had to have names “native to the country concerned” and also work in an institution in that country.

We suggest that the disciplinary corpora are acceptably representative of each discipline because of the use of two informants from each discipline to select journals, and the size of the corpora (six RAs from each journal, 36 from each discipline).

3.2. Classifying moves in the corpus

This was done using methods proposed by leading researchers on the topic, Dudley-Evans (1994) and Holmes (1997, 2001). They suggest that researchers classify moves as follows: (1) Look for organisation and patterns. Identify moves (and the boundaries between them) by a combination of linguistic evidence and text comprehension. (2) Work from a sentence-level analysis. (3) Assign all sentences to a move. (4) Validate the classification by testing inter-rater agreement. All these methods were adopted for this study. Inter-rater agreement was tested by a second coder, a local university lecturer, who independently rated 60% of the RAs. The second coder had an MA in Applied Linguistics but (at first) no special knowledge of the structure of RAs (discussions were held on this topic). Tests for intra-rater agreement were also made: this researcher re-classified six randomly selected RAs from each discipline 1 month after the initial classification.

RAs were analysed partly in terms of “generic structure potential” (GSP: Hasan, 1984)—what elements must occur, and where? What elements can occur, and where? How often can they occur?—as we agree with Paltridge (1993, p. 187) that this will provide a very useful teaching tool. Knowledge of GSP lets teachers tell learners typical move sequences, and how much “flexibility the genre will allow”—which moves and move cycles are obligatory (or virtually so) and which are optional.

4. Results

Results on research aims (1)–(4) will be presented in this section (1, 2, and 3 will be presented together), and discussed in the next section.

(1) Analyse the RAs in terms of the Dudley-Evans model.
(2) Examine interdisciplinary variation.
(3) Examine NS/NNS differences.

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13 Crookes (1986, pp. 61–62) describes a detailed procedure for doing this.
14 Testing for both inter- and intra-rater agreement involves comparing the independently obtained results and measuring the correlation between them.
15 Also see Ventola (1984, 1989)
The model was successfully applied to all 252 RAs. Inter-rater and intra-rater agreement were both over 90%. A total of 2706 moves were found in the whole corpus, an average of 11 moves per paper (NS 10, NNS 11). The average number of moves per RA in each discipline were as follows: Physics 8, Biology 13, Environmental Science 7, Business 9, Language and Linguistics 14, Public and Social Administration 12, and Law 13.

(i) Individual moves: overall frequency

Overall the three most frequent moves were 3. finding (587 occurrences—22% of all moves in the corpus); 7. claim (contribution to research) (19%), and 5. reference to previous research (18%). The least frequent were 6. explanation (4% of all moves) and 1. information move (5%).

(ii) Individual moves: frequency of appearance

No move was obligatory across all 252 RAs. Overall frequency of appearance was:

1. information move  
2. statement of result  
3. finding  
4. (un)expected outcome  
5. reference to previous research  
6. explanation  
7. claim  
8. limitation  
9. recommendation

Appeared in 42% of Ras  
Appeared in 42% of Ras  
Appeared in 84% of Ras  
Appeared in 52% of Ras  
Appeared in 73% of Ras  
Appeared in 33% of Ras  
Appeared in 90% of Ras  
Appeared in 43% of Ras  
Appeared in 59% of Ras

The four most widespread moves overall were 7. claim (in 90% of all RAs), 3. finding (84%), 5. reference to previous research (73%), and 9. recommendation (59%). The least widespread was 6. explanation (in only 33% of RAs).

Table 1 shows interdisciplinary and NS/NNS differences in the frequency of appearance of individual moves.

Interdisciplinary differences. Some noteworthy differences were found: authors in both Physics and Environmental Science made significantly fewer moves 5. reference to previous research, 8. limitation, and 9. recommendation. Table 1 also shows that move 1. information move appears more frequently in Biology and Physics, and less often in Environmental Science and in Language and Linguistics. Finally, move 5. reference to previous research is more widespread in Language and Linguistics.

NS/NNS differences. The important move 7. claim (contribution to research) appears much less often in papers by NNS authors in all three sciences (this was also the case for Business). Move 8. limitation (of the study) appears much less often in papers by NNS authors in both Physics and Biology. Finally, move 9. recommendations (for
future research) appears much less often in papers by NNS authors in all three humanities (Business, Language and Linguistics, and Public and Social Administration).

[iii] Move cycles

The nine-move Dudley-Evans model was found to be broadly accurate overall. However, our findings indicate that a number of moves and move cycles not predicted by Dudley-Evans are also common in all three parts of the “framework”. Additionally, a number of marked interdisciplinary and NS/NNS differences were found in the main part, Evaluation.

<table>
<thead>
<tr>
<th>Move</th>
<th>All disciplines</th>
<th>Physics</th>
<th>Biology</th>
<th>Environmental science</th>
<th>Business &amp; Ling.</th>
<th>Public &amp; Social</th>
<th>Law</th>
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<td>40</td>
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<td></td>
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I. Introduction (moves 1, or \(1+5\), or \(2/3\)).

Eighty per cent of RAs (NS 82%, NNS 78%) began with these moves/cycles (though only 3% started with \(1+5\)). However, it was observed that move \(7. \text{claim}\) was also common—a further 9% (NS 8%, NNS 10%) opened with this move.

II. Evaluation (the “key move cycles” here are \(2/3+5, 7+5, \text{or } 5+7\)).

Initial analysis showed that 41% of RAs had two or more of these cycles (NS 42%, NNS 40%). However, it was observed that the cycle \(3+7\) was also very common in the corpus, and it was therefore added to the model before further analysis. It was found to make up 29% of all moves in the amended move cycle model \(2/3+5, 3+7, 7+5, \text{or } 5+7\). The new figures (using the amended model) were: 55% of RAs had two or more of the cycles (NS 58%, NNS 52%). The average number of move cycles per RA \((N=252)\), using the amended model, was 2.2. Interdisciplinary and NS/NNS differences in the average number of move cycles are shown in Table 2.

Interdisciplinary differences. Examination of Table 2 shows that move cycles were much more frequent than average in Language and Linguistics, and in Law; and considerably less frequent in Physics and in Environmental Science.

NS/NNS differences. There were considerably fewer move cycles in papers by NNS authors in Biology, Environmental Science, and Business; and more in Physics and in Language and Linguistics papers.

Further analysis

Further analysis of the corpus revealed that two move cycles not part of the model, \(4+5\) (\textit{un}expected outcome + reference to previous research) and \(4+6\) (\textit{un}expected outcome + explanation), were much more common than the predicted cycles \(7+5\) and \(5+7\). If \(4+5\) and \(4+6\) were added to our amended model \(2/3+5, 3+7, 7+5, \text{or } 5+7\), they would make up 24% of all move cycles. However, Dudley-Evans’s “key” cycles \(7+5\) or \(5+7\) would only make up 15% of all move cycles in the model. However, the cycles \(4+5\) and \(4+6\) were very unevenly distributed. The cycle \(4+5\) alone comprised 29% (NS 28%, NNS 30%) of \textit{all} move cycles in Public and Social Administration papers, 17% of all Law cycles, and 14% of all Physics cycles, but hardly appeared in the other four disciplines. \(4+6\) alone made up 29% (NS 20%, NNS 37%) of \textit{all} move cycles in Biology, 24% (NS 0%, NNS 27%) in

| Table 2 | Average number of move cycles per RA \((N=252)\): interdisciplinary and NS/NNS differences (%) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | All disciplines | Physics         | Biology         | Environmental science | Business         | Lang. & Ling.   | Public & Social | Law            |
| ALL RAs        | 2.2             | 1.1             | 2.3             | 1.7             | 1.9             | 3.4             | 1.9             | 2.8            |
| NS only        | 2.2             | 0.6             | 2.9             | 2.2             | 2.6             | 2.7             | 1.5             | 2.7            |
| NNS only       | 2.1             | 1.3             | 1.8             | 1.2             | 1.6             | 3.9             | 2.3             | 2.9            |
Physics, and 14% in Environmental Science (NS 13%, NNS 16%); but was rare in
the other disciplines. The cycle $4+6$, then, was very common in papers by NNS
authors in the three sciences, particularly in Biology (37% of all move cycles) and
Physics. It was observed that in these two disciplines, it often appeared in NNS
papers that had no other cycles at all.

III. Conclusion (moves $3+7$, or 9).

Forty-nine per cent of RAs (NS 49%, NNS 49%) closed with one of these moves/
cycles. However, other cycles were also common in conclusions: a further 15%
closed with either $9+7$ or $8+7$ ($9+7$ was about twice as common).

(4) Test the hypothesis that the moves in RA discussion sections reverse the order in
introduction sections.

The hypothesis was supported for 45% of RAs (NS 58%, NNS 36%). However,
we found Berkenkotter and Huckin’s model to be inadequate compared to Dudley-
Evans’s as it is less comprehensive, and also does not include the important notion
of move cycles.

5. Discussion

(i) Moves and move cycles: overall findings

There was no move that appeared in all 252 RAs and therefore “must occur”.
Three moves seemed to be virtually obligatory: 7. claim (in 90% of all RAs), 3.
finding (84%), and 5. reference to previous research (73%). Move 9. recommendation
was also very common, appearing in 59% of RAs. We recommend that authors in
most disciplines include the first three of these moves. Three further moves were
optional, appearing in 40/50% of Ras—1. information move, 4. (un)expected out-
come, and 8. limitation. One move was less common; 6. explanation. Our results are
not directly comparable with those of previous research, as we looked at different
disciplines. Our findings on the common moves 3, 7, and 9 were similar to Holmes
(1997, 2001). However, he found move 5 to be uncommon. Our findings on two
moves, statement of results and recommendation, were very similar to Posteguillo
(1999). However, he found no other move to be common, in contrast to our find-
ings—the differences are probably a function of the different disciplines and larger
corpus in the present study.

The Dudley-Evans nine-move model was reasonably useful for describing overall
structure, but less successful for move cycles. The model correctly predicted the
structure of 80% of Introductions to discussion sections, but only 49% of Conclu-
sions. 41% of RAs had two or more of the predicted move cycles in the central
Evaluation section. However, a number of other move cycles that were not part of
the model were also found to be common, and this is clearly one reason for the low
predictive accuracy of the model for Evaluation and Conclusion sections. While Introductions very rarely started with $1+5$, they often began with move $7$. In the important Evaluation part, two cycles predicted by Dudley-Evans ($7+5$ and $5+7$) made up only 15% of all move cycles, whereas the unpredicted cycles $3+7$, $4+5$ and $4+6$ were very common, making up 46% of all cycles. In Conclusions, the cycles $9+7$ and $8+7$ were also common. Our findings indicate, therefore, gaps in the model. We shall present a revised model later in this section.

(ii) Interdisciplinary differences: moves and move cycles

There were clear interdisciplinary differences in the number of moves and move cycles used, particularly in two of the sciences, Physics and Environmental Science. Authors in these two disciplines made only around half as many moves per paper. They also used many fewer move cycles (this is still true if the cycles $4+5$ and $4+6$ are included in the count). Perhaps (as Holmes speculates) the reason for this is that authors feel less pressure to make their work stand out from that of their competitors.\(^{16}\) There were also clear differences in the type of moves used in Physics and Environmental Science—moves $5$, $8$ and $9$ were less common. This indicates that referring to previous research, describing limitations, and making recommendations for further research are less important in these two disciplines. Other discipline conventions that became apparent were that move $1$ is more frequent in Biology and Physics, and less frequent in Environmental Science and Language and Linguistics. Move $5$ (referring to previous research) seems to be more important in Language and Linguistics.

There were also clear differences in the type of move cycles used. The cycle $4+6$ was very common in the three sciences (and rare in the other four disciplines), comprising 23% of all move cycles (29% in Biology, 24% in Physics, 14% in Environmental Science). The cycle was far more common in the three sciences than the predicted cycle reference to previous research + claim ($7+5$ or $5+7$), which made up only 8% of all cycles. These discipline differences, in particular, support Taylor and Chen’s (1991) proposal that scientific discourse is heavily qualified by disciplinary cultures.

One other cycle not predicted by Dudley-Evans was very common in Public and Social Administration; $4+5$ comprised 29% of all move cycles. The predicted cycle reference to previous research + claim ($7+5$ or $5+7$) was also much more common in this discipline—27% of all cycles (only 13% in other disciplines). Linking outcomes and/or claims with previous research therefore made up 56% of all move cycles in the discipline, and was far more common than in other disciplines (only 19% of all move cycles).

It is not easy to explain these discipline differences. RA authors seek acceptance and appeal to their audience (editors and readers) to claim membership of their discourse community and face sanctions—rejection and/or questioning of claims—if

\(^{16}\) If so the reverse may be true in Language and Linguistics and Law, where cycles were much more frequent.
they step far outside discipline conventions. Much might depend on publication and peer acceptance, and the potential sanctions of rejected papers and claims may strongly motivate authors to follow discipline conventions. Hyland (2000, p. 78) says that writers need to “project an insider ethos”; and also (1999, p. 108) that discipline differences reflect rhetorical constraints within the discipline. We conclude that the discipline differences in move cycle patterns we found tell us much about disciplinary norms, and that the patterns found are accepted within the relevant discipline as being the recognised way for writers to persuade readers of the validity of their data and conclusions. The findings of this study indicate that in the sciences the cycle \( \text{[un]expected outcome} + \text{explanation} \) is much more important than \( \text{reference to previous research} + \text{claim} \); explaining outcomes is much more important than linking or comparing claims to previous research. This result diverges from Hyland’s suggestion (1998b, p. 449) that science authors typically build on and refer back to prior research. Science writers in our corpus spent much more time explaining their own results than referring to the results of others. Scientists apparently make a claim after describing and explaining their findings, with far fewer references to previous research than is the norm in other disciplines. The reverse seems to be true in Public and Social Administration, where it appears that linking either outcomes and/or claims with previous research is very much more important to authors than other move cycles. Presumably it is particularly important in that discipline to place findings in the context of previously published research.

(iii) NS/NNS differences: moves and move cycles

Various differences were found between NS and NNS RAs in the number and type of moves and move cycles. However, they were fairly sharply split along discipline lines. NNS authors in all three sciences made the important move 7. claim far less often than did NS authors. In two of the sciences, Physics and Biology, NNS authors made move 8. limitation (of the study) much less often. In contrast, NNS authors in all three humanities (Business, Language and Linguistics, and Public and Social Administration) made move 9. recommendations (for future research) much less often.

NNS authors in all three sciences had a much stronger tendency to use the move cycle \( 4 + 6 \) \( \text{[un]expected outcome} + \text{explanation} \) than did NS. It made up 37\% of all NNS move cycles in Biology, 27\% in Physics, and 16\% in Environmental Science (NS figures were 20\%, 0\% and 13\%). In Biology and Physics, it was often the only NNS cycle.

These differences provide support for the hypothesis (Duszak, 1994; Golebiowski, 1999; Wood, 2001) that NNS authors use recognisably different discourse patterns. It is supported for moves 7, 8 and 9 and for the move cycle \( 4 + 6 \). However, we have found sharp discipline differences apparently not predicted before. The most probable reason for the differences may be found in the suggestions of Vassileva (1997) and Yakhontova (1997) that NNS research writers have difficulty with genre conventions that differ from their L1.\(^{17}\)

\(^{17}\) It was not possible to investigate individual L1s in this study due to the widely varying L1 of the writers.
While Dudley-Evans was the best existing model (Berkenkotter and Huckin was much less useful), it needs to be improved. His description of certain moves needs updating. In move 7 (*claim*) many authors also make recommendations for action, and in move 6 they often include explanations for *expected* results as well as *unexpected*. These actions should be added to move descriptors. We also suggest that moves 2 and 3 be combined, as in both moves authors refer back to a finding, either with or without a reference to a graph or table—the only difference is whether the RA includes graphs or tables.

Second, we found the three-part framework and move cycle series to be inaccurate and incomplete. Very few RAs began with the predicted $1 + 5$, though many began with the unpredicted move 7. The unpredicted cycles $3 + 7$, $4 + 5$ and $4 + 6$ were much more common than the predicted $7 + 5$ and $5 + 7$. Finally, the unpredicted cycles $9 + 7$ and $8 + 7$ were common in the conclusion part of discussion sections.

We have revised the model—it now contains eight moves (two moves have been combined, and four others altered), along with a new taxonomy of move cycles for the three parts of discussion sections. We have kept the less common cycles $7 + 5$ or $5 + 7$ in the model, but made them less prominent. Justification for the changes comes from the results of the present study. The new model follows:

5.1. *A revised model*

Discussion sections have a three-part framework involving a series of move cycles combining two or more of these eight moves:

1. *information move* (background about theory/research aims/methodology)
2. *finding* (with or without a reference to a graph or table)
3. *expected or unexpected outcome* (comment on whether the result is expected or not)
4. *reference to previous research*
5. *explanation* (reasons for expected or unexpected results)
6. *claim* [contribution to research (sometimes with recommendations for action)]
7. *limitation*
8. *recommendation* (suggestions for future research).

The three-part framework and move cycle series are:

**I. Introduction** (moves 1, or 2, or 6)

**II. Evaluation** (the key move cycles are $2 + 4$, $2 + 6$, $3 + 4$, and $3 + 5$. Other less common cycles are $6 + 4$ and $4 + 6$)

**III. Conclusion** (moves $2 + 6$, or 8, or $8 + 6$, or $7 + 6$).

Users of the revised model should be aware of the disciplinary differences described in this paper, for example, the model is not very accurate for Public and Social Administration.
5.2. Implications for teaching

Knowledge of move structure is clearly important for the teaching of ESP, particularly to students of research writing.\(^{18}\) The findings of this study reinforce the notion that move structure varies to some extent between disciplines, and that discipline-specific teaching of discussion sections is necessary. One implication for teaching move structure is clear: sensitivity to interdisciplinary and NS/NNS variations is required for those who prepare teaching materials. We will make some suggestions for teaching move structure:\(^{19}\)

1. Discuss with students what moves are, why they are necessary and what they do.
2. Inform students that awareness of discipline-specific move structure is very important.
3. Prepare a discipline-specific move structure model.
4. Prepare discussion sections from the target discipline. Swales (1990) and many others describe the necessity of using these as models. In our view this is essential.
5. For teaching move structure, discipline-specific discussion sections and the move structure model will act as models and input.
6. Provide students with a discussion section with all the moves marked.
7. Ask students to describe the function of all the marked moves.
8. Ask students to mark all the moves in another (unmarked) text.
9. Ask students to write a discussion section.
10. It is particularly important to teach NNS authors in all three sciences to make an appropriate number of moves 6. claim and 7. limitation and not to over-use the move cycle 3 + 5 (un)expected outcome + explanation; and to ensure that NNS authors in the humanities make an appropriate number of move 8. recommendation.

5.3. Further research

This study is limited in that it was not possible to contact individual authors to check they were really NNS, nor could we analyse individual cultures or L1s. All the authors in this study were successful; we do not know the proportion of NS/NNS who successfully publish. Also, it is difficult to say which move sequence is ‘correct’—they were all published. Future studies may check these areas and also find out why discipline differences occur, perhaps by informant interviews. Finally, the new model may be applied to new disciplines.

\(^{18}\) Dudley-Evans (1997, pp. 351–352) says that teaching the subject through a focus on moves is the best approach.

\(^{19}\) Other teaching ideas may be found in Weissberg and Buker (1990) and Charney and Carlson (1995).
6. Conclusion

Analysis of our large and comprehensive corpus found a number of interdisciplinary and NS/NNS differences in the structure of RA discussion sections. In particular, we found differences in the three sciences and in Public and Social Administration. We applied a standardised model to seven disciplines, found a number of gaps in the model, and made suggestions for improving it.

We hope that this study has added to our understanding of genre conventions in academic writing and that our findings improve our knowledge of the nature of RAs. We also hope that the findings will have relevance for the teaching of research writing to NS and NNS, and help ESP teachers and course designers to prepare discipline-specific research writing courses.

Appendix. Journals in the corpus (in alphabetical order by discipline)

A total of 252 RAs were analysed, 36 from each discipline. Six RAs were used from each journal (except Law, where the numbers were uneven, as shown here):

**Business**
- Industrial Marketing Management
- International Business Review
- International Journal of Project Management
- International Journal of Research in Marketing
- Journal of Business Venturing
- Journal of Operations Management

**Language and Linguistics**
- English for Specific Purposes
- Journal of Neurolinguistics
- Language and Communication
- Language Sciences
- Speech Communication
- System

**Public and Social Administration**
- Child Abuse & Neglect
- Evaluation and Program Planning
- Habitat International
- International Journal of Public Sector Management
- Social Science & Medicine
- World Development
References


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