Generic Characterisation of Civil Engineering Research Article Abstracts

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ABSTRACT

English is increasingly used in advanced education. Among academic writing types, abstracts are one of the pivotal genres of communication among scholars from multiple disciplines. Nevertheless, non-English speaking scholars find the task of writing successful abstracts daunting and challenging. As a consequence, they might not be able to fully participate in their respective academia. To help these scholars disseminate their research findings, this study has the objectives of:1) identifying the structural organisation commonly followed in civil engineering abstracts and (2) identifying a set of linguistic features commonly associated with a particular type of information presented in the abstracts. To accomplish these objectives, a data set of 60 English abstracts belonging to civil research articles systematically selected from the top journals in civil engineering was compiled and analysed with reference to Swales' genre analysis. The subsequent analysis reveals a typical pattern of how information presented in the abstracts is organised. Furthermore, each information type was linguistically characterised by a cluster of linguistic features that frequently co-exist. These findings capture what constitutes an appropriate academic style of writing in civil engineering abstracts. The study thus helps form a pedagogical model viable and useful for civil engineering scholars to develop strategies in response to the rigorous writing demands of academia. A better understanding of how research article abstracts are constructed can enhance not only their writing skills to conform to the expectations of the target discourse community, but also the chance of success in their respective fields.

Keywords: Civil engineering; abstract; research article; structural organisation; genre

INTRODUCTION

In the Southeast Asian region, English is recognised as a working language in business, communication, and education. Academically, English is increasingly used in advanced education communication, be it written or spoken. Among all academic writing genres, abstracts are one of the pivotal means of communication among scholars across academic disciplines. Genre as defined by Swales and Feak (2009) refers to a type of text designed to achieve a set of communicative purposes. Some scholars argue that abstracts, as well as other sections of a research article (RA), are considered a sub-genre of the RA genre (Swales & Feak 2009, p. 2). However, others purport that abstracts are a genre embedded in the larger genre of RAs (Biber & Conrad 2009). In this paper, abstracts are treated as a genre because of their independent status and their own unique communicative purposes, which are different from those of the sections of Introductions, Methods, Results, and Discussions.

RA abstracts are acknowledged to be an efficient means of retrieving information (Cross & Oppenheim 2006, Fairclough 1995, Ventola 1997, Swales & Feak 2009, Hyland 2004). Specifically, in science, scholars and practitioners benefit from the availability of abstracts in order to be updated with current scientific discoveries, including sharing and disseminating new achievements. Given the burgeoning and huge volume of information available in print and on the Internet in scientific communities, scholars and practitioners need to be selective when engaging in the RA reading task (Salager-Meyer 1990, 1991). To

illustrate, given the inherent characteristics of precision and conciseness, abstracts facilitate the information retrieval by saving time in making a decision if the following sections of a RA should be read. In addition, with the availability of certain keywords, readers are provided with the major focus of the paper. Finally, RA abstracts act as a reminder of the article contents.

The roles of abstracts are evident not only in terms of information retrieval but also in terms of publication success, determining the acceptance/rejection for publication (Huckin 2001). Scholars thus find the task of writing abstracts quite daunting and challenging. For non-English speaking scholars or inexperienced learners of English, especially in Southeast Asia, the abstract writing task is much more intimidating. In addition to the disciplinary content to be presented in the abstract, novice non-English speaking scholars particularly need to possess two additional bodies of knowledge in writing successful abstracts in English: structural organisation and linguistic features. To elaborate, primarily, they need to know the overall organisation commonly followed in this particular genre of their respective academic disciplines. Moreover, they need to be able to choose appropriate lexical and grammatical features to make their abstracts accessible and understandable by their target discourse community members.

According to McKenna (1997), successful academic writing can be attributed to a number of factors. One of the factors listed is organisation. Given the fact that abstracts are crucial, and contribute to the growth and prosperity of scholars in all disciplines, knowledge of the structural organisation of English abstracts is advantageous. In this regard, a number of research studies focus on identifying the overall organisation of abstracts in specific disciplines (Samraj 2005, Pho 2008, Santos 1996, Martin 2003, Cross & Oppenheim 2006, Hyland 2004, Swales & Feak 2009, Šauperl, Klasinc & Lužar 2008). For instance, Samraj (2005) analysed abstracts across the two disciplines of conservative biology and wildlife behaviour. Martin (2003) examined social sciences abstracts across the two languages of English and Spanish. Pho (2008) compared and contrasted English abstracts on applied linguistics and educational technology. More recently, Cross and Oppenheim (2006) analysed the move structure of 12 abstracts in protozoology. Finally, Šauperl, Klasinc and Lužar (2008) analysed Slovenian abstracts in pharmacology, sociology, and linguistics and literature and Santos (1996) in applied linguistics. These studies suggest that, despite the overall structural organisation, abstracts seem to vary to a certain extent according to academic disciplines.

A number of scholars are interested in the microanalysis level of texts, focusing on specific linguistic features in RA abstracts. For example, while Pho (2008) scrutinised the use of authorial stance in applied linguistics and educational technology abstracts, Hyland and Tse (2005) analysed the use of evaluative *that* in abstracts from multiple disciplines. Lastly, Hu and Cao (2011) focused on two linguistic features of hedging and boosting in English and Chinese abstracts in applied linguistics. Interestingly, they found that, for instance, Chinese abstracts tend to use boosting devices more frequently than the English counterparts.

The two approaches of analysis mentioned above have provided insights into the writing of abstracts in various disciplines. Along the lines of research studies mentioned, this study aims to provide the overall organisation of civil engineering abstracts and the linguistic characterisation of information presented in these abstracts using Swales' genre analysis (1990, 2004) as an analytical framework. The abstract dataset analysed in this study was systematically compiled to assure that the texts analysed represent top quality abstracts in the field. The analysis shows that the civil engineering abstracts in general consist of a set of up to five moves, forming a common structural organisation. However, certain variations are

also observed in terms of both the frequency of occurrence of each move and the move sequence. Additionally, the linguistic features commonly used to express each of the five moves are highlighted. The structural pattern and linguistic features identified are of tremendous help for non-English speaking civil engineers when writing abstracts in English, assisting them in disseminating their research findings both locally and internationally.

METHODS

Two major stages were involved in the methodological procedure. First, a dataset representing the genre of RA abstracts in civil engineering was compiled. Second, the dataset was analysed, using Swales' genre analysis to capture the overall structural pattern made up of a set of moves. The move instances yielded from genre analysis were subsequently scrutinised to identify co-existing linguistic features.

DATASET COMPILATION AND DESCRIPTION

In order to compile a dataset for the study, initially, the top five journals with the highest impact factors in the discipline of civil engineering most recently available during the time of the study were consulted. The top five journals selected are referred to in this study as JE, JH, JI, JW, and JY. From each of the five journals, twelve articles were randomly selected to represent each journal. Therefore, the dataset for genre analysis in this study consists of 60 abstracts which were numbered in the order of their publication from 1 to 12. For instance, [JE1] means the abstract was taken from the journal abbreviated as JE, and it is the first abstract of the journal included in the dataset. The dataset is approximately 11,000 words in total. At this juncture, it should be noted that since there is no indicator to directly assess specifically the quality of the abstracts, given the top five journal impact factors of these journals, the dataset of abstracts taken from these journals can be assumed, to a certain extent, to represent well constructed abstracts in the discipline of civil engineering.

DATASET ANALYSIS

The dataset was analysed using Swales' genre analysis (1990, 2004). To reiterate, a central unit of this analytical framework is a 'move,' which refers to a text segment that has a communicative function. The objectives of this study are twofold: (1) to identify the structural organisation of civil engineering RA abstracts based on a typical sequence of moves found and (2) to identify a set of linguistic features associated with a particular move.
To address the first objective, 60 abstracts were analysed into sub-units called 'moves,' based on the communicative function and the cluster of linguistic features, creating a link to address the second objective of the study. That is, the alignment of individual move instances allowed us to identify a set of linguistic features commonly associated with each particular move in the abstracts. At this juncture, the frequencies of occurrence of individual moves were reported and calculated into percentages to suggest the potential role played by each move. Then, a typical structural organisation of civil engineering abstracts was formulated, based on the most frequent move sequence found in the dataset. In this regard, cyclical patterning of moves and possible structural variations, if found in the dataset, were also reported.

RESULTS AND DISCUSSION

The following section presents the results of the analysis. The examination of the dataset reveals a set of five moves present in the abstracts, interacting with each other forming a particular structural organisation. The five moves are: background, purpose, methodology, result, and discussion and henceforth are referred to as Moves B, P, M, R and D. The move names explicitly reflect the functions of the moves in the abstract texts. All examples presented in this article reflect verbatim copies of the original ones, with the following modifications. One, sentence numbers are inserted for the ease of reference. Two, certain linguistic features of each move are highlighted. Three, // are inserted to indicate move boundaries. Finally, specific names are replaced by XXX to maintain confidentiality.

In order to illustrate the demarcation of abstract texts into moves and the identification of linguistic features to signalize the move identification, the following abstract of [JY11] is presented:

> (S1) Few case studies **are** available on stream water quality monitoring during road construction, especially in highly protected watersheds. (S2) **Recent** reconstruction of two tunnels and approach roads in the great smoky mountains national park potentially could have impacted the adjacent stream due to sediment and acid-generating geology.// (S3) **To determine whether** impact occurred,// grab and passive sampling **were conducted** at stream sites above and below each construction area before, during and after construction. (S4) Performance of individual structural best management practises (BMPs) **was** also **monitored**.// (S5) Due to the small disturbance area, **the results showed that** tunnel reconstruction **had** no statistical impact on stream water quality based on comparison of upstream and downstream pH and suspended solids. (S6) Surprisingly, median suspended solids concentrations for the stream sampling locations **were** lowest during construction,// ostensibly **because** construction occurred in winter when the ground was frozen. (S7) Differences in stream pH and water quality between construction and pre and post construction phases **were attributed to** normal seasonal variation. (S8) BMP performance **was mixed**; the efficiency of check dams **was dependent** upon their ability to pond water.

S1 and S2, representing Move B, establish the research topic by presenting its relevant background information. For instance, the use of present tense verbs *are* and the word *recent* indicates the contemporary nature of the topic. In the first half of S3, the phrase *to determine whether* introduces the purposive statement. The second half of S3 and S4 belong to Move M, signalised by the use of past tense verbs in passive voice (*was conducted, was monitored*). S5 and the first half of S6 substantially form Move R, reporting the results through the formulaic phrase *the results showed that* and past tense verbs *had* and *were*. Finally, the second half of S6, S7 and S8 provide explanations, comments and interpretations of the results, recognised by the words or phrases *because*, *attributed to, was mixed,* and *was dependent*. Based on the sequence for moves delineated, this abstract depicts the B-P-M-R-D move sequence, a typical structural organisation of abstracts in this discipline, if all moves are present. However, at this juncture, it should be noted that not all abstracts strictly follow the five move pattern. Variations occur and will be shown later. The following sections

describe individual moves in the order they are likely to be found in this dataset. The frequencies of occurrence of individual moves are also reported.

BACKGROUND MOVE (MOVE B)

Background Move or Move B is found in 36 out of 60 abstracts (60%). If used, it is usually (although not always), at the beginning of the abstract. This move, as indicated from its name, is to provide background information of the topic of research being presented. Here are some of the instances of Move B found in this dataset:

[JH5] Development of stage-discharge relationships for coastal low-gradient streams **is** a **challenging** task. Such relationships **are** highly nonlinear, non-unique and often **exhibit** multiple loops. Conventional parametric regression methods usually **fail** to model these relationships

[JI4] Intelligent vision-based traffic surveillance systems **are** assuming an **increasingly important** role in highway monitoring and road management schemes.

[JW5] Forestry practises that **are** applied to buffer regions **can** be used as a strategy to **improve** water quality and flow regime in urbanizing watersheds.

As shown, Move B instances are to prepare readers for the topics focused in the abstracts, by highlighting the importance of the topic (*challenging, increasingly important, improve*) and the current state of the topic by the use of present tense verbs (*are, is, can, exhibit, fail*).

PURPOSE MOVE (MOVE P)

Purpose move or move P is used in 41 abstracts or 68.33% of the dataset. If Move B is used, Move P usually immediately follows. The purpose of the research is usually explicitly stated, as shown in the following instances:

[JY5] **This study compares** two established approaches for generation of monthly hydrological variables.

[JE5] **This study outlines** the last two phases of a joint research study performed by XXX and XXX.

[JI2] Real-time identification of freeway segments with high crash potential **is addressed** in **this study**.

The instances reveal that the phrase *this study* is commonly found in this move. In addition, the use of present tense and either active or passive voice (*compares, outlines, is addressed*) is preferred in this discipline.

METHODOLOGY MOVE (MOVE M)

Methodology move or Move M is found most frequently, compared with the other moves, in 56 out of 60 abstracts (or 93.33%):

[JH6] Experiments **were conducted** using two different nozzles and three tail-water depths.

[JI7] The algorithm **was tested** with 1334 natural-scene grey-level vehicle images of different backgrounds and ambient illumination.
[JW3] We **estimate** a hedonic price function for houses in the area of a pilot project and **include** the estimated part worth of yard area.

These instances briefly describe methodological procedures adopted by the studies. As seen, this move can be expressed, using research activity verbs in past and present tenses and active or passive voices (*were conducted, was tested, estimate, include*). A scrutiny of the grammatical collocations in these instances reveals that passive voice and past tense collocate (*were conducted, was tested*) when a subject is inanimate (*experiments, algorithm*) as in [JH6] and [JI7]. In contrast, active voice and present tense collocate when a subject is animate (*we estimate*) as shown in [JW3].

RESULT MOVE (MOVE R)

Result move or Move R is the next most frequent, with a frequency rate of 91.66% (55 out of 60 abstracts). This move is absent in 5 abstracts in which the aim of proposing a model (Move P) is explicitly stated and the model itself is the result. The high frequency of occurrence of this move indicates the integral role it plays in the abstracts.

[JE3] **We find that** one retrofit **exhibits** BCRs as high as 8 and **is** in excess of 1 in half of California zip code.
[JY11] …**the results showed that** tunnel reconstruction **had** no statistical impact on stream water quality …
[JH5] **The results show** an overall good performance of both modelling techniques.

These instances reveal that, to express Move R, the alternation of the present and past tenses of a reporting verb (*show vs. showed*) is possible. The subject of this reporting verb in [JY11] and [JH5] is inanimate (*the results show/showed*). It should be noted that the tense of the reporting verb (*show, find*) seems to be in agreement with the tense of a verb embedded in a *that* clause headed by a reporting verb as shown in [JE3] and [JY11].

DISCUSSION MOVE (MOVE D)

This move, if found, is usually the last move to end the abstracts. The move discusses the findings from several perspectives including implications, significance, interpretations, and explanations. This move occurs in 40 abstracts or 66.67% of the entire dataset:

[JY11] Differences in stream pH and water quality **were attributed to** normal seasonal variation.
[JE3] Higher quality **is estimated** to save thousands of dollars per house.
[JW11] Water managers **should consider** using tariff revenue to provide drought relief and transitional assistance.

The above instances demonstrate the multi-functions of this particular move. Accordingly, the linguistic features used to highlight the functions are quite diverse. As shown, *were attributed to* is used to explain the results in [JY11]; *is estimated* in [JE3] is used to interpret the finding; and *should consider* is used to state implications of the findings in [JW11].

Evidently, a set of five moves was not always used in the abstract dataset. Some moves were found to be more frequent than the others. The following table summarises the frequencies of occurrence of the fives moves identified in the civil engineering abstract datase

TABLE 1. Frequencies of occurrence of the moves

Move	Frequency	Percentage
Background (B)	36	60.00
Purpose (P)	41	68.33
Methodology (M)	56	93.33
Result (R)	55	91.67
Discussion (D)	40	66.67

As shown, Moves M and R are quite frequent, as opposed to Moves P, D, and B. Variations in the frequencies could be attributed to several factors. First, this compilation of the abstract dataset for this study does not control the word length. That is, some abstracts are much longer than the others. As a result, it is possible that lengthy abstracts might include a higher number of moves and vice versa. The table also shows that in civil engineering, based on their occurrences, Moves M and R play an integral role in the abstracts. In contrast, Move B is the least frequent. It is possible that these journals are published for a specific audience. Therefore, background information of Move B of the topic might not be necessary. In short, the frequencies of the five moves provide implications particularly for novice scholars in the discipline that, when writing abstracts, certain pieces of information are considered more important than the others. Therefore, they need to make a decision on what to be included in the abstracts, especially when limited by space constraints.

MOVE SEQUENCE AND CYCLICAL PATTERNING

At this juncture, the findings presented in the previous sections do not imply that all of the abstracts strictly follow the organisation pattern of B-P-M-R-D. This finding resonates with what Swales (2004) cautioned that is, the move structure generated by genre analysis is not meant to be prescriptive, and variations are likely to take place. In fact, variations occur partly because not all of the five moves occur equally frequently. As a result, the patterns of P-M-R, M-R-D, M-R, and P-M-R-D are also found in this dataset. This structural organisation variation thus demonstrates the flexibility of the analytical framework, allowing a certain amount of freedom and creativity for civil engineers when writing abstracts.

In this study, some abstracts display cyclical patterning of certain moves. That is, some moves are used more than once in a single abstract. Moves M, R, D and B are found to be cyclical in 10, 8, 3 and 2 abstracts, respectively. This finding seems to be in agreement with the frequencies of the moves presented in the table, substantiating the importance of Moves M and R. It is also possible that research studies reported are complex, involving a series of experimental procedures and each procedure produces an output. Consequently, Moves M and R are comparatively more cyclical when compared with the other moves. In short, knowing the move structure is beneficial, enabling scholars to conform to the discourse community expectations.

As a final note, limitations are in order. First, the topics of RA abstracts were not controlled. Second, constraints on the number of words imposed on the abstracts were not considered. Third, as is the case, how the abstracts were developed from the initial draft to

the final version was not taken into consideration. Therefore, the interpretation and the generalisation of the findings should be done with caution.

PEDAGOGICAL IMPLICATIONS

This study sets out to the address the general aim of helping non-native speakers of English particularly in the region of Southeast Asia to be able to compete with the world academia. This paper demonstrates that the genre of abstracts pertaining to RAs in civil engineering in English generally follows a move structure. This study also highlights that each move with a communicative function can be realised by a set of linguistic features. Based on these findings, it can be concluded that to develop novice foreign language scholars' writing expertise, genre awareness and linguistic knowledge can potentially contribute positively, and offer valuable pedagogical implications, to the enhancement of writing competence.

It is possible that a number of scholars develop their writing expertise intuitively through a substantial amount of exposure and years of extensive reading and writing RAs in English. However, in Southeast Asia, a large number of scholars are inexperienced or have limited experience with the use of the English language (as opposed to native speakers of English). Therefore, explicit-genre based instruction on academic writing is advantageous, providing them with a concrete opportunity to see how academic language works.

In this regard, as far as explicit instruction and pedagogical practises are concerned, academic instruction should start from instilling in the learners the awareness of the overall structure of a genre, followed by a set of components making up the genre, and concluded by a cluster of linguistic features associated with each move. Now, certain questions emerge. For instance, how can genre awareness translate into classroom activities or what type of training should novice scholars or advanced graduate students receive to successfully engage in the task of writing abstracts? As demonstrated by this study, genre awareness, to begin with, includes the knowledge of organisational structure prevalent of each genre. In a genre-based writing course, in order to raise this awareness, learners should be exposed to a wide range of academic genres (such as lab reports, lab manuals, theses, etc). Giving the learners the opportunities to be exposed to and analyse the genre from the perspectives of the discourse community members and communicative functions can provide them with sharpened sensitivity to genre subtleties. Then, the learners will be more than ready to further explore other academic genres and by extension, other genres encountered in their life.

After the learners' sensitivity to genre variation has been developed and instilled in the learners, they should be trained to engage in an analytical mode of genre analysis. This step corresponds with Swales' basic tenet that a genre can be deconstructed into smaller units called 'moves', each with a communicative function (1990, 2004). A number of moves co-exist in texts to help contribute to a general function of a genre. For example, functionally, an abstract is to provide a snapshot of a study being presented. Thus, the interaction among the moves in the abstract genre is systematic, resulting in a particular sequence of moves in this genre. However, it needs to be cautioned here that a multitude of studies conclude that structural organisation varies according to disciplines (e.g., Kanoksilapatham 2005, 2007, 2011a, 2011b, 2012a, 2012b, Lin & Evans 2012). To maximise the benefits of genre awareness, the learners should have hands-on experience in analysing a genre across disciplines and observe the impact of disciplinary variation on the structural organisation.

As previous studies reveal, the choice of language (e.g., active vs. passive voice, present vs. past tense, etc.) has been the topic of discussion in academic writing (e.g., Love 1993, Gledhill 2000, Hu & Cao 2011). As demonstrated in this study, language choice used in each move is not sporadic or random. In fact, it is justified by the communicative functions

expressed. For instance, the co-existence of present tense verbs and adjectives meaning 'important' in the background move (Move B) have no chronological reference. Instead, their use in this particular move emphasises the centrality of the research topic. Similarly, the use of passive voice verbs in past tense in the methods move (Move M) highlights the research activity completed. Additionally, the learners should be alerted to the co-existence of multiple linguistic features, rather than individual linguistic features. In short, to be successful in scholarly publication, as far as abstracts are concerned, scholars and practitioners need to possess the competence of the genre, the communicative functions, and the language used to express each communicative function. With this awareness, the scholars are able to engage in a wide range of academic writing tasks. The success in disseminating knowledge in science and technology at the regional level will inspire them to produce academic work and improve science and technology competence in an international forum.

CONCLUSION

It is known that scientific abstracts are to publicise the study being presented. Given the pivotal role of abstracts in academia, this study presents an empirical study of abstracts in civil engineering RAs. This study has the objectives to characterise their overall organisation and prominent linguistic features. The findings reveal that, in addition to their requirements of precision and conciseness, abstracts in civil engineering are not randomly organised. Overall, the analysis shows the internal organisation of abstracts that are identified as moves. With the presence of all of the five moves, a move structure of B-P-M-R-D seems to be common. Nevertheless, given the dynamic and flexible nature of abstracts, variations in the presence/absence of moves are expected.

This study captures what constitutes appropriate academic style of writing in civil engineering abstracts, enabling us to better understand the structure of this kind of writing. It also helps form a pedagogical model viable and useful for civil engineering scholars to develop strategies in response to the rigorous writing demands of academia encountered. A better understanding of how RA abstracts are constructed can enhance not only their writing skills to conform to the expectations of the target discourse community, but also the quality of communication and chance of success in their respective academic context.

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