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Move analysis of research articles across five engineering fields: What they share and what they do not

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HIGHLIGHTS

- The study examines 67 engineering research articles from 5 subdisciplines.
- Six engineering researchers coded full-length articles into moves and steps.
- There are some sections and moves conventional across all subdisciplines.
- No common move patterns exist throughout the papers across the subdisciplines.
- Limited similarities exist, such as the use of Move 5 Step 2 in 3 subdisciplines.

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ABSTRACT

While many genre researchers have examined the rhetorical structure of research articles in various disciplines, few have investigated the complete structure of articles for students in engineering, a discipline that includes a wide range of fields. Using Swales' move framework (1990), this paper analyzes the rhetorical structure of 67 engineering research articles from five subdisciplines: structural engineering, environmental engineering, electrical engineering, chemical engineering, and computer science. Six engineering researchers participated in the study by coding texts of full-length papers into moves and steps. The study found that the abstract, introduction, and concluding sections and some of their moves were conventional across all subdisciplines. The finding of no common move patterns throughout the papers across the subdisciplines is explained by the differences in the nature of research in each field. There were, however, limited subdisciplinary similarities such as the use of Move 5, Step 2 observed in environmental, electrical, and chemical engineering. The study results provide practical pedagogical resources, a theoretical background to guide writing in an engineering school, and implications for collaboration with researchers in specialized fields.

1. Introduction

The genre-based approach is often employed to understand research articles, one of the most important genres in research-oriented universities, by identifying their organizational structure and key linguistic features. Swales (1981, 1990) proposed and developed the concept of a move, a structural segment that has a specific communicative function and purpose, to analyze textual structure. According to Bhatia (1993), a move has a characteristic specific to a genre; thus, 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 or, in this study, a research article in the field of engineering.

Much work applying move analysis has dealt with only selected sections (i.e., the introduction, methods, results, and discussion and conclusion sections) of research articles, often drawing upon Swales' move framework (e.g., Brett, 1994; Lim, 2006; Peacock, 2002; Samraj, 2002). Studies that applied move analysis to an entire paper, such as Nwogu (1997) and Posteguillo (1999) are much fewer, and have not closely examined steps, the smaller rhetorical segments composing a move, throughout the papers. Kanoksilapatham (2005) should be noted as an exceptional study that conducted a move analysis of the whole structure of a large number of articles, 60 biochemistry research articles, providing a complete template of rhetorical organization with detailed analysis of both moves and steps. Identifying moves and steps has usually been

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performed by ESP researchers through close readings of content with the aid of linguistic keys. Researchers refer to the move framework to identify and code moves. The results of move analyses have been successfully used for developing teaching and learning materials (Chang and Kuo, 2011; Stoller and Robinson, 2013).

Yang and Allison (2004) indicated that in many previous studies only research papers with clear headings of "Introduction", "Methods", "Results", and "Discussion" (IMRD) were analyzed, although many papers do not have a clear IMRD structure. Thus, there is a knowledge gap when it comes to non-IMRD research articles. As for target disciplines, many studies have dealt with a single discipline, primarily experimental scientific research (e.g., Li and Ge, 2009; Nwogu, 1997) and linguistics (e.g., Lorés, 2004; Yang and Allison, 2003). Several multidisciplinary studies have been conducted, such as Basturkmen (2012), Holmes (1997), and Swales (1981, 1990), along with studies on variation within a single discipline (Ozturk, 2007, on linguistics) and across subdisciplines (Samraj, 2005, on wildlife behavior and conservation biology). However, these studies of disciplinary variation tend to focus on limited sections and subdisciplines. The present study thus attempts to make a contribution to knowledge by examining articles in their entirety, describing the rhetorical structure of research articles and variations within a discipline, specifically the discipline of engineering, where there is much need for understanding of writing in the subdisciplines.

1.1. Engineering research articles

Engineering education at the tertiary level is crucial for technological advancement and economic growth in many industrialized and emerging countries; naturally, the need for academic writing training for engineering students has existed for some time (Jenkins et al., 1993). Despite the wide range of subdisciplines that make up the discipline of engineering, researchers have so far concentrated their efforts on understanding certain engineering subdisciplines (e.g., Anthony, 1999, on computer science article introductions; Kanoksilapatham, 2011, on civil engineering article introductions; Koutsantoni, 2006, on hedging use in the fields of electrical and chemical engineering; and Rozycki and Johnson, 2013, on computer science). These studies have shown disciplinary specificities that would benefit graduate-level students and people in the target discourse community. Specificities, however, cannot be defined unless they are compared with other subdisciplines. Understanding the similarities and differences among multiple subdisciplines would particularly benefit both learners at the undergraduate level who have not yet chosen their engineering specialism and EAP teachers who are not engineering scholars and teach students from different engineering subdisciplines. In this regard, this paper considers engineering areas included in the Faculty of Engineering as engineering subdisciplines.

Studies dealing with a range of subdisciplines primarily examined lexical items in textbooks common across subdisciplines (Mudraya, 2006; Ward, 2009). More recently, Kanoksilapatham (2012) examined variations in the rhetorical structure of engineering article introductions in three subdisciplines. However, developing a better understanding of both article rhetorical structures and subdisciplines will require continued research efforts.

1.2. Specialist informants

The literature sometimes mentions participation by researchers in the target field, referring to them as specialist informants (or subject teachers or subject specialists). Consulting specialist informants is useful because they are the insiders of the target discourse community (Noguchi, 2006) and can validate the results of analysis (e.g., Kanoksilapatham, 2005). Understanding and analyzing whole articles across a range of fields is difficult for ESP researchers who do not belong to the discourse community of the target texts; therefore, the involvement of specialist informants seems necessary. In this situation, setting up a communication channel between ESP researchers and specialist informants becomes important. Among the few studies of full-length articles, Stoller and Robinson (2013) gave chemists a primary role in analyzing the article sections and used the results to inform an ESP course and discipline-specific materials. In the present study, six engineering researchers had a major role in coding the moves of research articles in five subdisciplines included in the Faculty of Engineering at the research site: structural engineering, environmental engineering, electrical engineering, chemical engineering, and computer science.[1]

But is there any difference in the rhetorical structure of research articles across these areas? What do they share? Which features are associated with certain subdisciplines only? In our study, we provide an analytical framework to make engineering researchers' implicit knowledge of writing research articles explicit to ESP researchers, which can ultimately be shared with students. We use Swales' move analysis to identify the complete rhetorical structure of engineering research articles and variations among subdisciplines. The results provide practical pedagogical resources to guide writing in a school of engineering, as well as implications for collaborating with researchers in the various fields of engineering.

2. The study

2.1. Corpus and the participants

Six engineering researchers with doctorates in their respective subdisciplines participated in the study as move coders. We sought the help of disciplinary insiders through the dean of the Faculty of Engineering. Hoping for the participation of as many researchers as possible, we asked for cooperation from researchers from a wide range of fields. Because the participation of engineering researchers was crucial to understanding whole papers, the specialisms of the engineers we recruited determined the subdisciplines in focus. Six researchers participated in the study, each coming from a different subdiscipline, with the exception of two researchers in environmental engineering who analyzed different articles.

The participating researchers selected articles close to their own fields of research from a corpus of articles randomly selected from international journals that were recommended by researchers in the Graduate School of Engineering at Kyoto University. These journals were recommended based on the criterion of being internationally recognized by researchers in the graduate engineering school who themselves read and write for these publications and wish for – or sometimes require – their students to do the same. We compiled the article corpus for this study by collecting the articles that the participating researchers selected. The texts analyzed in the study, therefore, were defined as full-length articles recognized by the discourse community, and their English use was appropriate for research and educational purposes. The articles included those that did not have an IMRD structure. Each researcher analyzed entire articles, which counted a total of approximately 100 printed pages.[2] Thus, the number of articles analyzed for each subdiscipline varied. Originally 10

[1] Computer science has been included as an engineering subdiscipline, as it is part of the Faculty of Engineering at the university where the study was conducted.

[2] We did not count the words contained in pages.

Table 1
Subdisciplines, number of articles, and researchers.

Subdiscipline	N. of articles	N. of researchers
Structural Engineering	9	1
Environmental Engineering	15	2
Electrical Engineering	21	1
Chemical Engineering	14	1
Computer Science	8	1
Total	67	6

articles were asked for from each participant; however, as the lengths of articles greatly varied and the engineering researchers were working under time constraints, we decided the number of articles to be analyzed would be based on a page count to read and code into moves.

A total of 67 articles were analyzed across five subdisciplines. The majority of articles were published in 2006, although some were published in 2005 and 2007. The number of articles examined in each subdiscipline is shown in Table 1.

The journals included in the dataset are as follows: *Journal of Structural Engineering* and *Earthquake Engineering and Structural Dynamics* for structural engineering, *Journal of Geotechnical and Geoenvironmental Engineering*, *Environmental Science and Technology*, *Design Studies,* and *Environment and Behavior* for environmental engineering, *Advanced Materials, Applied Physics A, IEEE Electron Device Letters, Journal of Applied Physics, Nature, Physical Review Letters,* and *Science* for electrical engineering, *Advanced Materials, Inorganic Chemistry, The Journal of Organic Chemistry, The Journal of Physical Chemistry B,* and *Tetrahedron* for chemical engineering, and *Communications of the ACM (Association for Computing Machinery), Mathematical Programming, Journal of the ACM,* and *Artificial Intelligence* for computer science. The number of articles from each journal varied because the researchers chose articles based on their research fields and interests. It should be also noted that some journals, such as *Nature* and *Design Studies*, cover more than one subdiscipline. The engineering researchers' L1/L2 status was not a consideration, primarily because these researchers are active members of the discourse community who read and write the target texts and also because of the predominance of engineering researchers who are not native speakers of English. For example, Rozycki and Johnson (2013) indicated that nonnatives comprise the majority of authors who publish in international engineering journals as well as authors of award-winning computer science papers analyzed in their study.

2.2. Move coding

The present study used Swales' theoretical framework (1990; 2004) and identified moves and steps based primarily on the content and, when applicable, linguistic features of each article. First, the authors created a move classification list to provide a reference framework for the engineering researchers. The move classification list was based on the 11 move categories discussed in Nwogu (1997), who in turn used Swales (1981, 1990) as a basis to draw up move categories. Although Swales (1990, 2004) provided move categories, these categories are mostly intended for the introduction section. In the preliminary analysis of 10 articles, the ESP researchers found Nwogu's (1997) categories applicable compared to other move categories of full-length articles such as Posteguillo (1999) and Kanoksilapatham (2005). Nwogu's (1997) categories seemed clear and comprehensive enough to serve as a reference for scientific researchers, including those from a wide range of engineering subdisciplines. The present study included the move of an abstract following the work of Salager-Meyer (1990, 1992). After the preliminary analysis and subsequent modifications involving other move classifications, the authors created the final move classification list, which contained 12 moves (including the abstract[3]) and 38 steps (see Appendix A).

The authors held a session with the engineering researchers to explain the objectives of the research and the analysis procedure for the texts. In the session, the authors first explained the move analysis and used an article as a sample to show how to categorize texts into moves. During the session, questions and concerns about the move analysis were discussed in a group first and then individually until the participating engineering researchers felt that they understood the procedure. Engineering researchers used the move classification codes to tag the texts at a place and time of their choosing within a three-month period. Where they encountered segments that did not correspond to the moves or the steps listed, they suggested new moves or steps as appropriate, explaining the new moves' or steps' communicative purposes in writing. The authors communicated with the engineering researchers via e-mail after the move analysis session to answer any questions concerning the coding procedure and to receive explanations of identified new moves when applicable. The follow-up questionnaire was also administered via e-mail. The open questionnaire consisted of two instructions: (1) Write comments on move analysis and its coding (where you had difficulties, etc.) and (2) Write any comments on your work and our project.

For a move to be recognized as typical or conventional, this study required that a move appear in at least half the articles examined in each subdiscipline. Although a similar study (Kanoksilapatham, 2005) that examined 60 whole papers in one discipline used 60% as the minimum standard, 50% was selected for this study as in Nwogu (1997) because the number of articles in each subdiscipline was much smaller and varied.

3. Results

All 11 conventional moves and the abstract move (see Appendix A) were observed in the target texts. However, unlike the other moves, "Move 4: Identifying data source and collection method" and "Move 6: Describing data analysis procedures" in the methods section were not conventions in any subdisciplines. Because the study included papers without clear IMRD structures and headings, for the presentations of the results, we determined probable sections based on the moves as delineated by Nwogu (1997).

3.1. Abstract

Table 2 summarizes the structure of the abstracts for articles in five subdisciplines. All of the following abstract steps contained in the move classification list were observed. The letters and numbers in brackets indicate the corresponding Move/Step labels in Table 2.

Step 1: Background of research [a1]
Step 2: Purpose [a2]
Step 3: Methods [a3]
Step 4: Results [a4]
Step 5: Conclusion [a5]

The frequency columns show the number of occurrences within the subdiscipline, and the range columns indicate the number of articles in each subdiscipline featuring the move. Ten articles did not have abstract sections. Some articles that had summary headings that served the same function as an abstract were included

3 In the present study, an abstract is considered to be one move consisting of steps in relation to a whole paper in terms of its length and function, although researchers who exclusively studied the abstracts (e.g., Salager-Meyer, 1990, 1992) regarded them as consisting of moves.

Table 2
Abstract moves of articles in five subdisciplines.

Move/Step	Structural Engineering ($N = 9$)				Environmental Engineering ($N = 15$)				Electrical Engineering ($N = 16$)				Chemical Engineering ($N = 12$)				Computer Science ($N = 5$)			
	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD
a1	56%	5	0.6	0.50	33%	5	0.3	0.47	31%	5	0.2	0.43	33%	4	0.3	0.45	60%	3	0.4	0.48
a2	78%	8	0.9	0.57	67%	10	0.7	0.47	88%	14	0.7	0.47	42%	5	0.4	0.48	100%	5	0.6	0.48
a3	100%	9	1.0	0.00	80%	14	0.9	0.57	44%	7	0.3	0.47	50%	6	0.4	0.49	40%	2	0.3	0.43
a4	56%	5	0.6	0.50	87%	16	1.1	0.57	94%	15	0.7	0.45	83%	12	0.9	0.64	60%	3	0.4	0.48
a5	33%	3	0.3	0.47	47%	8	0.5	0.62	6%	1	0.0	0.21	25%	3	0.2	0.41	0%	0	0.0	0.00

Note: The range was calculated by using the number of articles with abstract sections as the total number only for the abstract move. N = the total number of occurrences in each subdiscipline, M = mean, and SD = standard deviation.

Table 3
Introduction moves of articles in five subdisciplines.

Move/Step	Structural Engineering ($N = 9$)				Environmental Engineering ($N = 15$)				Electrical Engineering ($N = 21$)				Chemical Engineering ($N = 14$)				Computer Science ($N = 8$)			
	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD
11	100%	15	1.7	0.94	93%	36	2.4	2.24	100%	23	1.1	0.29	93%	24	1.7	0.80	75%	8	1.0	0.71
12	22%	2	0.2	0.42	27%	6	0.4	0.80	62%	13	0.6	0.49	36%	5	0.4	0.48	75%	7	0.9	0.60
21	89%	19	2.1	1.66	100%	73	4.9	2.80	95%	27	1.3	0.70	86%	18	1.3	0.88	88%	18	2.3	1.39
22	22%	4	0.4	0.96	67%	25	1.7	2.33	48%	12	0.6	0.66	29%	6	0.4	0.82	63%	10	1.3	1.20
31	89%	11	1.2	0.63	100%	35	2.3	2.65	90%	20	1.0	0.37	93%	16	1.1	0.64	100%	14	1.8	0.66
32	78%	7	0.8	0.42	67%	17	1.1	1.09	71%	18	0.9	0.64	71%	12	0.9	0.64	88%	16	2.0	0.87

in the total number of articles. Based on 50% usage as an indication of a typical move, "Move a, Step 4: Stating the results of the study" was conventional, along with "Step 2: Stating the purpose of the study", for which only chemical engineering had a rate slightly below 50%. In addition, "Step 3: Describing the methods" was important for structural engineering, environmental engineering, and chemical engineering but optional for the other subdisciplines. Similarly, "Step 1: Stating the background of the research", was conventional in structural engineering and computer science, but not in the other subdisciplines. "Step 5: Stating conclusions" was the least-used step across subdisciplines except in environmental engineering.

3.2. Introduction

Table 3 summarizes the structure of the introduction for articles in five subdisciplines. An introduction consists of the following three moves, with two steps for each move contained in the move classification list. The numbers in brackets indicate the corresponding Move/Step labels in Table 3.

Move 1: Presenting the background information
- Step 1: Reference to established knowledge in the field [11]
- Step 2: Reference to main research problems [12]

Move 2: Reviewing related research
- Step 1: Reference to previous research [21]
- Step 2: Reference to limitations of previous research [22]

Move 3: Presenting new research
- Step 1: Reference to research purpose [31]
- Step 2: Reference to main research procedure and outcome [32]

In all the subdisciplines, the three conventional introduction moves were widely used. However, as Table 3 shows, strategies to contextualize the research, the main purpose of the introduction, differed by subdiscipline. In structural engineering, environmental engineering, and chemical engineering, researchers tended to use only Move 1, Step 1 before proceeding to the second move (Example 1), while computer science and electrical engineering articles often referred to main research problems, Move 1, Step 2 (Example 2).

Example 1.

> **Move 1, Step 1:** A commonly experienced form of failure in the thin cylindrical shell walls of tanks and silos is buckling…that generally have longer axial wavelengths and occur when internal pressures are low or negative, as in the case of external pressure.
> **Move 2, Step 1:** Much past work has concentrated upon these nonsymmetric buckling modes that tend to develop when axial compression combines with external pressure. See summaries contained in, for example, [R].[4] (SE,[5] Ref. #1[6])

Example 2.

> **Move 1, Step 1:** The external electroluminescence (EL) quantum efficiency (QEEL) of a polymer light-emitting diode (PLED) can be affected by the following four factors: …**Move 1, Step 2:** Therefore, the dominating factor for achieving high efficiency for a given polymer is the balance and confinement of electrons and holes. Unfortunately, most conjugated polymers have unbalanced charge-transport properties as the hole mobility is much larger than the electron mobility. (EL, Ref. #2)

Writers tended to use Move 2 similarly to the way they used Move 1, in that all the subdisciplines typically included "Move 2, Step 1: Reference to previous research". However, that tendency did not necessarily lead to the use of "Move 2, Step 2: Reference to limitations of previous research". "Step 2: Reference to limitations" was commonly used in environmental engineering and computer science (Example 3).

Example 3.

> **Move 2, Step 1:** Recent studies [R] have shown that chloroethyne may be formed as an intermediate during reductive dehalogenation reactions of TCE and PCE. …. **Move 2, Step 2:**

[4] [R] stands for references.

[5] Letters stand for the article's subdisciplines: SE = Structural Engineering, EE = Environmental Engineering, EL = Electrical Engineering, CE = Chemical Engineering, and CS = Computer Science.

[6] See Appendix B for the references for all the articles quoted in the examples.

Table 4
Body section moves of articles in five subdisciplines (Moves 4–6).

Move/Step	Structural Engineering ($N = 9$)				Environmental Engineering ($N = 15$)				Electrical Engineering ($N = 21$)				Chemical Engineering ($N = 14$)				Computer Science ($N = 8$)			
	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD
41	11%	1	0.1	0.31	33%	9	0.6	0.95	0%	0	0.0	0.00	0%	0	0.0	0.00	25%	4	0.5	1.00
42	0%	0	0.0	0.00	27%	11	0.7	1.57	0%	0	0.0	0.00	0%	0	0.0	0.00	25%	3	0.4	0.70
43	0%	0	0.0	0.00	27%	11	0.7	1.57	0%	0	0.0	0.00	0%	0	0.0	0.00	13%	1	0.1	0.33
44	0%	0	0.0	0.00	33%	22	1.5	2.92	0%	0	0.0	0.00	0%	0	0.0	0.00	25%	2	0.3	0.43
45	11%	1	0.1	0.31	20%	10	0.7	1.62	0%	0	0.0	0.00	0%	0	0.0	0.00	38%	7	0.9	1.27
51	0%	0	0.0	0.00	53%	16	1.1	1.24	19%	4	0.2	0.39	57%	18	1.3	1.58	13%	2	0.3	0.66
52	0%	0	0.0	0.00	80%	56	3.7	3.34	95%	32	1.5	1.18	100%	117	8.4	16.52	38%	5	0.6	0.99
53	0%	0	0.0	0.00	7%	1	0.1	0.25	14%	3	0.1	0.35	36%	5	0.4	0.48	13%	1	0.1	0.33
54	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00	57%	11	0.8	0.77	0%	0	0.0	0.00
55	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00	14%	2	0.1	0.35	0%	0	0.0	0.00
56	33%	5	0.6	0.96	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00
57	89%	16	1.8	1.69	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00
58	33%	10	1.1	2.18	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00
61	0%	0	0.0	0.00	20%	5	0.3	0.79	0%	0	0.0	0.00	36%	8	0.6	0.90	25%	3	0.4	0.70
62	11%	1	0.1	0.31	13%	4	0.3	0.68	0%	0	0.0	0.00	0%	0	0.0	0.00	0%	0	0.0	0.00
63	22%	7	0.8	1.47	40%	10	0.7	1.25	5%	1	0.0	0.21	14%	5	0.4	0.72	38%	4	0.5	0.71
64	0%	0	0.0	0.00	7%	1	0.1	0.25	0%	0	0.0	0.00	7%	2	0.1	0.52	0%	0	0.0	0.00

> Surprisingly, for most of the reported natural organochlorines the underlying processes of formation are unknown. Although our previous work [R] has shown that chloroethene (vinyl chloride) is naturally formed in soil, the mechanism of formation has not yet been clarified. (EE, Ref. #3)

Move 3 primarily comprised two steps: "Step 1: Reference to research purpose" and "Step 2: Reference to main research procedure and outcome". In all subdisciplines, the two steps were used conventionally (Example 4). Only one article in structural engineering used "Step 3: Outline of the paper".

Example 4.

> **Move 3, Step 1:** Towards the goal of obtaining insight into the structure of optimal solutions, we would like to find the probability that xi = 1 in the optimal solution to Zmax(c), which we define as follows…**Move 3, Step 2:** In this paper, we use semi-definite and second-order cone programming to propose an approach to calculate the persistency of decision variables.… (CS, Ref. #4)

Frequent occurrence of Move 1, Step 1 and Move 2, Step 1 was consistent with the findings in previous studies (Kanoksilapatham, 2012; Swales, 1990, 2004). The finding that the frequency of these two moves was greater than the number of the articles indicated that Move 1 and Move 2 are cyclical, particularly in environmental engineering. Unlike the findings in these previous studies, Move 3 was also cyclical in environmental engineering, which had the higher number of occurrences (Example 5). However, the relatively higher standard deviation showed that the reiteration of these moves was optional.

Example 5.

> **Move 3, Step 1:** Because concern about the environmental and health risks associated with this HWI was remarkable among the population of the area, we initiated a wide environmental and biological monitoring program focused on assessing the influence of the new HWI on the environment and on public health. …**Move 2, Step 1:** In recent years, a number of studies on health risk assessment have been carried out around incinerators in various countries [R]. **Move 3, Step 1:** The aim of the present study was to assess the impact of the PCDD/F emissions from the HWI.… (EE, Ref. #5)

In the study, because of ambiguous headings and sections in some articles, some moves appeared in an unconventional section (such as "Move 2: Reviewing related research", which is typically used for the introduction section, was found in the body section). The numbers in the tables include moves that were observed in other sections.

3.3. *Body section: methods and results sections*

The body section here more or less corresponds to the methods and results sections. It includes a variety of headings and subheadings, making it difficult to compile the results under common headings across articles. This variety is probably the reason the body section and papers with unique headings have been ignored by previous research and why some of the moves conventionally used in introduction and concluding sections were found in the body section. Twenty-eight articles had a "materials and methods" or "experimental" section and a "results and discussion" section. Some texts used a more specific name for the "materials and methods" section, such as "Device Fabrication Process" and "Computational Details". The authors included these articles in the body section for analysis. Articles with a structure clearly similar to that of IMRD were concentrated in the fields of environmental, electrical, and chemical engineering. The other noticeable macrostructure was a body without any headings that ended with the "experimental" section. Seven articles in electrical and chemical engineering had this structure. The remainder had headings with specific names, such as the following:

- Experimental procedure
- Experimental test results
- Analytical results
- Analytical verification

This part of the article consisted of Moves 4, 5, and 6, which are included in the methods section and Moves 7 and 8 for the results section. Table 4 shows Moves 4, 5, and 6 and their steps contained in the move classification list. The numbers in brackets indicate the corresponding Move/Step labels in Table 4.

Move 4: Identifying source of data and method adopted in collecting them
- Step 1: Indicating source of data [41]
- Step 2: Indicating data size [42]
- Step 3: Indicating criteria for data collection [43]
- Step 4: Indicating data collection procedure [44]
- Step 5: Providing background details of data [45]

Table 5
Body section moves of articles in five subdisciplines (Moves 7 and 8).

Move/Step	Structural Engineering ($N = 9$)				Environmental Engineering ($N = 15$)				Electrical Engineering ($N = 21$)				Chemical Engineering ($N = 14$)				Computer Science ($N = 8$)			
	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD
71	33%	4	0.4	0.68	40%	27	1.8	3.12	14%	7	0.3	0.84	86%	59	4.2	3.12	0%	0	0.0	0.00
72	22%	2	0.2	0.42	33%	11	0.7	1.12	14%	4	0.2	0.50	43%	10	0.7	0.96	13%	1	0.1	0.33
73	89%	9	1.0	0.47	87%	72	4.8	3.69	19%	6	0.3	0.70	71%	39	2.8	3.17	38%	3	0.4	0.48
74	44%	4	0.4	0.50	73%	99	6.6	4.87	90%	104	5.0	2.89	100%	194	13.9	15.05	38%	7	0.9	1.17
81	89%	15	1.7	1.41	87%	83	5.5	3.46	100%	107	5.1	2.58	93%	90	6.4	3.25	38%	6	0.8	1.09
82	22%	3	0.3	0.67	67%	44	2.9	3.13	48%	15	0.7	0.88	71%	17	1.2	1.15	25%	5	0.6	1.32
83	22%	3	0.3	0.67	53%	13	0.9	1.09	19%	5	0.2	0.53	36%	7	0.5	0.82	25%	2	0.3	0.43

Move 5: Describing experimental procedures
- Step 1: Identifying main research apparatus [51]
- Step 2: Recounting experimental process [52]
- Step 3: Indicating criteria for success [53]

Move 6: Describing data analysis procedures
- Step 1: Defining terminologies [61]
- Step 2: Indicating process of data classification [62]
- Step 3: Identifying analytical instrument/procedure [63]
- Step 4: Indicating modification to instrument/procedure [64]

Move 4 (Example 6) is about the data used for the experiment or, if there is no experiment, for analysis.

Example 6.

Move 4, Step 2: Thirty samples were collected in the rural area adjacent to the facility at different wind directions (N, NW, S, and E), whereas the remaining 10 samples were collected in urban zones (U). **Move 4, Step 3:** The sampling points were chosen according to the results obtained by applying the dispersion model ISC2 (US EPA). (EE, Ref. #5)

"Move 5, Step 2: Recounting experimental process" was obligatory in chemical engineering and conventional in environmental and electrical engineering (Example 7). Only chemical engineering had "Step 4: Stating the hypothesis to test".

Example 7.

Move 5, Step 2: The irradiation of p-type silicon with 2 MeV He was carried out using a single-ended accelerator. The desired pattern was fed into the IONSCAN software which then controlled the beam scanning. The dose at each region was controlled by the amount of time the beam dwelled at that region…(EL, Ref. #6)

The following three steps of Move 5 were new, but found only in articles on structural engineering: "Step 6: Restating the theoretical background of the experiment;" "Step 7: Describing a procedure for numerical analysis and input elements for the analytical model;" and "Step 8: Proposing and explaining the analytical and evaluation methods for the analysis results". Indeed, Step 7 was conventional in this subdiscipline (Example 8). A researcher in structural engineering – more specifically, earthquake research – reported on the questionnaire that in the experimental move, papers contained steps for detailing the object to analyze and establishing the analytical model in the experiment section.

Example 8.

Move 5, Step 7: Consider the truss structure in Fig. 1. The horizontal truss members have cross-sectional area $A = 1000\ \text{mm}^2$ and all other members have $A = 500\ \text{mm}^2$. Each member is modeled by the uniaxial classical plasticity material model with Young's modulus $E = 200000\ \text{N/mm}^2$, yield stress $\sigma_y = 420\ \text{N/mm}^2$, isotropic hardening modulus $H_{iso} = 5\%$ of E . . . (SE, Ref. #7)

The following is an example of Move 6

Example 9.

Move 6, Step 1: For square image having discrete gray level values, $f(x, y)$, the Fourier transform is defined as follows:

$$F(u, v) = 1/K \sum_{x=0}^{K-1} \sum_{y=0}^{K-1} f(x, y) \exp\left(-2j \prod (ux + vy)/K\right)$$

where x, y = image coordinates; u, v = frequency coordinates; $F(u, v)$ = Fourier transform; and K = image size (pixels). (EE, Ref. #8)

As the examples and the responses in the questionnaire indicated, the variations in the uses of Moves 4 and 6 and some steps in Move 5 may be explained by the different types of experiments or studies conducted in a single subdiscipline.

Table 5 shows Moves 7 and 8 and their accompanying steps as described below, which are considered a part of the results section. The numbers in brackets indicate the corresponding Move/Step labels in Table 5.

Move 7: Reporting results
- Step 1: Restating data analysis procedures [71]
- Step 2: Restating research questions [72]
- Step 3: Stating general findings [73]
- Step 4: Stating specific findings [74]

Move 8: Commenting on results
- Step 1: Interpreting results [81]
- Step 2: Comparing results with previous studies [82]
- Step 3: Evaluating results (or research) [83]

All subdisciplines except electrical engineering and computer science heavily used "Move 7, Step 3: Stating general findings". Similarly, all subdisciplines except structural engineering and computer science conventionally used "Step 4: Stating specific findings". To comment on results (Move 8), many articles except computer science included "Step 1: Interpreting results", and articles in environmental and chemical engineering also compared the results with those of previous studies (Step 2). Measured by the range and high frequency of occurrence, cycling between Move 7, Step 4 and Move 8, Step 1 was particularly frequent in environmental, electrical, and chemical engineering (Example 10). However, it should be noted that the cycling varied markedly from article to article as their standard deviations imply.

Example 10.

Move 7, Step 4: Parts A and B of Figure 2 show the TEM images of the core–shell Ag–Pt nanoparticles prepared in this study.… **Move 8, Step 1:** This method leverages on the different binding characteristics of Pt-rich and Ag-rich surfaces for an affinity agent (phase-transfer agent) and …**Move 7, Step 4:** Figure 2A is a typical low magnification TEM image of the core–shell Ag–Pt nanoparticles, showing distinct brightness differences between the inner and outer regions of the particle.…. **Move 8, Step 1:** The formation of a discontinuous Pt shell on the Ag core is important, as it permits BSPP penetration to oxidize the underlying Ag core. (CE, Ref. #9)

One environmental engineering article on creating a mathematical model presented some new and unique moves and steps. These are "Move d: Presenting a theoretical model" with "Step 1: Stating the theoretical constraints;" "Move e: Presenting theoretical/mathematical elaboration" with "Step 1: Elaborating theoretically/mathematically" and "Step 2: Relating the theoretical elaboration to other works;" "Move f: Presenting theoretical results/predictions" with "Step 1: Comparing the experimental and theoretical results;" and finally, "Move g: Evaluating the theoretical model" with "Step 1: Indicating the implication of the model" and "Step 2: Comparing to other theoretical models". These moves and steps are not shown in Table 4 or Table 5 because they were observed in only one article. The researcher told us that this particular study was mathematically oriented which is reported to utilize a unique rhetorical structure (Anthony and Bowen, 2013; Kuteeva and McGrath, 2013).

3.4. Concluding section

The concluding section consists of 3 moves and a total of 7 steps as described below. Move 9 has no step. The letters and numbers in brackets indicate the corresponding Move/Step labels in Table 6.

Move 9: Highlighting overall results and their significance [9]
Move b: Explaining specific research outcomes
- Step 1: Stating a specific outcome [b1]
- Step 2: Interpreting the outcome [b2]
- Step 3: Indicating significance of the outcome [b3]
- Step 4: Contrasting present and previous outcomes [b4]
- Step 5: Indicating limitations of outcomes [b5]

Move c: Stating research conclusions
- Step 1: Indicating research implications [c1]
- Step 2: Promoting further research [c2]

The concluding sections utilized many different headings: Conclusion(s); "Discussion and Conclusion(s)"; "Conclusions and Recommendations for Future Actions"; "Summary and Conclusions"; "Discussion"; "Extensions"; "Discussion and Open Problems"; "Summary, Conclusions, and Recommendations"; "Future Prospects"; and "Functional Implications". The exception was chemical engineering, which used only the Conclusion heading. The inconsistency of headings might be the result of the inclusion of some moves and steps (Move 7 Step 1, Move 7 Step 2, Move 8 Step 2, and Move 8 Step 3) that are for results sections and not typical in the concluding section. There were fourteen articles (although none in structural engineering) that did not have a concluding section.

As reflected in the variety of headings, no moves were commonly conventional across subdisciplines (see Table 6). "Move 9: Highlighting overall results and their significance" was conventional for all subdisciplines (Example 11) except for electrical engineering.

Example 11.

Move 9: In this paper it is demonstrated that the computational effort to obtain response sensitivities for common types of inelastic structures can be significantly reduced. This is accomplished by a modified version of the direct differentiation method. The novel event-based computation strategy presented herein is demonstrated to provide…(SE, Ref. #7)

"Move b, Step 1: Stating a specific outcome" and "Step 2: Interpreting the outcome" were quite common in environmental, electrical, and chemical engineering. Move c tended to be optional, except for "Step 1: Indicating research implications" in chemical engineering and computer science and "Step 2: Promoting further research" in computer science (Example 12).

Example 12.

Move c, Step 2: Future efforts can take the output of this study and develop assessment instruments and training to help identify…(CS, Ref. #10)

Chemical and environmental engineering, in which all moves and steps were observed, have a larger number of conventional moves and steps (Move 9, Move b Step 1, Move b Step 2, and Move c Step 1; Move 9, Move b Step 1 and Move b Step 2, respectively).

4. Discussion

For this study, engineering researchers acting as move coders examined 67 full-length articles from five engineering subdisciplines. The majority of the papers had abstract, introductory and concluding sections. More specifically, referring to the purpose of the study (Step 2) and stating the results (Step 4) were conventional in abstracts in all subdisciplines except chemical engineering for Step 2. As the journals examined in the study were recommended by engineering researchers, it was anticipated that the examined articles, even those without abstracts, would meet the expectations of the discourse community in terms of conventions. In the introduction, Move 1, Step 1; Move 2, Step 1 and Move 3, Steps 1 and 2 typically appeared in all subdisciplines, although the use of these steps was not identical across subdisciplines. Structural and chemical engineering used relatively similar moves and steps in the introduction section. Unlike Kanoksilapatham (2012), the findings of this study did not show distinctive differences in the range of texts in which the move appeared, such as Move 1, Step 1. However, the frequency of the move showed differences in how writers used the move, which might depend on the maturity of the subdiscipline as Kanoksilapatham argued. This study found that the environmental engineering articles frequently used Moves 1, 2, and 3. According to both the participating researchers and the literature (e.g., Reible, 1998), this field is newer and more interdisciplinary than the other engineering fields included in this study; thus, the results could be interpreted as indicating that writers in this field needed to repeat introductory moves to contextualize their studies. In the concluding section, environmental and chemical engineering had the most shared conventional moves and steps: Move 9 and Move b, Steps 1 and 2.

In contrast to these conventional sections, the body section presented a variety of headings and the use of moves and steps, as well as a wider deviation within a subdiscipline. No conventional moves and steps common to all subdisciplines were observed. Moves 4 and 6 were not used or used relatively less often across subdisciplines than other moves, but Move 5 was used conventionally except in computer science. Environmental, electrical, and chemical engineering featured similar use of Move 5, Step 2, while structural engineering had no similarity with other subdisciplines in the use of steps for Move 5. In fact, these three subdisciplines had similar body sections and showed a notably

Table 6
Concluding moves in five subdisciplines.

Move/Step	Structural Engineering ($N = 9$)				Environmental Engineering ($N = 15$)				Electrical Engineering ($N = 21$)				Chemical Engineering ($N = 14$)				Computer Science ($N = 8$)			
	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD	Range	N	M	SD
9	67%	6	0.7	0.47	80%	16	1.1	0.77	0%	0	0.0	0.00	57%	9	0.6	0.61	50%	5	0.6	0.70
b1	22%	2	0.2	0.42	67%	16	1.1	1.00	86%	20	1.0	0.49	79%	17	1.2	1.42	13%	1	0.1	0.33
b2	11%	1	0.1	0.31	60%	15	1.0	1.15	86%	18	0.9	0.35	50%	12	0.9	1.30	0%	0	0.0	0.00
b3	0%	0	0.0	0.00	47%	11	0.7	0.93	43%	10	0.5	0.59	36%	5	0.4	0.48	38%	3	0.4	0.48
b4	11%	1	0.1	0.31	20%	4	0.3	0.57	10%	2	0.1	0.29	7%	2	0.1	0.52	0%	0	0.0	0.00
b5	00%	0	0.0	0.00	33%	11	0.7	1.24	10%	2	0.1	0.29	14%	2	0.1	0.35	0%	0	0.0	0.00
c1	33%	3	0.3	0.47	40%	7	0.5	0.62	33%	7	0.3	0.47	50%	7	0.5	0.50	50%	4	0.5	0.50
c2	11%	1	0.1	0.31	47%	11	0.7	0.93	10%	2	0.1	0.29	21%	3	0.2	0.41	50%	4	0.5	0.50

higher use of Move 7, Step 4 and Move 8, Step 1 than other subdisciplines. As writers in these subdisciplines repeatedly use Move 7, Step 4 and Move 8, Step 1 together, this move sequence may be treated as an independent move in these subdisciplines.

While articles in environmental and chemical engineering showed relative similarities in rhetorical choices and usage of moves, the results indicated that no subdisciplines share conventional moves and steps throughout all articles. This finding is primarily a result of variance in the body section. The participating researchers explained that different experiment types might cause these variances. For example, structural and environmental engineering articles that conduct experiments involving the earth or a specific geographic site as an object usually have separate experiment and analysis sections and require a detailed description of the object or site, such as its surrounding geographical and physical environment and conditions. In certain types of experiments in structural engineering, a description of parameters for the analysis is crucial, as shown in a separate step in the experiment move. Articles in the field of structural engineering used a separate step in the experiment move to describe computer simulations used for creating numerical analytical models. These articles tended to describe the experiment, interpret results, and create a numerical analytical model by repeating Move 7, Step 4 and Move 8, Step 1. Additionally, these articles sometimes included another method to interpret the experimental results, adding a new step to the experiment section.

The concluding section also differed, which seems to be due to differences in the emphasis of the article. For example, environmental engineering articles used a range of moves and steps, particularly Move b, for the conclusion. This pattern demonstrated that this subdiscipline considered explaining the significance of research and promoting further research to be as important as reporting and interpreting a study. Engineering research is often considered to be practically oriented, with the focus on the process of achieving certain objectives or making materials or products (the how) rather than trying to understand the why. Therefore, it can be said that traditional subdisciplines such as structural engineering do not use many of the steps for "Move b: Explaining specific research outcomes" by indicating significance, contrasting present and previous outcomes, and indicating limitations of outcomes. "Move c, Step 1: Indicating research implications" and "Step 2: Promoting further research" were conventional in computer science, which is a relatively new field (e.g., Loui, 1995).

Compared to other subdisciplines, the sections and use of moves in chemical engineering papers appeared consistent, agreeing with Kanoksilapatham's (2005) findings, although there were signs of variation within the subdiscipline in how often writers used particular moves such as Move 5, Step 2 and Move 7, Step 4. On the other hand, computer science articles shared fewer conventional moves, in accordance with the findings of Posteguillo (1999). This pattern could reflect the divergence of computer science from other subdisciplines, but we cannot deny the possibility of the idiosyncratic selection of articles, topics, and authors. It is also possible that labels for certain moves might be interpreted differently in this discipline. A bigger group of articles must be analyzed to further examine the disciplinary specificity of each subdiscipline.

Analysis of full-length articles was possible because researchers in the articles' targeted fields coded the moves. Because analysis was not limited to articles with IMRD headings, some moves appeared in nonconventional sections. In fact, only 28 articles (42%) in the study had clear IMRD headings. The number of articles with abstracts was 57 (85%), the number with introductions was 67 (100%), and the number with concluding sections was 53 (79%). Some divergence in findings from previous studies might be explained by this inclusion of non-IMRD articles. The study's results also included moves found outside of their typical corresponding sections. For example, Move 2, Step 1 and Move 3, Step 1 in environmental engineering were observed outside of the introduction section, in a relatively longer review section clearly separated from the introduction. These moves were not considered in previous studies. The study's inclusive approach compared to the more conventional approach, in which researchers count only those moves in standard sections, such as the introduction and conclusion, has resulted in differences in results in introductory and concluding moves. For introductory moves, although there was no difference in conventional moves, the difference was the increased frequency of Move 2, Step 1, Move 2, Step 2, and Move 3, Step 1 in environmental engineering, which helped to reveal the cycling nature of the moves in that field.

In the concluding section, some moves appeared both inside and outside of the IMRD section, and some also appeared in a section whose title was not indicative of its content as a conclusion (Example 13).

Example 13.

> **Move 8, Step 1:** Thus, the mortality values of HeLa cells in all the control systems were significantly lower than.... **Move 9:** In summary, we demonstrated the rational design of a bioinspired DDS. **Move b, Step 3:** Bioconjugated pH-responsive microgels offer a novel approach for highly specific targeting of cancer cells. We took advantage of the receptor-mediated endocytosis process ...(CE, Ref. #11)

For concluding moves, the results obtained from our inclusive approach were different from the standard IMRD approach in three ways. The first was the difference in the frequency but not in the range, as in introductory moves. A difference was observed in Move b, Step 1 in both environmental and electrical engineering, although this move seemed not to be cycling. The second difference was the change in the rate of text coverage in chemical engineering and computer science for Move 9, as well as in computer science for Move c, Step 1. In this study, these moves were considered conventional; however, if this had been an IMRD-focused study, they would not have been classified as such. The third difference was that, conversely, Move b, Step 3 in environmental engineering became non-conventional because its frequency stayed the same but the rate of coverage was divided by the number of all articles ($N = 15$)—not just articles with clear conclusion sections ($N = 11$), as in the IMRD-focused studies. The present study's focus on full-papers rather than only focusing on certain types of structures yielded a different picture of article structures.

All the above results were obtained with participations of the engineering researchers. As Hyland (2002) stated, many subject researchers appear to consider that their discourse conventions are self-evident and they are reluctant and unequipped to teach academic literacy which includes writing in specific academic genres. In this study, the ESP researchers provided an analytical tool and organized and analyzed the collected data. The participation of the engineering researchers was limited to classifying texts into moves as specialist informants and the authors were in charge of making the coded texts into education-research relevant materials. The engineering researchers gave positive feedback in an open-ended questionnaire after completing the move coding. While some of the complaints were about how time-consuming tagging codes was and how they were unable to spend much time on the project, they also had some positive feedback. They especially appreciated the move framework and project outline, which provided them with clear ideas for how they can use their expertise for teaching disciplinary writing to engineering students.

One researcher stated that the move coding helped put his knowledge of article writing into an explicit, understandable form. However, some engineering researchers had difficulty understanding the move framework. Two researchers stated that although they had learned some representative previous studies of move analysis through collaboration with the ESP researchers, the definitions of some steps, such as Move 7, Step 3 and Move 7, Step 4 (general findings versus specific findings), were sometimes difficult to distinguish depending on the articles. Other researchers were confused by move codes such as Move 5, Step 3 on the classification list that were irrelevant to their fields of research. Most of these comments were written on the questionnaire, although some were made via e-mail or in person. At the outset of the study, we made an agreement with the engineering researchers to set up a communication channel to answer any questions concerning move coding; the ESP researchers would ask engineering researchers for explanations by e-mail. It was expected that covering more than 60 articles from a wide range of subdisciplines might yield some questions that the preliminary analysis did not predict. A clear explanation of the purpose and the method of the project, the role and level of engagement of the subject researchers, and the tangible outcomes of their contributions all seemed to be essential to ensure the success of the project.

5. Conclusion

The study started with a theoretical question. By analyzing whole articles, it investigated whether so-called engineering English exists in rhetorical structures for research articles. With the help of six engineering researchers, the study employed a two-level (moves and steps) analysis without limiting the analysis to the papers with an IMRD structure, but it identified moves based on content and provided the structure of research articles in five fields of engineering. This paper demonstrates that while moves and steps vary widely by subdiscipline, there are some sections where the subdisciplines share conventional moves and steps. There are some subdisciplines closer in move/step structure than others, at least in certain sections, such as structural engineering and chemical engineering for the introduction section, or environmental engineering and chemical engineering for the body section. These differences reflect the community and culture of the particular field of engineering.

Although the numbers of move coders, research articles, and subdisciplines involved here are modest, the paper presents a case study of subdisciplinary variation that reflects part of the real-world practice of the discipline of engineering that should be taken into account when teaching engineering English. On its surface, engineering seems to be a unified discipline relating to the application of scientific principles and the production of useful things. However, it includes diverse subdisciplines ranging from observational experimentation to mathematical simulation, which was reflected in the diversity of the results. It would, of course, be preferable to analyze more subdisciplines in future studies to further explore the similarities and differences of the rhetorical structures of research articles in engineering. Analysis of individual journals would be also helpful to understand their effects on disciplinary variations.

The results of the study offer pedagogical implications. First, the findings, which suggest the existence of common core of rhetorical structure in writing articles, can be used as a starting point for course development, such as for introductory engineering students at the undergraduate level, where EAP teachers are likely to have engineering students from a range of subdisciplines. In this general course, EAP teachers can use materials from any subdiscipline or even from non-engineering disciplines, as long as they cover the generic standard structures. These courses should focus on inter-subdisciplinary characteristics, such as writing abstracts consisting of steps 1–5 in this order, and prescribed introductions in Swales (1990). While the results of the study revealed rather complex and detailed move-step structures, EAP instructors could use a simplified version for body sections consisting of only moves for general courses to promote easier understanding and later introduce step components in courses for specified engineering English. To provide students with continuous learning by linking general and specific engineering English, as Liyanage and Birch (2001) suggest, EAP teachers could embed the tasks and content specific to subdisciplines into the general engineering English courses. For example, while learning common rhetorical structures, students could also discuss variations among subdisciplines as found in this study in order to help students taking these courses to become aware of the generic structures required according to the students' future discourse community.

Second, even engineering faculty in each subdiscipline can learn from other subdisciplines' writings, particularly emerging and interdisciplinary subdisciplines, such as environmental engineering. Third, the study provides an example of collaborating with researchers in the field to utilize their expertise based on the ESP framework. Finally, the study's findings provide theoretical support for the engineering disciplinary common core and variations of rhetorical structures in engineering subdisciplines. Findings of the disciplinary characteristics of research articles in engineering fields could also provide theoretical insights in other academic disciplines and their subdisciplines.

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Appendix A. Move classification list

Code	Step	Move	Section[a]
11	Reference to established knowledge in the field.	Presenting background information	Introduction
12	Reference to main research problems.		
21	Reference to previous research.	Reviewing related research	
22	Reference to limitations of previous research.		
31	Reference to research purpose.	Presenting new research conducted by the author(s)	
32	Reference to main research procedure and outcome.		
41	Indicating source of data.	Identifying source of data and method adopted in collecting them	Methods
42	Indicating data size.		
43	Indicating criteria for data collection.		
44	Indicating data collection procedure.		
45	Providing background details about the study is going to analyze.		
51	Identifying main research apparatus.	Describing experimental procedures	
52	Recounting experimental process.		
53	Indicating criteria for success.		
61	Defining terminologies.	Describing data analysis procedures	
62	Indicating process of data classification.		
63	Identifying analytical instrument and procedure.		
64	Indicating modification to instrument and procedure.		
71	Restating data analysis procedures.	Reporting results	Results
72	Restating research questions.		
73	Stating general findings.		
74	Stating specific findings.		
81	Interpreting results.	Commenting on results	
82	Comparing results with previous studies.		
83	Evaluating results (or research).		
91	Stating the main results and significance.	Highlighting overall results and their significance	Discussion (Conclusion)
b1	Stating a specific outcome.	Explaining specific research outcomes	
b2	Interpreting the outcome.		
b3	Indicating significance of the outcome.		
b4	Contrasting present and previous outcomes.		
b5	Indicating limitations of outcomes.		
c1	Indicating research implications.	Stating research conclusions	
c2	Promoting further research.		
a1	Background of research	Abstract	Abstract
a2	Purpose		
a3	Methods		
a4	Results		
a5	Conclusion		

[a] Section would vary depending on articles.

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