

# Rhetorical Variation across Research Article Abstracts in Environmental Science and Applied Linguistics

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Received: May 5, 2014 Accepted: June 20, 2014 Online Published: July 15, 2014

doi:10.5539/elt.v7n8p81 URL: <http://dx.doi.org/10.5539/elt.v7n8p81>

## Abstract

Abstract is of a pivotal genre in scientific communication, assisting not only highly selective readers with judgment of the pertinent articles but also researchers in disseminating new knowledge and intellectual discoveries. Difficult yet challenging, however, is the task of writing effective abstracts particularly among non-English speaking scholars. This study reports on the identification of moves and co-existing linguistic features commonly used in environmental science and applied linguistics research article abstracts. 200 research article abstracts published during the years of 2010-2013 were analyzed with reference to Hyland's analytical framework. The two-tier analysis reveals a typical rhetorical structure including a cluster of linguistic features associated with certain pieces of information presented in each particular move, elucidating how research article abstracts in both fields are conventionally constructed. With the presence of all five moves, the structures of I-P-M-Pr-C and P-M-Pr-C were most prevalent among the corpus of environmental science and applied linguistics, respectively. All of the moves, except for Introduction move, were conventional across the two disciplines. Pedagogical implications of the findings are useful particularly for academic reading and writing instruction, enabling language teachers to empower their learners with strategies that contribute to the enhancement of success for publishing in scholarly leading publication.

**Keywords:** research article, abstract, environmental science, applied linguistics, rhetorical structure, disciplinary variation

## 1. Introduction

Among all writing genres, abstracts are considered one important genre in disseminating new knowledge and discoveries in academic discourse communities. With limited cognitive capacity and the information explosion with new journals being launched, the succinct summary of the entire document, both print and electronic archives, has become an invaluable, informative tool for highly selective researchers to access pertinent scholarly literature. Given the pivotal role in scientific communication, abstracts not only facilitate information retrieval but also determine publication success, be it acceptance or rejection (Huckin, 2001). Submitting an abstract is the first requirement for an initial consideration of publication of a research article (RA). In information-rich environments, the strategic manipulation of rhetorical and linguistic features that conform to the standards of the target academia encountered can enhance opportunities for successful publication.

In this respect, genre analysis serves as an approach to identifying the move structures including a cluster of linguistic features prevalent of a genre. Large quantities of previous research on abstract genre were extensively investigated within particular disciplines (e.g., Santos, 1996; Martín-Martín, 2003; Cross & Oppenheim, 2006; Zhangsirikul, 2012; Kanoksilapatham, 2013) and, by extension, across multiple disciplines (e.g., Hyland, 2000; Samraj, 2002; Pho, 2008; Suntara & Usaha, 2013; Saeew, 2013). For example, Santos (1996) conducted a move analysis of RA abstracts in applied linguistics. Hyland (2000) studied abstracts across a vast array of knowledge domains. Samraj (2002) compared the structural organization of abstracts between conservation biology and wildlife behavior. Martín-Martín (2003), moreover, contrasted English with Spanish abstracts in experimental social sciences. The schematic organization of abstracts in protozoology was also analyzed by Cross and Oppenheim in 2006. Pho (2008) investigated RA abstracts in applied linguistics and educational technology. Zhangsirikul (2012) identified the move structure of English language teaching abstracts published in Thai journals. More recently, linguistics and applied linguistics abstracts were examined in Suntara and Usaha's (2013)

study, illustrating disciplinary variation between the two related academic fields. Finally, genre characteristics of civil engineering RA abstracts were investigated by Kanoksilapatham (2013), rendering a rhetorical description of the texts consisting of up to five moves.

Some of these studies apparently suggest that academic disciplines exert, to a certain extent, discernible influences on the overall structure and language choices. According to Becher and Trowler (2001), academic disciplines can be fragmented into the four-domain matrix of knowledge: hard-pure, hard-applied, soft-applied, and soft-pure. The clear distinction between the knowledge fields can benefit the scholars from knowing the writing conventions in their own disciplines. Despite the growing interest in disciplinary variation of abstract writing, little research has been conducted so far to account for the rhetorical variation between environmental science, as the hard-applied discipline, and applied linguistics, as the soft-applied discipline. It is also interesting to see whether these two academic disciplines which are completely different in terms of disciplinary contents (hard and soft domains) but belongs to the same knowledge category (applied domain) share any certain similarities or differences in the conventional rhetorical styles of writing.

This study generally aims to report on the identification of move structures and co-existing linguistic features associated with each individual move, providing the guidelines viable for writing RA abstracts in two disciplines. To the best of our knowledge, the study seeks to answer these following research questions:

- 1) What are the move structures of research article abstracts in environmental science and applied linguistics?
- 2) What are key linguistic features commonly used in research article abstracts of environmental science and applied linguistics?

With limited exposure and experience with the use of English language, non-English speaking scholars may find the task of writing abstracts difficult and challenging. The findings of this study provide insights into how abstract writing can be done to achieve the commonalities in the two focused disciplines. A better understanding will encourage the writers to actively engage in such academic writing tasks. In this study, pedagogical implications are finally discussed in consideration of genre-based instruction.

## 2. Method

### 2.1 The Compilation of the Corpus

The entire corpus consisted of a total of 200 empirical RA abstracts from environmental science and applied linguistics. First, the top four journals with the highest impact factors representing each academic discipline were determined, including *Water Research* (WR), *Journal of Environmental Sciences* (JES), *Waste Management and Research* (WMR), *Bioresource Technology* (BioT), *Applied Linguistics* (AL), *System* (SYS), *English for Specific Purposes* (ESP), and *TESOL Quarterly* (TQ). Twenty-five abstracts from each chosen journal were selected, making up a total of 100 for each corpus. These selected samples were published during the years of 2010-2013. All of the samples were informative abstracts derived from empirical research articles following the nomenclature of IMRD. In other words, the abstracts from academic, theoretical, or conceptual articles were excluded.

### 2.2 Approach to Textual Analysis: Hyland's (2000) Analytical Framework

Given a number of models available (i.e. Swales, 1990; Bhatia, 1993; Santos, 1996; Hyland, 2000), the selection of the analytical framework needs to be justified through the pilot testing of a small sampling of RA abstracts from both disciplines. Following Suntara and Usaha (2013), eight of which from each discipline were selected to assess the four existing models mentioned. First of all, Swales' (1990) IMRD structure was originally centered on the experiential studies and the experimental articles, most notably in natural sciences (Day, 1989). This structured pattern of IMRD accordingly does not correspond to the actual sequence presented in the abstracts of other research fields, i.e. lack of purpose statements and the function of providing applications, which in turn cannot account for disciplinary variation. Second, some sentences establishing current knowledge or background information cannot be explicitly labeled using Bhatia's (1993) model. It is clearly shown that these two following excerpts did not precisely match any move proposed by Bhatia.

Sample (1) excerpted from research article abstracts in the field of environmental science

*Constructed wetlands (CWs) have been shown to improve the water quality of treated wastewater. The buffering capacity of CWs during peak discharges is potentially a key factor for water quality in the receiving waters. (Mulling et al., 2013)*

Sample (2) excerpted from research article abstracts in the field of applied linguistics

*Native English-speaking English teachers at universities in English as a foreign language contexts are sometimes asked to edit English manuscripts written by non-native English-speaking colleagues in scientific*

*fields. (Willey & Tanimoto, 2012)*

Another framework similar to Hyland's (2000) model is Santos' (1996) five-move model. Because the two above excerpts can be realized in Situating the research move of Santos' or Introduction move of Hyland's, these two models are assumed to be applicable to the analysis of this study. However, Suntara and Usaha (2013) endorsed the generalizability of Hyland's model in that his model was created based upon the investigation of 800 abstracts across eight disciplines whereas Santos' model was derived from the analysis of 94 abstracts solely limited to the field of applied linguistics. That is, Santos' model may not be sufficient to account for disciplinary variation. Hyland's (2000) model can therefore be potentially used to capture the rhetorical moves associated with the nature of research across diverse knowledge fields as shown in Table 1.

Table 1. Hyland's (2000, p. 67) five-move model of abstract analysis

Introduction	Establishes context of the paper and motivates the research
Purpose	Indicates purpose, thesis or hypothesis, outlines the intention behind the paper.
Methods	Provides information on design, procedures, assumptions, approach, data, etc.
Product	States main findings or results, the argument, or what was accomplished.
Conclusion	Interprets or extends results beyond the scope of the paper, draws inferences, points to applications, or wider applications.

Based on Swales' genre analysis (1990), "move" and "step" are two central units of the analysis. Nevertheless, the unit called 'step' was not found in this study partly due to the characteristic of conciseness. As stipulated by Santos (1996), a sentence that expresses more than one communicative function is referred to as 'move embedding'. The unit of coding can thus be either a clause or a phrase. Upon the move identification, certain linguistic features that characterize individual moves were identified. Following Kanoksilapatham (2005), the move frequencies were then calculated to determine move stability, i.e. obligatory ( $n = 100\%$ ), conventional ( $n \geq 60\%$ ), and optional ( $n < 60\%$ ). At this juncture, the move structures of the two disciplines can be outlined. In this regard, all plausible variations were later on discussed in terms of move reversal, move embedding, and move cyclicity.

### 2.3 Inter-Coder Reliability Analysis

As cautioned by Crookes (1986), the lack of the systematic coding protocol and explicit rules for decision on move boundaries raises the questions of reliability and validity of the findings. To insure the consistency of the analysis, a subset of research article abstracts from both disciplines was given to the selected coder, an expert in discourse analysis, to independently conduct the individual move identification. Table 2 reports inter-coder agreement rates of move boundaries demarcated by the two coders. Percent of observations is 90% to 100%, reflecting a sufficiently high level of agreement.

Table 2. Summarized results of inter-coder reliability analysis in percentage

Moves	Coded units	Agreement	Disagreement	Percentage
Introduction	13	13	0	100
Purpose	11	11	0	100
Methods	23	22	1	95.65
Product	24	24	0	100
Conclusion	10	9	1	90
Total	81	79	2	97.53%

## 3. Findings and Discussion

### 3.1 Move Identification

The identification of moves reveals not only the overall structural organization but also a set of linguistic features commonly used by the writers in environmental science and applied linguistics. However, certain variations of the move frequency and the move sequencing are observed. All five moves are henceforth referred to as I

(Introduction), P (Purpose), M (Methods), Pr (Product), and C (Conclusion) for the ease of reference. Some examples are also provided and numbered in order of their publication included in the corpus.

### 3.1.1 Introduction Move (Move I)

Similar to Zhangsirikul (2012), this move was found optional, being realized in 52% of environmental science corpus and 54% of applied linguistics corpus. Kanoksilapatham (2005) suggested that the presence of this move reflects the richness of current literature in the fields and, on the other hand, the absence of the move may be due most likely to the relatively short history in the fields.

A clear statement of knowledge related to previous studies is usually introduced using this move. In this study, consistent with Suntara and Usaha (2013), the statements of background knowledge are mostly followed by the indication of a gap or a research problem. The following are some instances of Move I found in the dataset.

Some excerpts from abstracts in environmental science:

- 1) *Different ethnic minorities **currently make up an important** proportion of immigrants from different parts of the world, **but little is known about their recycling behavior and attitudes.*** [WMR6]
- 2) ***However, the differences in degradation of sludge during aerobic and anaerobic digestion remain unclear.*** [BioT5]

Some excerpts from abstracts in applied linguistics:

- 3) *While language aptitude **has been investigated** actively within second language research, **there is a current dearth of research on the effects of aptitude in cases of attrition.*** [AL23]
- 4) ***However, few studies to date have investigated the use—and effects of—English in advertising in Eastern European countries.*** [ESP20]

Consistent with Tseng (2011), the two distinguished tenses found in Introduction move were present simple and present perfect. Orasan (2001) advocated that this move is usually expressed through present simple tense to create the current state of problems or research topics and through present perfect tense when emphasizing the weaknesses of prior research. A closer look shows that present perfect tense was used more frequently by applied linguists than by environmental scientists. It was further observed that only in the field of applied linguistics past tense verbs were used when the specific authors are cited. This resonates what Hyland (2000) claims, that is, the citations, if used, occur less often in hard disciplines than softer areas. Such a practice helps draw readers' attention primarily to the fact being reported, and to what the authors know to be generally accepted in the field. Besides the use of present tense, attitudinal stance words (e.g., *important*) are also used to highlight the importance of research topic.

### 3.1.2 Purpose Move (Move P)

This move was found conventional in 86% of environmental science corpus and 94% of applied linguistics corpus. The construction of Purpose move was similar to that offered by previous researchers, e.g. Li (2011) and Pho (2008). In accordance with Suntara and Usaha (2013), the majority of Purpose move can be explicitly signaled by the formulaic patterns of reporting verbs preceded by deictic items (determiners) and nouns indicating inquiry type.

Table 3. Formulaic patterns of purpose move in environmental science

Deictic items	Inquiry type	Reporting verbs		
this (46)	study (37)	investigate (38)	focus on (4)	develop (2)
the (4)	paper (5)	evaluate (9)	compare (3)	explore (1)
		article (3)	determine (8)	assess (3)
	work (2)	study (7)	analyze (3)	estimate (1)
	research (2)	aim to (6)	was conducted to (3)	discuss (1)
	contribution (1)	examine (5)	identify (3)	report on (1)

Table 4. Formulaic patterns of purpose move in applied linguistics

Deictic items	Inquiry type	Reporting verbs		
this (71)	study (60)	examine (26)	present (3)	show (1)
the (22)	article (21)	investigate (22)	address (2)	compare (1)
	paper (9)	report on (12)	describe (2)	discuss (1)
	analysis (1)	explore (10)	contribute to (2)	focus on (1)
	research (1)	aim to/at (5)	identify (2)	document (1)
	project (1)	report (4)	evaluate (2)	survey (1)
	investigation (1)	analyze (3)	was conducted to (1)	seek to (1)

The three most common choices of the nouns indicating inquiry type in both disciplines were *study*, *article*, and *paper*. Pho (2006) suggested that the use of “study” indicates a more direct way to introduce the present work. Besides, the subjects such as “this article” and “this paper” tend to be accompanied by the present tense verbs because they yield the sense of immediate physical objects in front of the readers, whereas the subjects like “this study” and “this research” are likely to be associated with the past tense verbs as they represent the entire work already accomplished. However, these items can be realized in present tense when used to highlight the current state of the work.

One obvious difference between these two fields is the choice of tense in Purpose move. Most scholars in environmental science resorted to past tense in either active or passive voice while those in applied linguistics preferred present tense mostly in active forms. Though not prominent, use of personal pronouns was also observed and turns out to be a more direct way of introducing the study. In contrast to Hyland (2009), the writers in a “harder” discipline did not downplay their personal role in the research. When used, the pronoun “we” was used more frequently to suggest the collaboration of research activities including interpretations yielded by multiple researchers.

Unlike Kanoksilapatham (2013), the occurrences of move embedding were observed in environmental science corpus and, to a lesser extent, in applied linguistics corpus. Thanks to the condensed form of the abstracts, two communicative functions can be realized within a single clause. As evidenced by Santos (1996), this move was found to occur in combination with either Move I or Move M.

5) *While previous studies have examined online learning in comparative terms (i.e. Which format is better: in class or hybrid?), this study examines certain personality and cognitive factors that might define the ideal hybrid language learner.* [SYS7]

6) *As there is little research on the use of the English language within the European Union for ESP pedagogic purposes, as part of a larger scale analysis, the aim of this study is to explore the structures and functions of lexical bundles ...* [ESP21]

Examples (5)-(6) were however limited to the field of applied linguistics, illustrating the embedding patterns of Purpose move preceded by Introduction move. Besides the construction of I+P, the structure of Methods move embedded in Purpose move can also be seen in the following instances.

Examples of move embedding in environmental science:

7) *This article examines the oxidative disposal of Prozac® (also known as Fluoxetine, FXT) through several oxidative processes with and without ...* [WR20]

8) *The potential of application of indigenous bacteria for enhancing oil recovery was evaluated by examination of the effect of bacterial stimulation on ...* [BioT2]

9) *To study the role of leaf litter in the mercury (Hg) cycle in suburban broadleaf forests and the distribution of Hg in urban forests, we collected leaf litter and soil from suburban evergreen and ...* [JES14]

Examples of move embedding in applied linguistics:

10) *This study explores the problems of learning L2 vocabulary word form by focusing on Arabic-speaking ESL learners.* [SYS14]

11) *Beliefs about the nature of language learning, ... and self-efficacy were examined through survey instruments.* [SYS25]

12) *To explore the lexico-grammar of Discussions, this article relies on two small corpora, one of physics*

*research articles and the other of ...* [ESP16]

Two main embedding strategies similarly used in the abstracts of both disciplines were prepositional phrases, as in (7)-(8) and (10)-(11), and infinitival phrases, as in (9) and (12). The prepositions can be followed either by a noun (phrase) or a present participial phrase.

This phenomenon can presumably be explained by the condensed nature of the abstracts. These rhetorical strategies also well express the knowledge of syntactic complexity upon higher-level decisions of the scholars. As illustrated in (13)-(14) below, such horizons hence allow the reversal of these two moves in both environmental science and applied linguistics texts. That is, Purpose move and Methods move are reversed using similar strategies.

13) **By varying** the carbon (methanol) loading rate ..., **this study quantitatively investigated** the electron distribution among different nitrogen oxide ... [WR5]

14) **Using** exploratory techniques that triangulate on real-time screen recordings, corpus queries, and oral/written reflections, **this paper documents** these interactions as evidencing each learner's efforts to resolve ... [AL10]

### 3.1.3 Methods Move (Move M)

As a means to briefly discuss research paradigms, participants, approaches, or processes that contribute to final products, Methods move is pervasive in 82% in environmental science and 91% in applied linguistics. This move is therefore considered conventional by the scholars in both fields. In congruence with Santos (1996) and Kanoksilapatham (2013), this section is quite technical and objectively presented particularly by employing past passive constructions. Examples abound in the corpus:

Some excerpts from abstracts in environmental science:

15) *The experiments **were conducted** at a temperature range of 450-600°C and a fixed pressure of 25 MPa.* [JES18]

16) *In this study, a questionnaire survey **was distributed** to 249 of the 400 members of Avfall Sverige ...* [WMR3]

17) *Here, **we used** a tank mesocosm system (50 l) to follow the degradation of weathered oil (10 g l<sup>-1</sup>) **using** a bacterial consortium mobilised onto ...* [BioT7]

Some excerpts from abstracts in applied linguistics:

18) *Forty-eight adult native speakers of English, ... **were randomly assigned** into explicit correction, recast, and control (no feedback) groups.* [AL2]

19) ***Four university students participated** in this study; data **were collected through** semi-structured interviews, learning journals recorded by the students, and ...* [SYS11]

20) ***We applied** multi-group structural-equation modeling to analyze ...* [AL14]

Generally speaking, these instances can be marked overtly via the use of research activity verbs, past tense verbs, and technical nominal phrases. The scholars in both fields showed a strong preference for past tense over present tense. Similar to Kanoksilapatham (2013), a scrutiny of grammatical collocations reveals that in environmental science passive voice usually collocated with an inanimate subject (e.g. *experiment, questionnaire survey*). Active voice was rarely seen in the corpus of environmental science but, when used, it collocated with an animate subject (e.g. *we used*). On the other hand, as in (18)-(19), the use of passive voice in applied linguistics abstracts was able to collocate with animate or inanimate subjects.

As detailed in Suntara and Usaha's (2013) study, the occurrences of Methods move are classified into three strategies: embedded in Purpose move (P+M), placed separately behind Purpose move, and embedded in Product move (M+Pr). The two former patterns were already exemplified in the previous section 3.1.2. Here, the following sentences instantiate the extent to which this move can be embedded in the larger syntactic unit.

Some excerpts from abstracts in environmental science:

21) ***By analysing** the pre-recycling behaviour of Minsk citizens and ..., **we indicate** common sociodemographic variables for both cases and determine ...* [WMR24]

22) ***Among** 32 rice cultivars tested, **there were significant differences** in Cd (0.06–0.59 mg/kg) and Pb (0.25–3.15 mg/kg) levels in their brown rice, and ...* [JES10]

Some excerpts from abstracts in applied linguistics:

23) **Based on data collected through classroom observations, stimulated-recall interviews, and reflective journals, it was found that** situational WTC in L2 classrooms ... [SYS16]

24) **The structural–functional analysis of the dialogues written from the course showed that, across the four trades explored ...** [ESP13]

Once this move is placed within Product move, the amount of information concerning data description, data collection methods or data analysis is contracted to accommodate the conciseness. Either prepositional or participial phrases were inserted to construct the embedding patterns. Apart from these strategies, the nominal entities recognized by the analysis in (24) were also used as a sentential subject by some writers in applied linguistics.

### 3.1.4 Product Move (Move Pr)

Obligatory in the field of environmental science and conventional in the field of applied linguistics is Product move. This move was recognized in 100% of the environmental science corpus and 95% of the applied linguistics corpus. Principle findings are announced in the move. As expounded upon in Suntara and Usaha (2013), the onset of this move can be signified by that-complement clause constructions and formulaic lexical patterns illustrated in Table 5 and 6.

Table 5. Key lexical choices of product move in environmental science

Opening subjects	Reporting verbs	
result (52)	show that (32)	reveal that (3)
there (16)	find that (15)	reveal (2)
analysis (10)	indicate that (10)	indicate (1)
data (5)	suggest that (6)	demonstrate (1)
it (4)	demonstrate that (5)	
finding (2)	show (5)	

Table 6. Key lexical choices of Product move in applied linguistics

Opening subjects	Reporting verbs		
result (44)	show that (38)	identify (4)	illustrate (1)
finding (21)	indicate that (13)	show (3)	
analysis (15)	find that (11)	argue that (2)	
it (7)	reveal that (10)	depict that (1)	
data (4)	reveal (8)	demonstrate (1)	
study (3)	suggest that (6)		

The subject types, according to Pho (2008), are classified into two categories in this study: (i) reference to writer's own work (i.e. results, analysis,) and (ii) objects of research and their attributes (i.e. participants, variables). As shown, the preference use of lexical choices was relatively similar. The noun *result* and the verbs *show*, *indicate*, and *find* were used most frequently for opening Product move among the two disciplines.

Contrary to Pho's (2008) findings, the analysis shows that first person pronouns were used quite often in this study, suggesting that assertive disposition of the authors of empirical research articles. Some scholars however resorted to the general subjects "it" and "there" to conceal their identity or the source of evaluation. For example,

Some excerpts from abstracts in environmental science:

25) **We found that** for sediment sampled from these high-energy rivers ... [WR25]

26) **There was antagonistic effect among Cd and Zn in the multi-metals ...** [JES20]

Some excerpts from abstracts in applied linguistics:

27) **We found that, of the items that were difficult though composed of ...** [AL16]

28) **It was also seen that among the participants with below-average aptitude ...** [AL23]

In contrast to Orasan (2001), the current work exhibits the prevalent use of past tense over present tense in

Product move. One surprising outcome contrary to Kanoksilapatham's (2013) study is the alternation of the present and past tenses of the reporting verbs. The tense of the reporting verb is not in agreement with the tense of a verb embedded in a that-complement clause as shown below.

29) *The results of this study **demonstrated that** temperatures >35 °C **inhibit** reductive dechlorination activity at the Great Lakes and Ft. [WR14]*

30) *Results **show that** the free-writing condition **enhanced** the quality of the learners' writing; the task-content-given condition and ... [TQ4]*

To enhance promotional attributes, Li (2011) suggested that Product move should be escorted by Conclusion move. The current findings indicated that this structure was however featured solely in the field of environmental science. Here are some examples taken from the corpus.

31) *The variability of total suspended solids for many characteristics was similar to Escherichia coli, **indicating that** the variability of E. coli **may not be substantially higher than** that of other pollutants **as initially speculated**. [WR10]*

32) *Higher concentrations of enterococci and higher incidence of Campylobacter were found in stream waters collected before sunrise, **suggesting** these organisms **are** sensitive to sunlight. [WR18]*

### 3.1.5 Conclusion Move (Move C)

Move Cs are present 70% and 72% in the environmental science and applied linguistics corpus, respectively. Consistent with Suntara and Usaha (2013), Conclusion move is deemed conventional in the applied disciplines. The appearance of this move is supported by a shift from a more 'indicative' to a more 'informative' type of abstracts. Optional as it was, this move is currently acknowledged as the key component that draws readers' attention to explore the remainder of the article.

Kanoksilapatham (2013) sustained that this move, in fact, discusses the findings from several perspectives. In support of Feltrim et al. (2003) and Li (2011), Conclusion moves in this study can be divided into four types of content: (a) deducing conclusions or drawing explanations, (b) evaluating value of the research, (c) indicating the structure of the discussion, and (d) endorsing recommendations for implications/further research.

(a) Deducing conclusions or drawing explanations

33) *This improvement **can be attributed to** the trash-in-trash-out (TITO) system of SW collection which is currently practiced by ... [WMR22]*

34) *The methanogenic potential of this type of waste **is not determined by** the amount of sludge and it does not need an external inoculum. [BioT16]*

35) ***As** university lecturers use metaphors for important functions, such as explaining and evaluating, such international students **may thus be missing** valuable learning opportunities. [AL16]*

36) *These results **suggest that** the linguistic background of ESL teachers **is only one** among numerous variables influencing students' attitudes ... [TQ21]*

(b) Evaluating value of the research

37) *The addition of orthophosphate salts in the drinking water treatment process **would be an effective method** for aluminum control in ... [JES25]*

38) *... a process combining anaerobic digestion and algae cultivation **can be proposed as an effective way** to convert high strength dairy manure ... [BioT23]*

39) *This study **can shed light on the effective role** of setting speech acts, and compliments in particular, as part of curriculum design to help ... [SYS8]*

40) *This research provides ESL teachers and researchers with **useful insights** into how these measures **can be used effectively as** indices of college-level ... [TQ19]*

(c) Indicating the structure of the discussion

41) *The pedagogical implications of these findings **are discussed**, as are the suggestions for future research. [SYS22]*

42) *The paper **concludes by discussing** the implications of the study for academic writing research as well as the design of ... [ESP10]*

(d) Endorsing recommendations for implication/further research



- 43) **Future work is recommended** to determine infectious risks of recreational waterborne illness related to ... [WR17]
- 44) These results **have application for** screening level colloid filtration modeling of riverbank filtration in these systems. [WR25]
- 45) We **argue that** greater collaboration between English teachers and researchers in scientific fields **is needed**, and that consultation and clarity **should** become ... [ESP6]
- 46) These findings **have implications for** teacher educators, TESOL institutions, and accreditation bodies that are ... [TQ9]

The above instances demonstrate the multi-functions of this particular move. As shown, the explanations of the results are hedged using auxiliaries in order to avoid negative influence of subjectivity (Hyland, 2009). Plus, attitudinal stance words are used to offer the positive evaluation of the applications of the findings. The structure of the article is also discussed but found only in applied linguistics abstracts. Moreover, auxiliaries, like *should*, and *need*, are used to offer recommendations. To promote individual contributions, some scholars employ overt nominal phrases (i.e. *application*) to suggest a possible application of research findings.

One major difference is remarked by Suntara and Usaha (2013) in that the applicability of findings between these two fields is contextually different. Environmental scientists tend to evaluate the value of their contributions to the real-world context since the knowledge yielded from environmental science research helps improve environmental quality and human existence in various aspects. On the other hand, applied linguistics research investigates and offers solutions to language-related problems. Its contributions are very useful for language-related activities and academic instruction. It can also be assumed that since language plays a pivotal role in communication, the solution to language-related problems can benefit the acquisition of language (both perception and production) in humans which, in turn, can be accomplished by learning and teaching regardless of learning contexts (Saeew, 2013). To serve language teachers, the research contributions in applied linguistics are thus considered worth applying to the educational system and language instruction, in particular.

Suntara and Usaha's (2013) and Saeew's (2013) findings have corroborated the relationship between the nature of applied sciences and the function of Conclusion move. The application of research findings seems to correspond to the nature of environmental science and applied linguistics disciplines. Hence, the investigation of this study confirmed that Conclusion move is considered conventional in the applied sciences rather than the pure ones.

### 3.2 Move Frequency

Table 7. Frequency of the occurrences of moves in environmental science

Moves \ Journals	Water Research (N = 25)	Journal of Environmental Sciences (N = 25)	Waste Management and Research (N = 25)	Bioresource Technology (N = 25)	The total of move occurrences (%)
Introduction	17	7	19	9	52 (52%)
Purpose	23	22	20	21	86 (86%)
Methods	18	22	24	18	82 (82%)
Product	25	25	25	25	100 (100%)
Conclusion	20	21	19	10	70 (70%)

Table 8. Frequency of the occurrences of moves in applied linguistics

Moves \ Journals	Applied Linguistics (N = 25)	System (N = 25)	English Specific Purposes (N = 25)	TESOL Quarterly (N = 25)	The total of move occurrences (%)
Introduction	13	11	15	15	54 (54%)
Purpose	23	24	23	24	94 (94%)
Methods	23	23	23	22	91 (91%)
Product	23	25	24	23	95 (95%)
Conclusion	18	19	15	20	72 (72%)

As reported in Table 7 and 8, the frequency of the occurrences of individual moves is calculated in percentages to suggest the potential role played by each move. More generally, most of the abstracts in these two fields consist of a set of up to five moves. Introduction move was not as frequently found as the other moves and was therefore optional in both fields. It is likely that in some journals Introduction is not considered the core requirement and the readers may already have strong background knowledge of the study being examined (Zhangsirikul, 2012). In line with Cross and Oppenheim (2006), and Pho (2008), Purpose, Methods, and Product were present in almost all abstracts and were recognized as the conventional moves of the genre. Conclusion move, despite its lower frequency than any other conventional moves, is considered important in writing the abstracts in these two fields.

The findings of this study, inconsistent with Hyland (2000), reveal a higher percentage of the occurrences of Conclusion as the conventional move in the applied disciplines, suggesting that more scholars acknowledge its importance and are making greater efforts to promote their work. The realization of this move is clearly discipline-dependent owing to the nature of applied sciences. According to Li (2011), three possibilities of the absence and identification of the move as optional are raised in order. First, the abstracts for the analysis might not be all from empirical research articles in which results and discussion are included. It is possible that other types of research article, e.g. theoretical articles, were included in the corpus. As evidenced by Zhangsirikul (2012), the selective use of analytical framework can also influence the results of the analysis. His findings showed that Conclusion move was optional in English language teaching, a sub-discipline of applied linguistics (Cook, 2003). Besides differences in analytical framework subtleties, it is further assumed that the results might be due to variation within the same discipline. The last possible reason is that in some cultures people are not encouraged to sell their ideas and contributions.

### 3.3 Move Structure

Upon completion of the move identification, the representative templates of research article abstracts in both disciplines can be determined, suggesting how a set of moves can be conventionally structured. As illustrated in Table 9, the analysis showed that all abstracts did not follow the same rhetorical patterns.

Table 9. Move structures in environmental science and applied linguistics

Environmental science (N = 100)		Applied linguistics (N = 100)	
1. I-P-M-Pr-C (23%)	8. M-Pr-C (5%)	1. P-M-Pr-C (32%)	8. I-M-Pr-C (2%)
2. P-M-Pr-C (20%)	9. I-P-Pr (4%)	2. I-P-M-Pr-C (25%)	9. I-P-M-C (1%)
3. P-M-Pr (13%)	10. P-Pr (3%)	3. P-M-Pr (13%)	10. P-I-Pr-C (1%)
4. I-P-M-Pr (8%)	11. M-P-Pr-C (3%)	4. I-P-M-Pr (11%)	11. I-P-C (1%)
5. I-P-Pr-C (6%)	12. P-I-M-Pr-C (2%)	5. I-P-Pr-C (8%)	12. M-Pr (1%)
6. I-M-Pr-C (6%)	13. M-Pr (1%)	6. I-M-Pr (3%)	
7. P-Pr-C (6%)		7. P-I-M-Pr (2%)	

Consistent with Hyland (2000) and Li (2011), P-M-Pr-C was the most preferred move structure in the soft-applied discipline. The analysis also demonstrated similar rhetorical structures to Cross and Oppenheim's (2006) and Kanoksilapatham's (2013) studies which show that I-P-M-Pr-C was identified as the most prevalent move structure in the hard-applied field. The results of move structure further indicated that not all moves were present in all abstracts. The inclusion and exclusion of the moves suggest that the moves and their communicative purposes are not all equally important. The writer's preference of the moves influences the patterns of thought and the ordering of information to be addressed in the text. Less prominent information would likely to be excluded while more salient points are elaborated in greater detail. To draw attention of the interested readers, some moves are also sequenced in syntactically reverse order.

A scrutiny of the move structure additionally found that Methods, Product and Conclusion are interwoven and cyclical. In consonance with Samraj (2002), the cyclicity of the moves was found solely limited to the field of environmental science. The cyclicity denotes a recurrence of moves in either form of embedding moves (i.e. phrases or subordinating clauses) or independent clausal units. Kanoksilapatham (2013) concluded that the cyclical patterning and sporadic occurrences of the moves demonstrate the complexity of the study entailing a number of methods, results, and simultaneously conclusions as illustrated below.

**[Move3: Methods]** *First, several electro-dewatering cycles were used to increase sludge temperature to about 100 °C after 6 min, during which time the average pH decreased from 7 to 3.6 after 10 min. [Move4: Product] Total coliforms and E. coli MPNs reached their detection limits after ... [Move3: Methods] Second, the dewatering cake was separated into four horizontal layers. After 8 min of electro-dewatering, [Move4: Product] the pH in the top layers decreased to 3, whereas the pH in the bottom layers increased to 8. [WR13]*

#### 4. Conclusion

The purpose of this study was to identify the rhetorical structure and co-existing linguistic features commonly followed in environmental science and applied linguistics RA abstracts. Based on a 60% cut-off criterion, all of the moves identified in the abstracts, except for Introduction move, are conventional across the two disciplines. The structure of I-P-M-Pr-C is most prevalent in environmental science abstracts while P-M-Pr-C is the most preferred move structure in applied linguistics abstracts. The analysis also shows that the rhetorical strategies deployed by the scholars in these two applied disciplines are relatively similar. Present tense is prominent in Introduction move and Conclusion move, while past tense is dominant in Methods move and Product move. That-complement clauses headed by the reporting verbs are typical of Product move and Conclusion move. Personal pronouns are also observed, suggesting that the researchers in these fields become more argumentative and assertive in their stance on reporting. Irrespective of diverse functions and the ordering of preference, most scholars in both fields appear to share similar sets of lexical choices in Purpose move, Product move, and Conclusion move.

Despite these similarities, most scholars in applied linguistics seem to use present tense more frequently in Purpose move than do those in environmental science. In other words, the writers in the hard-applied field resort to past tense more often than present tense in Purpose move. One last major difference is the applicability of the findings is contextually different. The environmental scientists extend the applications of their results to their discipline, research field, and real-world context. On the other hand, the scholars in applied linguistics promote their contributions by potentiating the implications of their results specifically to the educational milieu or learning environments.

In this respect, certain variations are observed in terms of move embedding, move reversal and move cyclicity. The moves deemed more necessary by certain individuals are likely to be included or reversed to the front, while those less important are prone to be excluded. The results also demonstrate the occurrences of move embedding in environmental science abstracts and, to a lesser extent, in applied linguistics texts. Some writers resort to embedding strategies to maintain the conciseness of the abstracts. The last deviation from Hyland's model is the move cycling patterns in the field of environmental science. When several results are reported serially, some such moves as Methods, Product, and Conclusion are likely to recur in the text a number of times.

Overall, this study confirmed the closeness between these two applied disciplines. Certain variations can be observed at both levels of organization and language choices between hard and soft knowledge domains. The flexibility of the analytical framework allows a certain amount of freedom and creativity for the writers. Because abstracts are of importance in scientific dissemination, knowledge of basic rhetorical structures will enable learners and novice scholars in their fields to fully engage in academic writing tasks and enhance their chances of success for publishing in scholarly leading publication. At this juncture, it should be noted here that environmental science and applied linguistics are not exactly the typical representative of the hard-applied disciplines and the soft-applied disciplines, respectively. Accordingly, the interpretation and the generalization of the findings should be done with caution.

##### 4.1 Pedagogical Implications

The implications of this study are valuable for didactic purposes, enabling language teachers to empower learners with strategies in response to the rigorous writing demands of the two disciplines. Instead of a sample abstract and a very general description of abstract, like 'do not use personal pronouns', advice on what constitutes a prototypical of an abstract and how each rhetorical unit can be linguistically realized needs to be addressed. With limited exposure and experience with the use of English, as opposed to native speakers of English, the explicit genre-based instruction is very useful and should be incorporated into academic courses for non-English speaking learners to prepare them for the research world.

Before they are asked to write, sensitivity to genre conventions needs to be developed by presenting them with genre exemplars and having them engage in the practice of genre analysis. Anderson (1999) recommended the use of authentic materials as it visualizes how language is actually used in the context being studied and motivates them to actively participate in the tasks. Likewise, authentic materials can make learners more realistic about their abilities.

Kanoksilapatham (2013) suggested that giving the learners the opportunities to be exposed to and analyze the genre from the perspectives of the discourse community members and communicative functions can provide them with sharpened sensitivity to genre subtleties. Through the analysis process, learners will begin to recognize the structural organization, key elements of a genre and, further, variations across genres, disciplines and/or languages. With hands-on experience and a better understanding of the rhetorical structure of the genre, learners will be able to compose the texts that better satisfy the expectations of their target discourse communities and be more than ready to cope with other genres encountered in their professional lives.

#### 4.2 Recommendations for Further Studies

Some interesting points of views recommended for further investigations are in order. First, genre analysis is a product-oriented approach to textual analysis. Further research on discovering how learners develop their rhetorical strategies and how texts are organized from the very beginning is critical and the analysis of the developmental process of writing can be supplemented by employing qualitative tools, such as interviews and think-aloud protocols. Second, in order to visualize a clearer and more precise picture of how a genre in a particular field is structured, the examination of the rhetorical structures of abstracts across sub-disciplines is suggested. Finally, the samples of this study are contextualized in the fields of environmental science and applied linguistics and all are in English language. The comparison between native and non-nativeness can provide more evidence on variation imposed by cultures. In addition, in order to gain deeper insights into cultural and disciplinary variations of language choices, further studies may explore the abstracts in other disciplines and/or languages.

#### Acknowledgments

This paper is based on part of my thesis completed at Thammasat University. I am grateful to Assoc. Prof. Dr. Supong Tangkiengsirisin for dedicated time, feedback, and guidance throughout the entire process, and Asst. Prof. Dr. Ora-Ong Chakorn for her help as the coder for a sub-set of the corpus.

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