Move Analysis of Conclusion Section of Aerospace Research Article

By Huang Siming

Northwestern Polytechnical University

Abstract- This paper reports on the move analysis of the conclusion section of the aerospace English research article (RA). The results are based on the identification of 50 pieces of aerospace conclusion section of RA, published in two leading journals that were written by English native writers from 2018 to 2023. Yang&Allison(2003) and Zhiqing Hu(2007)'s model are the starting point for the analysis. Then, the major Moves and Steps were extracted and the frequencies were calculated, which attempts to provide a modified model for aerospace research articles' conclusion section. The results reveal that the aerospace conclusion section has three major Moves, which are Move 1: Summary of study; Move 2: evaluation of study; Move 3: suggestion for future research. Most of the conclusions have Move 1 and Move 2. This study aims at improving the genre awareness of novice and non-native researchers in order to facilitate their disciplinary writing, publishing, and reading.

Keywords: genre analysis, move analysis, research article, conclusion section, aerospace.

GJHSS-G Classification: FOR Code: 090199

MOVEANALYSISOFCONCLUSIONSECTIONOFAEROSPACERESEARCHARTICLE

Strictly as per the compliance and regulations of:

Move Analysis of Conclusion Section of Aerospace Research Article

Huang Siming

Abstract- This paper reports on the move analysis of the conclusion section of the aerospace English research article (RA). The results are based on the identification of 50 pieces of aerospace conclusion section of RA, published in two leading journals that were written by English native writers from 2018 to 2023. Yang&Allison(2003) and Zhiqing Hu(2007)'s model are the starting point for the analysis. Then, the major Moves and Steps were extracted and the frequencies were calculated, which attempts to provide a modified model for aerospace research articles' conclusion section. The results reveal that the aerospace conclusion section has three major Moves, which are Move 1: Summary of study; Move 2: evaluation of study; Move 3: suggestion for future research. Most of the conclusions have Move 1 and Move 2. This study aims at improving the genre awareness of novice and non-native researchers in order to facilitate their disciplinary writing, publishing, and reading.

Keywords: genre analysis, move analysis, research article, conclusion section, aerospace.

I. Introduction

In the context of burgeoning international academic collaborations, the research article (RA) has gradually become one of the main channels for disseminating and advancing scientific knowledge among scholars worldwide. Hyland (1996) calls it the key medium for the legitimating of claims and of disciplines. Regarding this, the ability to read and write a professional research article in English is pivotal for scholars (Kanoksilapatham, 2005).

Since 2016, China's space technology develops by leaps and bounds. China's aviation technology, led by large aircraft and engine special projects, is rapidly improving its capabilities and levels through in-depth international cooperation. China's aerospace development urgently needs to cultivate aerospace researchers' international vision and global competency. Therefore, in order to enhance the efficiency of reading and writing aerospace research articles, both native and non-native speakers of English need to be aware of the conventional rhetorical organization used in aerospace articles to make communication more effective and dissemination of research achievement more professional (Kanoksilapatham, 2005).

Genre analysis provided by Swales (1990) becomes a frequently used method to analyze discourse in different domains. The aim of the genre-based approach is to raise learners' awareness of both the rhetorical organization and the linguistic features closely associated with the genre. Many researchers conducted studies in various disciplines by using genre analysis. Studies focus on the different parts of the RA, especially the discipline of linguistics, with attention being paid to the structure of the abstract, introduction, methodology, and discussion section. But scant attention has been given to the aerospace discipline, especially the conclusion section.

The conclusion section plays an integral part in RA, which summarizes and evaluates the whole study and draws deductive inferences from the previous section, including pointing out the importance and limitations of the study and providing recommendations for future research (Yang & Alison, 2003). This requires writers to consider carefully the choice of language in order to conclude in a concise and powerful manner. The high-stakes nature of the conclusion sections of research articles calls for further research.

The main objective of this study is to identify the rhetorical structure of aerospace RA's conclusion section. By using Yang&Allison and Zhiqing Hu's model as references, the results of this study provide a basic template for the structuring of the aerospace RA's conclusion section. The implications of this article not only lie in raising genre awareness among aerospace novice and non-native researchers but also facilitate them to meet the international scientific community's expectations and demands.

II. Literature Review

a) Genre Analysis

The word "genre" can be traced back to the Greek word "category" or "classification" in the period of Aristotle (Hyon, 1996). Traditionally, it has several characteristics, it was a collection of fixed conventions; it mainly focuses on literature; it is based entirely on the regular form and content of passage; it is unchangeable; finally, it was divided into clear and mutually exclusive types (Zhiqing Hu, 2007). In the 20th century, modern critics have reconceptualized genre as "a dynamic set of conventions", which are associated with changing social purpose (Swales, 1990). Since the 1970s, the concept of genre has gradually penetrated into the field of linguistics (Yumei Ju, 2004). Specifically, genre analysis refers to the way in which texts are structured and organized (Hopkins & Dudley-Evans, 1988), based on that, move analysis, as a part of genre

Author: Northwestern Polytechnical University, Xi'an China.
e-mail: 1298647107@qq.com

analysis (Swales, 1990), has been applied in a number of studies to identify the rhetorical organization of particular texts.

Generally, "move" in a genre serves a particular purpose in society and is composed of a series of segments. Some of the moves in a genre are obligatory, in that they are necessary to achieve the communicative purpose of the genre, whereas others are optional. In Hasan (1989)'s study, optional moves refer to what speakers or writers may choose to employ if they decide those moves add to the effectiveness of the communication but do not alter the purpose of the text. Each of these moves has its own purpose and contributes to the realization of the overall communicative purpose of the genre. Researchers posit different meanings for the move (Adel, 2015).

Santos (1996) mentions that a move is regarded as a stage in a particular genre with a specific communicative purpose which in turn serves certain communicative purposes of that particular genre. Similarly, Bhatia (2001) describes moves as rhetorical instruments that realize a subset of specific communicative purposes associated with a genre. More specifically, Yang & Allison (2003) define move and step as a function of a specific segment of the texts on a general level, while steps are very specific rhetorical means used to manifest and realize the move functions. Swales (2004) gives the definition from a social perspective, it is socially recognized and highly structured, referring to a communicative discoursal event or activity which fulfills a particular communicative or social function in a certain community or in spoken or written discourse. Identifying moves and steps has usually been performed by English for Specific Purpose (ESP) researchers through close readings of content with the help of linguistic keys, normally, researchers refer to the move framework to identify and decipher the moves in a certain domain. Additionally, the results of move analyses have been successfully used for developing teaching and learning materials (Stoller & Robinson, 2013). Knowledge about the function of each move and the structural pattern of the whole text will allow for a greater understanding of a specific genre (Maswana S et al, 2015).

b) Previous Study of RA's Conclusion Section

Ample research has been done on the analysis of the different sections of an English research article by using the move analysis models. The conclusion section in previous studies is usually regarded as part of the research discussion in academic papers (Bunton, 2005). In this regard, unlike other sections, to date, few models and empirical studies have been proposed for the conclusion sections (Adel et al, 2015).

Posteguillo (1999) analyzed thirty-four conclusions from research articles in the field of computer science. He identified eight moves, which are "background information", "statement of results", "(un)expected outcome", "reference to previous research", "explanation", "exemplification", "deduction and hypothesis" and "recommendation for further research". The result shows that the cyclical patterns of the conclusion section appear in his research, then, he compared his model with Yang & Allison's, showing that his model contains more moves than Yang's model.

Utilizing Yang and Allison's (2003) model, Amnuai and Wannaruk (2011) compared the rhetorical organization of English RA conclusion sections published in Thai journals with those articles published in international journals. The result reveals that the most frequent move in both sets of data was Move 1 (Summarizing the study), and the frequency of Move 2 (Evaluating the study) and Move 3 (Deductions from the research) in the international corpus was higher than that in the Thai corpus.

Bunton's (2005) proposed a model for the conclusions Chapter of Ph.D. dissertations, namely, introductory restatement, consolidation of research space, practical implications and recommendations, future research, and concluding restatement, out of which the first two are found to be obligatory.

Having combined the Models of Yang and Allison (2003) and Bunton (2005), Aslam and Mehmood (2014) explored the Moves of 50 conclusion sections of research articles in Social Sciences and Natural Sciences. Their research identifies the differences in RA's conclusion sections across various disciplines in terms of Moves and Steps.

In the discipline of law, Tessuto (2015) built up a corpus with ninety law research articles published from 2010 to 2012 in three international journals. His study indicated that even though the conclusion part has a high frequency as an independent part, it is still merged with other parts in some research articles. Besides, the three moves of the conclusion part of research articles in the field of empirical law he identified are the same as Yang & Allison (2003)'s model, with slightly different Steps in Move 2 and Move 3.The above models and empirical studies pave the way for the study of the conclusion section of RA.

c) Move Models for Current Study

Notable work for the conclusion part was carried out by Yang and Alison (2003). They distinguished the discussion section and conclusion section at the very beginning of their research. Then, they analyzed 20 conclusions from applied linguistics articles and reported the observed moves and steps. It is found that most of the move of the conclusion section possesses a linear structure. Their research has great significance and can be the authorities' reference in the conclusion section. The following are the specific Move and Step of Yang & Allison's model:

Table 1: Yang&Allison's(2003) Model for Conclusion Section of RA

Move	Function
Move 1	Summarizing the study
Move 2	Evaluating the study Step 1: Indicating significance/advantage Step 2: Indicating limitations Step 3: Evaluating methodology
Move 3	Deductions from the research Step 1: Recommending further research Step 2: Drawing pedagogic implications

After a comparative analysis of 100 concluding parts of English research articles, Zhiqing Hu(2007) also developed a Move model for the conclusion section of some hard disciplines, including mechanical, electronic, computer science, materials, aerospace, energy, chemical, physical, biological, and environmental sciences, etc. The model mainly consists of five moves. The following are specific Move and Steps of his model.

Table 2: Zhiqing Hu's (2007) Model for Conclusion Section of RA

Move	Function
Move1	Summarize the study Step 1 Provide background information Step 2 Summarize the main study steps Step 3 Summarize the main findings Step 4 Summarize the main claims
Move 2	Main contributions of the study Step 1 Present the validity of the study Step 2 Identify the strengths of the study Step 3 Identify the importance of the study Step 4 Identify the practical applications of the study
Move 3	Limitations of the study
Move 4	Make Suggestions for future research

In this paper, Yang&Allison (2003)'s model and Zhi qinghu's (2007) model are adopted to analyze aerospace conclusions as the starting point, because the two models have a great similarity. Besides, Yang & Allison's model seems to fit best the conclusion section, although it is based on linguistics, it has been widely used in the analysis of moves and steps in different disciplines and has greater reference value (Adel et al, 2015). Moreover, Zhiqing Hu's model further improved Yang&Allison's model, and based on that, he established a model for hard disciplines, which is fit for the present aerospace corpus. Therefore, the combination of the two models provides a solid theoretical basis and a high degree of credibility for this research.

III. METHODOLOGY

a) Research Question

This study is a corpus-based move analysis of the aerospace conclusion section of RA by native English writers, by analyzing 50 pieces of conclusions, this research aims to answer the following two questions:

1. What is the distribution of Moves and Steps in aerospace RA's conclusion section?
2. What rhetorical structure model is suitable for aerospace RA's conclusion section?

b) Corpus Collection

The aerospace discipline in this research can be focused on the study of avionics systems, aircraft design, manufacturing, and other aspects related to mathematics, physics, computers, etc.

Based on the above aerospace research direction, following the principles of representativeness, authority, and accessibility proposed by Nwogu (1997), a random sample of 50 articles written by native English speakers were selected from the following two high-profile journals: *Progress in Aerospace Sciences, Aerospace Science and Technology*, the period lasts

from 2018 to 2023. All these two journals are recommended by aerospace researchers and experts, these two journals belong to authoritative foreign aerospace journals with long-standing impact factors, and have a high volume of publications, thus ensuring the English proficiency and professionalism of the authors. More importantly, the above two journals cover most of the research directions of aerospace and aeronautics, including astronautic engineering, aircraft design, aerodynamics, space structure, etc.

Importantly, it is worth noticing that the definition of native English speakers in this research has two ways to identify, the first author was from an inner-circle country whose native language was English, such as America, UK, Canada, Australia, etc, and the first author's name-writing system was also used as a reference for identification. (Medgyes P, 2001).

c) Corpus Annotation

Corpus annotation is the most crucial process in this research, the reliability of move identification can be achieved by inviting different coders to conduct corpus annotation together. To ensure that the coder has expertise in the focused discipline, two aerospace major Ph.D. candidates served as assistants for annotation. Another coder who majors in linguistics will join in move identification. The author conducted a 3-hour training and discussion session for the participants so as to assure that the coder clearly understood how to code a sample text using the coding scheme (Kanoksilapatham, 2005). Moreover, we asked for cooperation from aerospace experts in identifying some professional knowledge that is difficult to understand. After the annotation was completed, by using SPSS.20, the kappa coefficients of the annotation result were checked for consistency and subsequently discussed and adjusted the move identification until a high degree of agreement was reached, then a model for aerospace discipline of the conclusion section of RA is produced.

d) Instruments

Totally three tools are employed in the process of move identification and data analysis. BFSU Standford Pos Tagger 1.1 and Microsoft Word are used to input the texts and code; SPSS2.0 is used to do the data analysis; Antmover1.0 is assisted to identify the move and the function of the sentence unit.

IV. RESULT AND DISCUSSION

After the annotation of 50 pieces of writing, a modified model based on Yang&Allison (2003) and Zhiqing Hu (2007) is put forwards for aerospace RA conclusion. We extracted three major Moves based on the analysis of the corpus, including Move 1: summary of the study; Move 2: evaluation of the study, and Move 3: suggestion for future research. Also, five Steps are specifically shown within the three moves. There is a total of 108 Moves and 152 Steps in these 50 writing pieces. According to Kanoksilapatham (2005), Moves having 100% occurrences are identified as obligatory. To be recognized as a conventional move, a move must occur in 60% of the appropriate sections in the corpus. If the frequency of a move falls below 60%, it is considered optional (Kanoksilapatham, 2005). Based on the above criteria, this section presents both the statistical analysis and the explanation of each Move and Step in the studied corpus.

a) The Distribution of Moves and Steps

Table 1: The Frequency of Moves and Steps in Aerospace Conclusion Section

Move and Step	Number	Frequency
Move 1 Summary of Study	50	100%
Step 1 Summary of Background	20	40%
Step 2 Summary of Purpose	44	88%
Move 2 Evaluation of Study	41	82%
Step 1 Evaluation of Method	30	60%
Step 2 Evaluation of Result	36	72%
Step 3 Evaluation of Contribution/Limitation	22	44%
Move 3 Suggestion for Future Research	18	36%

b) Move 1: Summary of Study

From table one, there are 50 Move 1 that appears in the aerospace conclusion section, which is the most frequent Moves, proving Move 1 is obligatory Move in the aerospace conclusion section, this result is in line with Yang & Allison's (2003) study in the Linguistics corpus.

The main function of Move 1 is to make a summary of the claim of the study. This move includes two Steps, the first Step is the summary of the background, aiming to provide background information about the theory and some key definition of concepts, in this Step the author usually use one or two sentences to provide a precise background and indicate a research

gap. Step 2 is the summary of the purpose, which includes the statement about the purpose and introduction of the study. Since the main function of the conclusion section is to summarize the main claim of the study, Move 1 is a necessary one to be included in the conclusion section.

Tracing back to the original text, after introducing the background information in Step 1, the author usually shows the purpose of their study in the following Step. One interesting finding is that not every conclusion section has Step 1 because this Step is usually found in the abstract and introduction sections of an article, we usually do not find it necessary to repeat the background information related to the study in the conclusion section since background knowledge is a consensus between writers and readers. However, the background information in the conclusion section is shorter than in the abstract and introduction sections and is mostly aimed more at helping the reader better understand the author's research. This Step is not a necessary one for the conclusion. If the author uses this Step in Move 1, it is usually found at the beginning of the conclusion section (Zhiqing Hu, 2007). While Step 2 in Move 1 seems to be conventional, which accounts for 88%. There are some typical expressions in Move 1:

Example one: The flow field around an oscillating, straked delta wing was analyzed numerically. **(Move 1: Step 1: Summary of Background)**

Example two: **In this work,** *the ability of the harmonic balance method to deal with transonic buffet flows has been evaluated.* **(Move 1: Step 2: Summary of Study)**

c) Move 2: Evaluation of Study

The total Frequency of Move 2 accounts for 82% of the corpus, showing that most of the conclusion section includes an evaluation of their research. Specifically, Step 1 in Move 2 is 60%, and Step 3 accounts for 72%, which are higher than Step 3. The statistic shows that Step 1 and 2 in Move 2 is conventional, only 22 pieces contain Step 3, proving that this step is not a required Step in Move 2. The above results corresponds with Zhiqing Hu's (2007) research.

Move 2 aims to evaluate the research method, result, and limitation or contribution of the study. In the first Step, the authors outline the main steps and procedure of the study. Since the papers we selected are from aerospace journals, many of the papers in which the authors have built models performed experiments, or formulate formulas. Therefore, in this Move, the authors describe how the model was built or how the experiments were conducted, and what methods were used in this study. What's more, the evaluation of results is also presented after the explanation of the research method, the authors summarize the main empirical experimental results, often in the form of a logical order by using "first", "second". Then, the evaluation of limitations or

contributions will be given. This Step aims to point out the main contribution or limitation of the study. The author indicates the validity, significance, merits, and practical applications of the study, or indicates what is not solved in the study, or the circumstance under which their research is not applicable (Zhiqing Hu, 2007). The following are some typical expression of these Move and Steps:

Example two: **These numerical simulations were obtained using** *1200 cores of the NASAs Pleiades supercomputer during three weeks, i.e., approximately 6×105 core-hours. Comparison to measurements within arc heaters, such as those of Winter et al.* **(Move 2: Step 1: Evaluation of method)**

Example three: **It has been shown that** *a combination of surface properties, in particular topography and chemistry, need to be optimised in order to effectively mitigate insect residue adhesion.* **(Move 2: Step 2: Evaluation of result)**

Example Four: The propellant studies **were limited to** *available literature data on well-known ionic liquids, so future research should focus on creating novel liquid propellants designed specifically for multimode propulsion.* **(Move 2: Step 3: Evaluation of limitation)**

d) Move 3: Suggestion for Future Research

Among 50 pieces, we found 18 pieces have Move 3, which shows that Move 3 is optional and less used in the conclusion section. Move 3 intends to provide direction for future research based on the author's research. It usually appears at the end of the conclusion.

Example Five: Future researchers should look to a cohesive comparative study of predictions made by each of the models, developed under a consistent framework and validated against a comprehensive experimental database. (Move 3: Suggestion for future research)

V. Conclusion

Successful writing of the conclusion section of a research article contributes to a thorough and understandable unfolding of the whole RA. With this being said, good writing of the conclusion is fundamental to the writers. This article reports on the result of the Move analysis of the aerospace conclusion section of RA. Based on the findings of the analysis, a modified two-level rhetorical structure (Moves and Steps) based on Yang & Allison (2003) and Zhiqing Hu (2005)s' has been developed for aerospace conclusions.

The study expands the application of move analysis to aerospace research articles, and yields a better and deeper understanding of the conclusion section of aerospace RA for scholars, raises genre awareness in academic writing, and facilitates them to take part in the international academic community. In addition to the theoretical contributions to discourse analysis, this study offers practical implications to those novice and non-native researchers in reading and

writing instruction of academic articles. The modified model for the conclusion section can be applied in the classroom of aerospace English academic writing class to raise learners' consciousness of discipline-specific reading and writing skills. (Kanoksilapatham, 2005). However, there are still some drawbacks associated with this research, manual annotation of the corpus may influence the result, and further investigation is needed to provide a more scientific method in academic discourse analysis.

References Références Referencias

1. Adel S M R, Ghorbani Moghadam R. (2015). A comparison of moves in conclusion sections of research articles in psychology, Persian literature and applied linguistics [J]. Teaching English Language, 9(2): 167-191.
2. Bunton D. (2005) The structure of PhD conclusion chapters [J]. Journal of English for academic purposes, 4(3): 207-224.
3. Bhatia V K. (2001). The power and politics of genre [J]. Analysing English in a global context: A reader, 65-77.
4. Dos Santos M B. (1996). The textual organization of research paper abstracts in applied linguistics[J]. Text & Talk, 16(4): 481-500.
5. Ellis R, JOHNSON K E, HENRY A, et al. (1998) An evaluation of a genre-based approach to the teaching of EAP/ESP writing[J]. TESOL quarterly, 32(1): 147-156.
6. Hopkins A, Dudley-Evans T. (1988). A genre-based investigation of the discussion sections in articles and dissertations[J]. English for specific purposes, 7(2): 113-121.
7. Hyland K.(1996). Writing without conviction? Hedging in science research articles[J]. Applied linguistics, 17(4): 433-454.
8. Hyon S. (1996) Genre in three traditions: Implications for ESL [J]. TESOL quarterly, 30(4): 693-722.
9. Kanoksilapatham B. (2005). Rhetorical structure of biochemistry research articles [J]. English for specific purposes, 24(3): 269-292.
10. Kashif M, Mehmood K, Ayub T, et al. (2014). Reasons and patterns of tooth extraction in a tertiary care hospital-A cross sectional prospective survey [J]. J Liaquat Uni Med Health Sci, 13(03): 125-29.
11. Maswana S, Kanamaru T, Tajino A. (2015). Move analysis of research articles across five engineering fields: What they share and what they do not[J]. Ampersand, 2: 1-11.
12. Posteguillo S. (1999) The schematic structure of computer science research articles [J]. English for specific purposes, 18(2): 139-160.
13. Swales J. (1990). Genre Analysis: English in Academic and research Setting Cambridge: Cambridge University Press.
14. Swales, J.M. (2004). Research genres: Explorations and applications. Cambridge: Cambridge University Press.
15. Stoller F L, Robinson M S. (2013). Chemistry journal articles: An interdisciplinary approach to move analysis with pedagogical aims [J]. English for Specific Purposes, 32(1): 45-57.
16. Tessuto G. (2015) Generic structure and rhetorical moves in English-language empirical law research articles: Sites of interdisciplinary and interdiscursive cross-over [J]. English for Specific Purposes, 37: 13-26.
17. Wannaruk A, Amnuai W. (2016). A comparison of rhetorical move structure of applied linguistics research articles published in international and national Thai journals[J]. RELC Journal, 47(2): 193-211.
18. Yang, R., & Allison, D. (2003). Research Articles in Applied Linguistics: Moving from Results to Conclusions. English for Specific Purposes, 22, 365-385.
19. Y M. Ju, (2004). "Genre analysis and Chinese English academic paper abstracts," Foreign Language Education, 32-36.
20. Zhiqing Hu. (2007). A Corpus-based Contrastive Study of Discourse Construction of China's and International English Scientific Journal Papers[D]. Huazhong University of Science and Technology.
21. Hasan, R. (1989). The structure of text. In M. Halliday & R. Hasan, Language, context, and text: Aspects of language in a social-semiotic perspective. Oxford: Oxford University Press, 52–69.