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Interpreting Analysis on Rhetorical Strategies Modeling in Computer Science Research Articles

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Abstract

Description on rhetorical strategies modeling proposed by experts in the field of language provides clues on strategies used in research writing. However, the interpretation and analysis on the utilization of the rhetorical strategies models are limited to comparing the strategies used in articles grouped according to research disciplines such as biomedical, linguistics, and arts. In view of the constraint, this chapter focuses on the interpretations of rhetorical strategies modeling by analyzing the computer science research articles in a few categories. The first interpretation of analysis is on the articles with high and low citation index, followed by analysis on the articles grouped according to journal wise population and lastly analysis on articles written by non-native writers. The interpretation of the analysis suggested that the strategies proposed in the models are used differently by the writers of articles with high and low citations, writers of different journals, and non-native writers. The descriptions provided in this chapter account on the important strategies utilized by highly cited writers, specific journals, and non-native writers.

Keywords: technical writing, rhetorical strategies, research article, writing, computer science, text analytics

1. Introduction

In tandem to the dire need to increase the quantity and quality of research article publication, easier ways to write research articles are studied globally on a large scale [1–4]. Some of the studies have derived models that simplify the strategies for writing, for example, Swales' CARS models [5–7] which are examples of prominent models that are being used among many research writers. The models are based on an earlier model that was derived from “an analysis of 158 research article introductions in English distributed across various discipline areas” ([8], p. 241). Descriptions on rhetorical strategies modeling proposed by experts in the field of language provide clues on strategies used in research writing such as the Four-move models for research article introductions [5], CARS model [6, 7], Multiperspective Model [9], Project Justifying Model [10], and Problem Justifying Model [11]. These models have been utilized by writers to write better. Ahmad [10] did an initial

analysis for Malay scientific research articles, and from here, she proposed the Project-justifying model. Safnil [11] came up with a new model Problem Justifying Project (PJP) for rhetorical analysis on Indonesian research article introductions. This chapter describes the strategies used in research articles by presenting the analysis using the model.

Following the models over the years, researches have progressed in having the models tested and extended [12, 13]. Adnan [12] used Bunton's model, which was also a modification of Swales' model [6], to study the introductory sections of PhD theses and proposed some extension on the model. Adnan [12] analyzed the Indonesian research article introductions in education discipline and also proposed some extension after finding none of the research articles' introductions fit the CARS model and only less than half fit the Problem Justifying Project (PJP) model proposed by Safnil [11]. Briefly, while the major models [5–7, 10, 11] provide valuable guidelines on how writers write their research, further studies on the models showed that the applications of the strategies suggested in the model are applied differently across the discipline. The strategies suggested by the models are more prominent or less preferred in different disciplines. Accordingly, this chapter focuses the analysis on research article in computer science discipline.

The interpretation and analysis on the utilization of the rhetorical strategies models are mostly on comparing the strategies used in articles grouped according to research disciplines such as biomedical [14] linguistics and arts. Many have reported on such analysis on computer science research article [15, 16]. In view of extending the study in this area, this chapter focuses the interpretations of rhetorical strategies modeling by analyzing the articles in a few categories. The first interpretation of analysis is on the articles with high and low citation index, followed by analysis on the articles grouped according to journal-wise population and lastly analysis on articles written by non-native writers [14, 17, 18].

2. Rhetorical models for research articles

Some models used in other research article genre studies are Four-move model [5], CARS model [6–8], Project Justifying Model [10], Problem solution model [19], Problem Justifying Project model [11], and Ideal problem solution model [12]. Critiques on problem-focused models pointed out that not all research begin with a problem or “have a recognizable problem” and the other models [10–12] are for research article introductions in other languages than English. Bhatia ([9], p. 11) commended the Swales model as capable to “introduce a thick description of language in use” apart from “Combine socio-cultural” and “Psycholinguistic (including cognitive) aspects of text construction and interpretation with linguistic insights.” This study chooses the model by Swales [7] to be used.

CARS model [7] also begins with establishing a territory and topic generalization. However, in this revised model, citations are required and the topic generalization has the quality of increasing specificity to the intended research. The review of previous research is deemed as an obligatory support for the steps on establishing territory and topic generalization with increasing specificity. There are a few reasons as to why this study uses the CARS model version 2004. The reasons are mainly concerned with the dynamic nature of the research article [7, 20] problems pointed out by previous researchers in using the 1990 model [7, 20], and the improvements made in the 2004 version by Swales himself [7].

The next move suggested in the model is Move 2, which establishes a research niche. In this move, the writer reveals the niche or the specialized area in the subject which has already been mentioned in general, earlier in Move 1. The writers may

support this move with citations. This move is further realized either by indicating a gap or by adding more information to what is known. “Adding to what is known” is a strategy where the previous research is reviewed, development in the research area is explained, unresolved matters in the research are pointed out and the stance on the research development is presented.

After fulfilling either of these two steps, Swales [7] added that writers may repeat the previous moves and this recycling step is with increasing specificity toward the intended research. This move is dependent on the other moves mentioned before because it is actually a repetition of Move 1 and Move 2. The next step in Move 2 is presenting justification where the writer, one way or the other, asserts that the research must be carried on. However, this step is optional so the writer may or may not present the justification for the intended study.

Move 3 in the CARS model is about presenting the present work, which is a strategy that is gaining more importance particularly when the number of publication escalates every year and the competition among the submissions to the editorial also intensifies. The strategy on presenting the present work may affect how the research article fares against other submissions. In facing the competition, the presentation of the research work in the introduction must be interesting, relevant, worthy, and is able to captivate the intended audience.

Swales [7] suggested seven steps on accomplishing Move 3. Out of the steps listed, one step is obligatory step, three are optional steps, and three other steps are probable in some fields, but unlikely in others. Step 1 in Move 3 is the obligatory step, which is announcing the present research descriptively and/or purposively [7]. In this obligatory step, the readers are presented with the information on what the rest of the paper is going to be reporting or discussing. The model puts it that this can be done in two ways: purposively, which is by stating the purpose and reasons on why the study is done and/or descriptively, which is by describing, listing, and recounting the composition of the study. Shehzad ([20] p. 139) elaborated that purposive announcement is where the authors indicate their main purpose or purposes or outline the “nature of the study”, and descriptive announcement is where the authors “describe the main feature of their research.” In other words, this step is where the readers are informed about the reasons, and the rationale of the study is presented.

The next step for Move 3 is Step 2, which states the research questions or hypothesis and is suggested as an optional step. Presenting the present research is described the step being utilized by native writers as being “more explicit about what the researchers are investigating, an approach that makes their text less demanding to the reader” (Figure 1, [21], p. 246).

The following step for Move 3 is definitional clarifications that can be realized by giving brief explanations on some of the methods, terms, techniques, modes, or concepts related to the study. This step is optional and the reason for having the definitional clarification is to give a clear meaning to the item in context and regularize it. Another optional step for Move 3 is summarizing methods where brief information on the method used in the study is presented. Steps 2–4 are not only optional but also less fixed in order.

The following steps of 5–7 are probable in some fields but unlikely in others. Step 5 is announcing principle outcome where the main findings of the study are presented to establish the research contribution as early as possible in the research article. While Swales [6] listed this step as probable in some fields, studies on computer science research articles have shown that this step is obligatory among the computer science writers [15, 22, 23]. The next step is Step 6 that states the value of the present research. This step is also reported as obligatory in the computer science research article introductions [16, 24]. In this step, the writers promote their

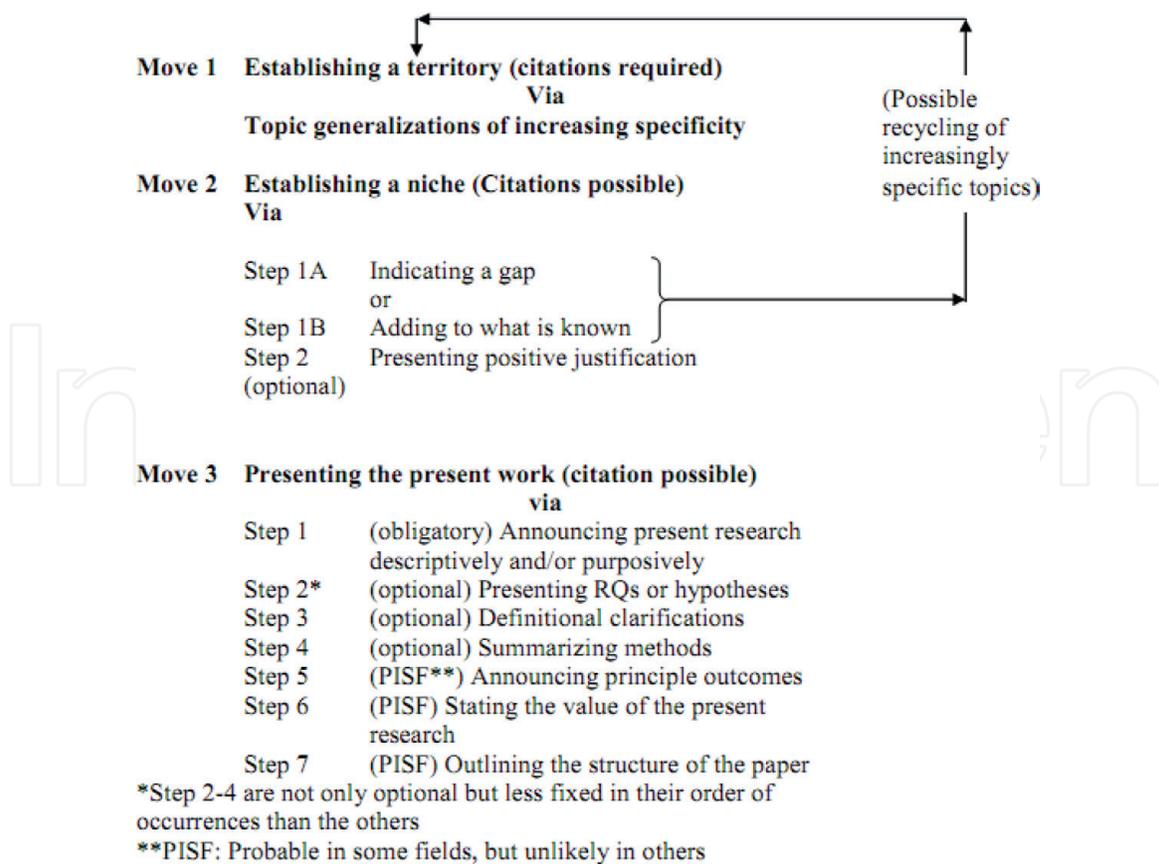


Figure 1.
CARS model version 2004 [6].

studies and highlight the value of their research. The last step in the CARS model [7] is outlining the structure of the paper where the outline of the research article is briefly explained.

3. Method and instrument

The study uses qualitative method and the approach is top-down. Qualitative method with top-down approach calls for emphasis on meaning and ideas rather than the language structure and lexical formation. The analysis focuses on the discourse structure in the text written in the area of the targeted discipline. In this analysis, “moves” in the text is identified in series of sequences. Every “move” is identified to the communicative function. The examination on the moves starts with the establishment of an analytical framework. And then, the moves types are identified and described.

It started with choosing 120 research articles. About 150 articles were chosen because the data gathered from the articles have reached saturation. The next step was to conduct the move analysis on the research articles. This study wanted to know what were the moves and steps being used in the articles.

3.1 The corpus

The corpus of the study consisted of the computer science research articles written by academicians in Malaysian Universities, which were listed in Scopus in the year 2010. The Malaysian Universities Computer Science Scopus Articles Corpus was created for this study and included 150 computer science research articles

written by academicians in Malaysian universities. Analysis on the introduction sections was conducted, which comprised 98,597 words.

The list of the intended journals was generated from the SciVerse Scopus database using the following steps. First, the list of private and public universities was obtained from the Ministry of Higher Education Website. The Ministry of Higher Education Website listed 20 public universities and 25 private universities [25]. Next, the number of Scopus publications by each of the 45 universities was retrieved from the Scopus database system. This information was obtained using the affiliation search function and the spellings used on the Ministry of Higher Education Website.

Since the number of publications consisted of various documents such as articles, conference papers, reviews, articles, short summaries, conference reviews, editorial reviews, and even notes, the search was narrowed down further to research articles only. But the number obtained included the number of articles in various fields. As this study focused on computer science, the search was narrowed down to computer science. The next step involved excluding articles in multidisciplinary areas because such inclusion also included articles other than those in the computer science discipline.

A total of 150 articles were chosen because the data gathered from the articles have reached saturation. Patton [26] stated that sample size can be affected by “the purpose of the inquiry” which in this study refers to “identify patterns across data.” This study wanted to know what the moves are and steps being used in the articles and how the moves and steps were realized. As suggested by Shehzad [27], the articles were selected and added. Initially, the analysis of the articles indicated some patterns that lead to categories of how the moves and steps were realized. More articles were added until the analysis showed that new articles no longer generate new patterns and categories on how the moves and steps were realized. After analyzing 120 articles, the patterns on how the moves and steps were realized became regular and predictable. For example, in the analysis of Move 2 Step 1A, four categories were identified; after adding more articles up to 150, the categories became consistent and no new categories emerged because the patterns can just fit into the existing for categories. Similar consistency was noted in the categories for the other moves and steps upon reaching 150 articles. The data has reached saturation at 150 articles and no pattern or category emerged from addition of article, and therefore, the size of the corpus consists of 150 articles.

Shehzad [27] suggests that a corpus should be authentic and follow specific criteria and should be taken from high ranking journals as the high rank reflects the publication’s soundness [28]. On the same note, the research articles in this study were taken from the Scopus indexed database. If the study uses articles from non-Scopus database, the samples derived from the non-Scopus articles may not be suitable for learners who aim to publish in the Scopus indexed journal.

The 2010 publication was chosen because as the database was already completed, the citation index had grown substantially and had become more constant in terms of citing hierarchy. The citation index is an important criterion for this study because of a few reasons. For one reason, citation index is systematically generated to indicate the number of times the paper has been cited by other writers. As such, it is more neutral and unprejudiced in determining the value of the research articles. Moreover, citation index for publications is also one of the sought-after criteria for university ranking in Malaysia [29, 30]. As such, citation index has been taken into account in the performance evaluation of the academicians [29, 31]. Given its importance, citation was also included as a criterion of selection for the corpus.

3.2 Sampling on high and low citation groups

For the analysis of the data, the citations of the research article were also considered. Research articles with six citations or more were grouped together in the research articles with more citation group. Research articles with zero citation were grouped in the research articles with lesser citation group.

Research articles with citation of one to five were not included in any group and were not counted in this analysis. The reason was to give the two groups the difference in citations which was needed to achieve the purpose of the analysis. It is noteworthy that the analysis was meant to obtain the description on the moves and steps that have been used in the higher citation research articles. The moves and steps of the research articles with lower citations are also noted and analyzed. Consequently, if the difference of citations between the two groups is only by one citation, the findings on the moves and steps may not show much difference and actually may also be similar descriptions. The elimination of research articles with citations of one to five, there would be a difference of six citations between the groups. A bigger difference established between the two groups is needed to ensure that the two groups are really distinct and the research articles are not in either group by chance. High citation groups consist of 62 research articles, while research articles with lesser citation groups have 65 research articles. For the analysis, the total moves and steps for each group was turned into percentages and comparisons were made in terms of the moves and steps accomplished.

3.3 Sampling on journal wise group

In journal wise sampling, the research articles are taken from a selection of journals instead of random journals for the reason that research articles from the same journals showed more cohesive findings. Studies [15, 16] have shown that more regular patterns were detected in research articles from the same journal.

Two Malaysian journals, the Malaysian Journal of Computer Science and PERTANIKA Science and Technology, were chosen. All articles published in the journal for 2010 were included. The Malaysian Journal of Computer Sciences is published by the Faculty of Computer Science and Information Technology, University of Malaya. The journal has been in circulation since 1985 and is indexed in Scopus since 2007 and is also abstracted in ISI and a few other databases [32, 34].

The journal publications also include research articles from local and foreign universities, not limited to the academics only but also consisting of the works from the business and industrial sectors in the field of Computer Science and Information Technology. Pertanika Journal of Science and Technology is published by Universiti Putra Malaysia. The area for the research articles in this publication includes a wider scope than those in the Malaysian Journal of Computer Science. Apart from Computer Science and Information Technology, it also covers research in the area of bioinformatics, bioscience, biotechnology, and bio-molecular sciences,

4. Results and discussion

The results of the study are presented according to the groupings in the following sections.

4.1 Results on high and low citation index

The analysis according to the citation index shows that the highly cited research article accomplished more of the moves and steps recommended in CARS model [6] compared to the research articles that have never been cited. First, the analysis showed that research articles with high citation have a higher percentage of realizations in presenting the present work. Ninety-seven percent of the highly cited articles accomplished this strategy, while only 83% of research articles with zero citation utilized this move, thereby suggesting that more highly cited writer utilized this strategy compared to the writers with zero or less citation.

Second, the difference in percentage between the two groups in realizing this move is also found in the use of announcing the present research descriptively. Compared with the research articles with zero citation, the highly cited research articles were more inclined to fulfill this step at 92%, which indicate that the step has been used at obligatory level, just as suggested in the CARS model [6]. On the other hand, only 75% of the research articles with zero citation use this strategy.

Finally, the findings also shows that apart from these two differences, the highly cited research articles were also more inclined to utilize the strategy proposed in the Swales [6] model of Move 3 compared to the research articles that had never been cited. **Table 1** shows the summary on moves and steps by high and low citation groups.

Apart from the two steps explained in this paragraph, compared to the research articles that had never been cited, highly cited research articles are also more inclined to utilize the strategy proposed in the Swales [6] model in Move 3.

Moves and steps	Percentages High citation	Percentages Low citation
Move 1		
Establishing a territory	97	91
Topic generalizations of increasing specificity		
Move 2		
Establishing a niche (citations possible)	100	100
Step 1A: indicating a gap	86	71
Step 1B: adding to what is known	100	100
Step 2: presenting positive justifications (optional)	68	52
Move 3		
Presenting the present work	97	83
Step 1 (obligatory): announcing present research descriptively and/or purposively	92	75
Step 2 (optional): presenting the hypothesis or the research question	0	1
Step 3 (optional): giving clarification on the definitions	18	20
Step 4 (optional): giving brief information about the methods used	55	40
Step 5 (PISF): informing the readers about the principle outcomes	14	12
Step 6 (PISF): informing the readers about the value of the research in context	44	28
Step 7 (PISF): giving an overview on the structure of the research article	36	20

Table 1.
Summary on moves and steps by high and low citation groups.

In summary, the highly cited research article group has better accomplishment in presenting the summary of the methods in the Introduction section. The interesting finding is in the step of Move 3 Step 6 “Stating the value of the present research.” The analysis shows that 44% of the research articles with high citation utilized this strategy. On the other hand, only 28% of the zero cited research articles accomplished this strategy. The big difference in percentage between the two groups for this step is more noticeable and evident. This big difference suggested and marked that authors of research articles with high citation count were more adamant and persistent in announcing the findings of their study and promoting the value of their research work. Such promotion and statement provides the readers with anticipation on the value and relevance of the articles, hence may increase readership which in turn increase the chance for citation. The research articles with low citation count did not perform this strategy as well as the other group. The percentage on the practice is lower. Despite the fact that the authors of this group stated the findings and the values of their study, the announcement on these matters were postponed and were written in the later section. Many of the authors in this group wrote the findings and values of their research in the “Findings and Discussion” section. The section is toward the end of the article and would have required the readers to read longer. Move 3 Step 7, “Outlining the structure of the paper,” suggested by CARS model [6] is the last strategy proposed. In presenting the research work, this step was also “probable in some fields, but unlikely in others.” The findings show that 36% of the research articles with high citation count practiced this strategy successfully. Then, again only 20% of the zero cited research articles accomplished this strategy. The analysis of the findings suggested that the research articles with high citation count were more insistent and bold in presenting the research work. The research articles with high citation counts not only tell the readers about the structure of the paper but also revealed briefly the overview of the following sections. By writing this in the Introduction section, the readers can anticipate what the research article is about and how relevant the rest of the article is. In addition, the readers can also skip directly to the intended part for reading.

The study shows that the highly cited research articles utilize more strategies proposed in the Swales [6] model compared to the research articles that had never been cited. The findings also stressed the need for writers to be more assertive in promoting their research work in the introduction paragraph by utilizing the “Announcing the principle outcome” and “stating the value of the present research” steps.

4.2 Results on journal-wise population

The finding for Move 3 also confirmed that journal selection influences the way rhetorical structure is realized in the research articles. **Table 2** summarizes that both journals do have a similar structure to the general computer science research article structure found in the studies using global writers’ work [14, 15, 22, 24, 33]. However, the obligatory and optional status of the moves and steps differed for *Pertanika Journal*. The research articles from the *Pertanika Journal* did not emphasize on presenting their present work in the Introduction section.

Rather, the presentation of their research work is delayed in the next section. Such preference is explained by reading the articles further, which shows that this journal has Materials and Method section after the Introduction section. Most writers began to introduce the intended study in Materials and Method section instead of doing so in the Introduction section.

Most of the research articles in the *Malaysian Journal of Computer Science*, on the other hand, followed the contemporary Introduction-Method-Result-Discussion

Moves and steps	Percentages for Pertanika	Percentages for MJCS	
Move 1	Establishing a territory Topic generalizations of increasing specificity	95	100
Move 2	Establishing a niche (citations possible)	95	100
	Step 1A: indicating a gap	71	78
	Step IB: adding to what is known	97	93
	Step 2: presenting positive justifications (optional)	53	78
Move 3	Presenting the present work	79	100
	Step 1 (obligatory): announcing present research descriptively and/or purposively	76	100
	Step 2 (optional): presenting the hypothesis or the research question	0	0
	Step 3 (optional): giving clarification on the definitions	18	14
	Step 4 (optional): giving brief information about the methods used	39	21
	Step 5 (PISF): informing the readers about the principle outcomes	10	28
	Step 6 (PISF): informing the readers about the value of the research in context	26	57
	Step 7 (PISF): giving an overview on the structure of the research article	8	57

Table 2.
Move and steps by journal-wise population.

sections structure. As such, the presentations of the intended research are mostly done in the Introduction section.

However, it is important to note that the promotional steps in both journals are low compared to the findings in the studies using global writers' work [14, 22, 24, 25, 33]. The percentages for the promotional moves are below 80%. Announcing principle outcomes is scored at only 10% in Pertanika journal and only 28% in Malaysian Journal of Computer Science. The other step related to promotional strategy is stating the value of the present research, which is realized at 26% in Pertanika journal and 57% in Malaysian Journal of Computer Science. It can be concluded that the promotional strategies in the research articles of both journals can be further enhanced by using these two steps.

Findings on M3S5 by the university group percentage of announcing principle outcome. Similarly, analyzing the corpus based on the journal-wise population, the research articles from Malaysian Journal of Computer Science used this step more frequently compared to the research articles in the Pertanika journal. Twenty-eight percent of the research articles in Malaysian Journal of Computer Science utilized this step, whereas only 10% of the research articles in the Pertanika journal accomplish this step in the Introduction section.

The analysis for this group also shows that the research articles in the Malaysian Journal of Computer Science are more prone to presenting the present research work via outlining the structure of the paper compared to the research articles in the Pertanika journal. Fifty-seven percent of the research articles in the Malaysian

Journal of Computer Science employed this step, whereas only 8% of the research articles in the *Pertanika Journal* utilized this move.

All in all, the findings indicate that the utilization of the strategies differs from journal to journal; therefore, writers must understand the preference of the journal and tailor their writing to the style of the targeted journal.

4.3 Results on non-native writers

In this analysis, the findings of the study that is focused on non-native writers are compared to the findings in the study by Shehzad [24] who analyzed the strategies in Swales model among the global writers.

Table 3 shows that 94% of the article introduction sections in the study utilized Move 1 at an obligatory level, which is close to the 95% occurrences in the study by Shehzad [24]. Similarly, the strategy of establishing the research niche has also been fulfilled by all writers in this study. However, the strategy of indicating a gap has been underutilized by only 73% of the writers as compared to 95% accomplishment in the study by Shehzad [24] and 91.7% in a similar study by Anthony [33]. The strategy of Move 2 Step 1A which is “Indicating a gap” is underutilized. Studies on global writers [24, 33] have reported that this step is used at an obligatory level by the computer science writers; therefore, the awareness on the potential of this strategy among the non-native writers must be asserted so that the non-native writers would utilize this strategy more frequently.

On the other hand, 99% of the non-native writers in this study are more fond of using Move 2 Step 1B which is “Adding to what is known.” However, this step

	This study	Shehzad [24]
Move 1 Establishing a territory Topic generalizations of increasing specificity	94%—obligatory	95%—obligatory
Move 2 Establishing a niche (citations possible)	100%—obligatory	93%—obligatory
Step 1A: indicating a gap	73%—optional (underutilized)	95%—obligatory
Step 1B: adding to what is known	99%—obligatory	NA
Step 2: presenting positive justifications (optional)	62%—optional	NA
Move 3 Presenting the present work	91%—obligatory	NA
Step 1 (obligatory): announcing present research descriptively and/or purposively	86%—optional (underutilized)	98%—obligatory
Step 2 (optional): presenting RQ or hypothesis	1%—optional	32%—optional
Step 3 (optional): definitional clarifications	17%—optional	NA
Step 4 (optional): summarizing methods	53%—optional	NA
Step 5 (PISF): announcing principle outcomes	15%—optional (underutilized)	73%—obligatory
Step 6 (PISF): stating the value of the present research	35%—optional (underutilized)	55%—obligatory
Step 7 (PISF): outlining the structure of the paper	34%—optional (underutilized)	86%—obligatory

Table 3.
Results on non-native writers.

is not available in the previous CARS model [5], which is used by Shehzad [24]; so, it is not possible to compare the practice with the global writers. Move 2 Step 2 “Presenting positive justifications” is also not reported by Shehzad [24] and only occurred in 62% of the corpus. In short, comparing the percentages of the three steps for Move 2 “Establishing a niche”, it can be concluded that most of the non-native writers prefer to add “to what is known” compared to “Indicating a gap” and “presenting positive justifications.”

In correspond to the findings on Move 1 and 2, it is suggested that more emphasis and caution on utilizing Move 2 Step 1A “Indicating a gap” is to be given in the teaching of writing using CARS model [6] to computer science writers in Malaysia.

Move 3 is occurs in 91% of the articles. While the overall percentage for Move 3 is high, the percentages of the steps indicated that some of the steps are underutilized. Step 1 for Move 3 “Announcing present research descriptively and/or purposively” has been underutilized at only 86% compared to 98% in Shehzad [24]. Move 3 Step 2 has also been utilized in a smaller percentage compared to the study by Shehzad [24]. Only 1% of the corpus opts for this strategy compared to 32% in Shehzad [24]. Move 3 Step 3 “Definitional clarifications” and Move 3 Step 4 “Summarizing methods” are realized at 17 and 53%, respectively. However, percentages from the previous studies on computer science articles are not available for comparison because these steps are newly added in CARS 2004 model [6], whereas most of the studies used CARS 1990 model [5].

The steps in Move 3 are less fixed in orders and may appear before one or another. Swales [6] suggested that Steps 5–7 are possible in some field but may also be unlikely in others. In this study, Move 3 Step 5 “Announcing principle outcomes” is realized in only 15% of the corpus. The percentage of 15% is alarmingly low as the utilization of this step in studies on computer science research articles suggested that this step is realized at higher percentage of 73% in [24], 70% in [14], and 75% in Anthony [33]. Furthermore, Shehzad [24] suggested that this step is an obligatory strategy for computer science articles. Move 3 Step 6 “Stating the value of the present research” is also underutilized at 35% compared to 55% by Shehzad [24]. This step is recommended as an obligatory step in computer science research article; however, the non-native writers in this study prefer to skip this strategy. In addition to the low percentages in Steps 5 and 6, Move 3 Step 7 “Outlining the structure of the paper” is also realized at a low percentage of 34% compared to the other studies with 86% [24], 70% [14], and 83.3% [33]). Following the low utilization when compared to the other computer science corpus, Move 3 Steps 5–7 must be emphasized in the writing classroom for computer science non-native writers in Malaysia.

In this section, the findings on the use of citation in Move 1 are presented. First, the percentage on the citation used for move 1 was given, and then, the excerpts that showed the severity of not utilizing this step in Move 1 is explained. After that, the percentages of occurrence for Move 1 according to the university group and journal type are given.

Another phenomenon discovered in this study is the use of citation for Move 1. CARS model [6] posits that Move 1 is to be accompanied by citations. However, it was discovered that even though the research articles fulfilled the strategy on establishing the research territory by making topic generalization and increasing the specificity of the topic, many of the research articles did not have the required citation. Twenty-five research articles or 16.7% of the research articles have delayed the citation up to the fifth sentence and as late as the 17th sentence. The details on the citation in the Introduction section are summarized in the table below.

	Count	Percentage
Realization of Move 1	141	94
Move 1 with citation	96	64
Move 1 with delayed citation	25	16.7
Move 1 with no citation	22	14.7
No citation made in Introduction section	7	4.7

About 14.7% of Move 1 made in the research articles did not have any citation at all; instead, the citation only appeared in Move 2 where the discussion has developed to the research niche level. More surprisingly, 4.7% or seven of the research articles did not include any citation at all in the entire Introduction section. Only 64% of the research articles in the corpus used citation as suggested in CARS model [6].

- 1 “Data development meta-analysis (DEM) is a prevailing instrument
- 2 for measuring the operation of system organizations and the
- 3 functioning sections of components. DEM includes the parameters of
- 4 many research areas particularly in system operation, management of
- 5 data, organizational behavior, operational research, finance, and
- 6 statistics. DEM is a multi-parametric procedure for calculating the
- 7 qualified competences of a set of developed management protocols
- 8 (DMPs), which uses a number of inputs to produce a number of
- 9 outputs. The focus is to assess the comparative competence of the
- 10 homogenous DMPs by expending the proportion of the outputs to the
- 11 measured sum of inputs. It specifies the usual competence capacity
- 12 from a single input to a number of inputs. *This method was initially*
- 13 *introduced by Anas (1978) and popularized by Amber, Cain, and Bates (1988) (ACB model).”*

The need for citations even during the initial part of the introduction is necessary, even when the topic is being written on the general level. When the writers establish the research territory by writing on the general topics, the writers are addressing a bigger readership compared to writing directly on the research niche. By addressing on the general domain first, bigger readership can be expected [32] and then by writing with increasing specificity to the niche, this group of readership can be drawn to the niche of the study. If the writer dives straight to writing on the niche, some readers who are not familiar with the terms of the niche may be put off, not realizing the possible link and extension that the particular niche has with the readers’ research interest [35]. As such by missing citations in Move 1, the research article may miss out a number of potential readers and future citations. Given that Move 1 provides the link and extension with the bigger research domain and readership, it is understood why CARS model (2004) explicitly posits that citation as an obligatory strategy. Citation must be used especially when citing the previous work at this point to establish the association and connection to what Shehzad ([24] p. 22) described as the “research cult.” The following example is used to illustrate the importance of citation, even when at the initial level of establishing the research territory.

In this excerpt, the citation has been delayed to the sixth sentence which is in line 12. The Introduction begins with Move 1 by giving description on the general research topic which is DEM. And then, the research article offers a definition for DEM, and this definition is considered as Move 1, not Move 3 Step3 which is “definitional clarifications.” The reason is because the niche of the research article based on the title is “decision-making units” and “fuzzy concept”, so the term being defined is still at topic generalization level and not yet at the specific niche level. Notice that

the citation only comes in after a few sentences later. No citation was made for the definition, description, or comments on the general topic. The citation is considered delayed because citations on the definition, description, and comments could have linked the writing to the existing literature and body of research. Having the citation delayed caused the connection and association to be established at a later reading sequence and appeared less connected to the existing body of research.

In short, delay or omission of citation in Move 1 is a deficiency and may appear like a lack of involvement and ambiguous ownership of ideas.

The findings on the use of citation suggest that the utilization of Move 1 for this group of non-native writers needs to be improved. Even though Move 1 has been utilized by the writers, there is room for improvement on the use of citation for this move because the citation has been delayed and omitted in some of the research articles.

5. Conclusion

In short, the patterns of the findings indicate the common moves and steps that are being utilized by the Malaysian writers. The underutilized steps have also been identified and thus suggested the need for more emphasis and caution in the application of CARS model in teaching writing for the particular group. While the findings indicated the applicability of CARS model [6], the description on how the moves and steps are utilized in target publication is still needed; particularly when many English teachers are not content experts in computer science discipline.

The model for research article provided a common guideline for authors to follow. While journal type plays an important factor in the selection of strategies, the highly cited research articles showed that the strategies recommended in the model is still prevalent. Given that the findings of the studies shows that non-native writer underutilized some of the important strategies, writing instructors and non-native writers must be cautioned and reminded on using these strategies. The underutilized strategies must be explained, particularly on what the strategies are and how the strategies can be realized. The assertiveness on accomplishing the strategies must be taught and reminded by the instructors.

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