

Moves analysis of the scientific thesis introductions of the Grade 12 STEM students of the University of the East-Calooocan Campus

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ABSTRACT

Scientific research has been known for presenting tangible solution to industrial, environmental, and economical problems. There's no other way for this research genre to present its importance effectively but to establish a research problem (niche) using its introduction. Despite its importance, thesis introductions have been overlooked throughout the years. Its ultimate communicative purpose is to convince the reader of the present research's worthiness before diving deep into the entire paper. Using content and top-bottom analysis, this study described the implementation of the John Swales' CARS (Create A Research Space) model (2004) of 24 scientific thesis introductions (Background of the Study) of the Grade 12 STEM students of the University of the East-Calooocan Campus. It was found out that the CARS model was fully utilized in all moves but manifests difficulty in Move 2: Establishing the niche (problem). Findings of this study suggests that strategies in reviewing the literature should be given focus to improve M1S3(Reviewing items of previous research) and Move 2.

Keywords

Research introduction, CARS model, scientific research, senior high school research, moves analysis

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Introduction

Scientific research as distinct genre is defined as the systematic investigation of scientific theories and hypotheses (Barrot, 2016; Cristobal & Cristobal, 2017; Del Rosario-Garcia, 2017; Trinidad, 2018). This requires statistical treatment to test the hypothesis (Miller-Cochran & Rodrigo, 2013; Devlin, 2017). Quantitatively, scientific research seeks to understand the magnitude of a scientific phenomenon (Trinidad, 2018; Treiman, 2014), by determining the extent of the relationship among variables (Kanire, 2012; Nadal, 2011; Holland, 2013; Stage & Manning, 2015) and building scientific predictions (Barakso, Sabet, & Schaffner, 2013). What separates this genre from the others is that the researcher needs to conduct a scientific experiment (i.e. testing the durability, etc.) to test the hypothesis (Cristobal & Cristobal, 2017, Del Rosario-Garcia, 2017; Trinidad, 2018). An example is when he aims to develop a bioplastic made out of banana peelings to lessen the production of plastics as this contributes to the plastic pollutions that destroy marine habitat (Mohapatra, Prasad, & Sharma, 2014; Mohamed, n.d.; Ghamande, Kulkarni, Shah, Kothari, & Bhosale, 2018; Treiman, 2014). He needs to have the necessary variables (independent, dependent, control) and statistical treatment via experiment to create a solution to the presented problem. Scientific research has been known for presenting tangible solution to society's timely problems (Barrot, 2016; Cristobal & Cristobal, 2017; Del Rosario-Garcia, 2017; Trinidad, 2018). A great opportunity for this research genre to present itself but establish a research problem (niche) using its introduction.

A thesis introduction is closely associated with the employment of Swales' move structure (Zand-Vakill & Kashani, 2012; Avilés, 2007; Cheung, 2012). In writing academic text, specifically research papers, presenting the

introduction is an attempt to provide the necessary background and context of the research (Noorzan & Page, 2012; Loi, 2010). A research introduction should be structured to assure comprehension to the readers which serves as a synopsis and will be explicitly explained later in the entire article. It lays out the research overview by providing the background of the study, putting forward the problems as significant factors of the study then describing how and why the problems will be solved (Abdullah, 2016). Swales (2004) claimed that introductions are known to be troublesome, and nearly all academic writers admit to having more difficulty with getting started on a piece of academic writing than they have with its continuation. Despite its importance, thesis introductions have been overlooked throughout the years (Trinidad, 2018; Hinkson & Smith, 2005; Atai & Samani, 2012). This neglects the ultimate communicative purpose of the thesis introduction. While existing studies have clearly established the relevance of analyzing thesis introductions (Kyeong-Yeon, 2012; Hinkson & Smith, 2005; Atai & Samani, 2012; Avilés, 2007; Cheung, 2012; Loi, 2010), review of related literature (Darani, Tahririantan, & Afghary, 2018; Jianping, 2017; Asaria, Kurnia, & Suharsono), and abstracts (Kyeong-Yeon Park, 2012; Shim, 2019; Sidek, Saad, Baharun, & Idris, 2016) in various fields of discipline across different levels, they still failed to describe how these patterns were able to establish the backbone of a research thesis: the a) situation, b) problem, and c) solution (Swales, 2004). More importantly, since scientific research proved to be valuable in daily life (Cargill, & O'Connor, 2013; Mohapatra, Prasad, & Sharma, 2014; Ghamande, Kulkarni, Nimish Shah, Sakshi Kothari, & Bhosale, 2018), it should be able to ascertain the relevance it deserves.

Since grounding the situation, problem, and solution is, conceptually, the very heart of scientific research; this study investigates the rhetorical organization of the introduction

(Background of the Study) of the Grade 12 STEM students of the University of the East-Calooocan Campus by adopting John Swales' CARS (Create A Research Space) model (2004). When the researchers explored the scientific introductions of the Grade 12 STEM students, it was found out that the CARS model was fully utilized in all moves but manifests difficulty in Move 2: Establishing the niche (problem).

Literature Review

Scientific research is the systematic investigation of scientific theories and hypotheses (Barrot, 2016; Cristobal & Cristobal, 2017; Del Rosario-Garcia, 2017; Trinidad, 2018). It is a research method that seeks to explain naturally occurring phenomena in the natural world by generating credible theories (Mohapatra, Prasad, & Sharma, 2014). It is a systematic process that involves formulating hypotheses, testing predictions using relevant data and other scientific methods, and finally coming up with a theory (Ghamande, Kulkarni, Nimish Shah, Sakshi Kothari, & Bhosale, 2018). As such, this study requires rational and statistical evidence to draw conclusions.

At such, scientific research is concerned with natural science which is the description, prediction, and understanding of natural phenomena (Cargill & O'Connor, 2013), based on observational and empirical evidence (Cargill & O'Connor, 2013; Mohapatra, Prasad, & Sharma, 2014). Under natural science we find life science (or biological science) and physical science. Under physical science, we have physics, space science, chemistry, and Earth sciences (Cargill, & O'Connor, 2013; Mohapatra, Prasad, & Sharma, 2014; Ghamande, Kulkarni, Nimish Shah, Sakshi Kothari, & Bhosale, 2018). The aim of scientific research is to understand the magnitude of a scientific phenomenon (Trinidad, 2018) by testing hypotheses (Treiman, 2014; Cristobal & Cristobal, 2017; Del Rosario-Garcia, 2017; Trinidad, 2018), relationship between variables (Kanire, 2012; Nadal, 2011; Holland, 2013; Stage & Manning, 2015), and making predictions (Barakso, Sabet, & Schaffner, 2013). An example is when a researcher aims to develop a bioplastic made out of banana peelings (Mohapatra, Prasad, & Sharma, 2014; Mohamed, n.d.; Ghamande, Kulkarni, Shah, Kothari, Bhosale, 2018; Treiman, 2014). He needs to have the necessary variables (independent, dependent, control) and a statistical treatment via experimentation (i.e. testing the durability, etc.) to test the hypothesis. Because of its importance to society, this research genre should be able to establish a research problem (niche) using its introduction to further render its importance.

Presenting the introduction is an attempt to deliver the necessary background and context of the research comprehensible to the readers (Noorzan & Page, 2012; Loi, 2010). It should be structured to explicitly explain latter parts of in the entire article (Zand-Vakill & Kashani, 2012; Avilés, 2007; Cheung, 2012). It gives an overview by research's background highlighting the problems followed by how the study will the aforementioned problem (Abdullah, 2016). However, Swales (2004) claimed that introductions are known to be troublesome. Practically all

practitioners admit to have difficulty getting started (Trinidad, 2018; Hinkson & Smith, 2005; Atai & Samani, 2012).

Banuceru, et al. (2012) found that BA theses introductions were concise and cohesive because it employed a limited number of moves. This seems to be a recent development under the influence of English writing conventions specifically the CARS model (Swales, 2004). In their study, move 1 (establishing a territory) with its sub-move (introducing the particular topic) and move 7 (presenting the structure of the paper) were widely adopted. However, the extensive use of these "descriptive" moves to the detriment of the more "reflective" moves which was M4 (summarizing previous research) and M5.1 and M5. 2 (indicating a gap in and a possible extension of previous research, respectively). The lack of intricate rhetorical strategies and use of a relatively more concise style yields a low number of moves and clearer and shorter sentences. This contrary to Wasima & Abbas (2015), in which they analyzed MPhil theses' introduction chapters in the disciplines of Linguistics and Literature produced in Pakistan which contrary to other CARS based studies, M3M1, M1M3 and M3M3 were found as dominant move sequences with dominant occurrence of Move 3.

Darani, Tahririantan, and Afghary (2018) found out that the various steps within Move 2 (indicating a gap) showed a lack of rhetorical inclination that opposed the foregoing genre-based findings. This affects the writing conventions for research publication purposes based on academic norms. Analyzing the moves shows that graduate students do not display a close adherence to the generic conventions of writing research introductions. This includes the hybrid patterns and move combinations along with the marked step and sub-step realizations. The various steps within Move 2 exhibited a lack of indicating a research gap, adding to what is known, and presenting positive justification in introduction sections. Also, the niche-related sub-steps as a means of indicating the gap seemed not to favorable to graduate students as writing this move were challenging to them.

Cheung (2012) examined the Master's theses in the soft sciences on how the CARS model can be used to explain their introductory chapter. He found out that that applied linguistics and educational management theses has high frequency of authorial presence and non-integral citations while instructional design and technology student writers show both low authorial presence and low frequency of using non-integral citation.

Sidek, et al. (2016) studied the selected conference proceedings abstracts and its essential rhetorical moves and sequential presentation according to its classification. It was found out that other moves that emerged that show the partial rhetorical moves with a variety of moves sequence. In a follow up study, Sidek (2017) himself analyzed entrepreneurial articles with the same problem as his previous paper with his colleagues. Findings revealed that only one abstract satisfied the rhetorical moves while the others contain only varied parts and sequence of the rhetorical moves.

Asaria, et al. (2018) examined the rhetorical moves in writing out English Language Teaching and Learning

(ELTL) research articles employed by Indonesian English academics. It revealed that discussions written by Indonesian English academics in ELTL research articles employed four moves consistently with four other moves were absent. However, the cognitive pattern delivered was substantially logical, coherent, and linear. They found out that there are only three noticeably common moves: Move 1 (background information), Move 2 (statement of results), and Move 4 (reference to previous research). While five other Moves were hardly employed. The existence of Moves 4 and 5 indicates focus in discussing, elaborating, and explaining the research findings. This moves were established to paint a clear picture towards comprehending every component to make readers understand easily the findings.

Ghasempour and Farnia (2017) investigated the law research article abstracts in English and Persian languages. It was found out that all moves (i.e. Introduction, Purpose, Method, Result, and Conclusion) were considered mandatory in writing English research article abstracts, whereas moves one (Introduction) and two (Purpose) are compulsory moves in Persian abstracts.

Abdullah (2016) found out that the rhetorical moves of the CARS model is totally applicable in Civil Engineering (CE) corpora but it slightly fitting to the presented structural patterns in English Language Teaching (ELT) research articles. Results show that structural pattern in ELT and CE corpora are different in presentation. Subsequently, there were 'extra' moves included like evaluation of research shows its potentially adapted by authors from the CE discipline (Atai & Habibi, 2009).

In the reviewed literatures, it is conspicuous that relying on the CARS model has provided general guide for researchers in writing research introduction across various disciplines. The model, in which most of the literature reviewed were based on, could be further revised in allowing emerging moves and patterns depending on the necessity of the discipline. This review also has proved that there is no specific structural pattern can be proposed for each discipline, however, the model can be formed as a standardized writing framework as variation of each discipline goes beyond the nature of written discourse. It is due to the facts that many interdisciplinary fields of related or different disciplines are formed and wider multi-functional single disciplines are evolved in which allow variation of observation even in subdisciplines' context.

Research Objectives

This study describes the implementation of the John Swales' CARS (Create A Research Space) model (2004) of 24 scientific thesis introductions (Background of the Study) of the Grade 12 STEM students of the University of the East-

Figure 1. CARS model (2004)

- Move 1 Establishing a territory**
 - Step 1 Claiming centrality and/or
 - Step 2 Making topic generalization(s) and/or
 - Step 3 Reviewing items of previous research
- Move 2 Establishing a niche**
 - Step 1A Counter-claiming or
 - Step 1B Indicating a gap or
 - Step 1C Question-raising or
 - Step 1D Continuing a tradition
- Move 3 Occupying the niche**
 - Step 1A Outlining purposes or
 - Step 1B Announcing present research
 - Step 2 Announcing principal findings
 - Step 3 Indicating Research Article structure

Caloocan Campus. Subsequently, this article aims to answer

1. What rhetorical patterns are present in the scientific research of the Grade 12 STEM students?
2. What is the frequency of each step and their errors in the background of the study of the scientific thesis of the Grade 12 STEM students?
3. How were they able to present their thesis in terms of the:
 - a. context;
 - b. problem; and
 - c. solution?

Theoretical Framework

John Swales' Create A Research Space (CARS) model (2004) have been preferred widely by researchers to explore the rhetorical organization of research articles for more than a decade. It has been applied and experimented in multidisciplinary research articles. This have been used to find a rhetorical organization of research articles written in languages other than English that shows its applicability across cultures (Arvey, Anett & Gyula, 2004). Thus, the its applicability has also been identified in the introductory section of the conference presentations worldwide (Swales, 2004). In addition, the CARS model is not rigid and accepts modifications according to evolving generic practices as suggested by Bunton (2002) and Shehzad (2007). To date, it has been used in several graduate schools in the Philippines and has been established to be the standard in writing research introduction.

Conceptual Framework

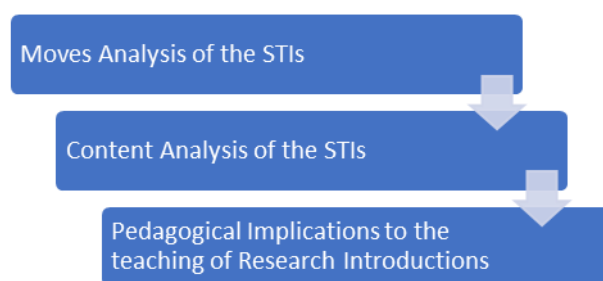


Figure 2. Research Paradigm

The schematic figure represents the research paradigm of this study. The diagram shows a bottom-up analysis of the scientific thesis introductions (STIs). First, the STIs underwent moves analysis to determine their frequency and percentage with regard to their moves, steps, and errors. Secondly, content analysis was done to the STIs to determine the errors committed and the characteristics of the moves utilized. The findings of the study may impact pedagogical implications to the teaching of research introductions.

Methods

This paper used quantitative-humanities mixed approach. The background of the study of the thesis of The University of the East-Calooocan Campus Grade 12 Science, Technology, Engineering and Mathematics (STEM)

students were analyzed. Swale's CARS model (2004) was taught to the Grade 12 STEM students but were not required to apply it. Hence, their final introduction was decided upon by their research adviser.

Corpus of the Study

The grade 12 STEM theses were done under the subject, HRE 121: Research in Daily Life 2, HRE 122: Research Project, and HRE 123: Research Capstone all offered in one semester. Therefore, these theses utilized quantitative approach in creating or proposing a prototype in the field of Science, Technology, Engineering and Mathematics (STEM). They were selected conveniently because this subject was handled by the researcher. There were 30 corpora from the research introductions.

Sampling

This study used convenience sampling in which the selected corpora were taken from the class of which the researcher is handling in the subject, HRE 121: Research in Daily Life 2. This subject covers the writing of Chapter One which encompasses the background of the study specifically the CARS model (Swales, 2004) were taught to the students as an outline in writing their introductions.

Analysis of Data

This study undertook a bottom-up analysis of the scientific thesis introduction. They were tabulated using frequency distribution and percentage to determine the frequency of the steps and the sequence of the moves. Focusing on structure, moves, and deficits as elements of textual coherence and cohesion, the theses were subjected to content analysis.

Participants of the Study

Grade 12 Basis Education STEM (Science, Technology, Mathematics) students in the Philippines, aged 16-18 years old. Practical Research is part of their K-12 curriculum in the Philippines.

Results and Discussion

Move characteristics

Table 1. Rhetorical Patterns of the Scientific Thesis Introductions
n=24

SAMPLES	CARS Model	Rhetorical Pattern
1	YES	M1-M2-M3
2	YES	M1-M2-M3
3	YES	M1-M2-M3
4	YES	M1-M2-M3
5	YES	M1-M2-M3
6	YES	M1-M2-M3
7	YES	M1-M2-M3

8	YES	M1-M2-M3
9	YES	M1-M2-M3
10	YES	M1-M2-M3
11	YES	M1-M2-M3
12	YES	M1-M1-M2-M3
13	YES	M1-M2-M3
14	YES	M1-M2-M3
15	YES	M1-M2-M3
16	YES	M1-M2-M3
17	YES	M1-M2-M3
18	YES	M1-M2-M3
19	NO	M2-M1-M1-M3
20	YES	M1-M2-M3
21	YES	M1-M2-M3
22	YES	M1-M2-M3
23	YES	M1-M2-M3
		M1(Step 3, 1C from M2)-M1 (Step 3)-M2 (STEP 1C), M2 (STEP 1D)
24	NO	
Total	22	

Table 1 reports the frequency of scientific thesis introduction (henceforth, STIs) that utilized the CARS model (Swales, 2004). In this table, the samples, compliance to CARS model and rhetorical pattern are shown. There are 22 out of 24 that complied with the CARS model. Shown in table two is their frequency (f), percentage (%), and compliance to the CARS model.

Table 2. Rhetorical Patterns
n=24

Rhetorical Pattern	f	%	CARS Model
M1-M2-M3	21	87.5	YES
M1-M1-M2-M3	1	4.166667	Modified
M2-M1-M1-M3	1	4.166667	NO
M1(Step 3, Step 1C from M2)-M1 (Step 3)-M2 (STEP 1C), M2 (STEP 1D)	1	4.166667	NO

As shown in table 2, 21 STIs were found to have used the CARS model (M1-M2-M3) equivalent to 87.5%, while one used a modified version with M1-M1-M2-M3 pattern equivalent to 4.166667%. The other two STIs did not comply with the CARS model which utilized M2-M1-M1-M3 and M1-M1-M2-M2 patterns with one each equivalent to 4.166667%.

Table 4. Frequency of Moves
n=24

Move	f	%	Errors
M1	24	100	10
M2	24	100	14
M3	23	85.83333	0

Table 4 presents the frequency (f), percentage (%), and errors found in each move. Both Moves 1 and 2 were used in all the STIs equivalent to 100%. However, M2 had the most error with 14 and 10 for M1. M3 is the least used with 23 STIs equivalent to 85.3333% which has no errors.

The findings of the present study in which all of the 24 Grade 12 STEM STIs contains M2 as opposed to the corroborated literature in which most models for writing theses and research article introductions contain occupying the niche (Move 3) and establishing a territory (Move 1) as a combination (Swales, 2004; Bunton, 2002; Shehzad, 2008). According to Cheung (2012), the writers prefer to establish the territory first and occupy later for one area of the research followed by establishing the territory and occupying other area of the same research. Furthermore, Wasima and Abbas (2015) revealed that the dominant move patterns were M3M1, M1M3 and M3M3 that are again contrary to the findings of other CARS based studies that showed dominant cyclical move patterns of M1M2. It is noted that there is “contextual layers” on these STEM Grade 12 researches should be taken into account not exclusively as disciplinary values and but rhetorical inclinations and should be analyzed in terms of discoursal, cultural, and lack of rhetorical awareness’ factors (Cheung, 2012).

Steps characteristics

Steps in Move 1

Table 5. Steps in Move 1.
n=24

STEPS	Description	f	%	Errors
1	Claiming Centrality	21	87.5	2
2	Making topic generalization	22	91.66667	2
3	Reviewing items of previous research	19	79.16667	6
Total				10

Table 2 shows the frequency (f), percentage (%) and errors found in Move 1 in the 24 STIs examined in this study (n). Step 1: Claiming centrality got 21 equivalent to 87.5% with 2 errors; Step 2: Making topic generalization got 22 with 91.66667% with 2 errors; while Step 3: Reviewing items of previous research got 19 with 79.16667% with 6 errors. Overall, there are 10 errors found in this move.

Most of the STIs were able to utilize Move 1: establishing a territory. Step 2 is the most common with the least amount of errors showing that most of the students were able to ground the importance of their topics. However, with the sufficient sources provided, there seem to be a lack of cohesion which defeats the purpose of the step since there is no clarity in the information provided:

(1) Example 1

Glass waste as an aggregate in concrete and have a potential for sand replacement is a common finding in international studies (Eme & Ekwulo, 2018; Fawaz, 2018; Taha &

Nounu, 2009). Several studies have suggested that there is a need for further study about utilization of TGF as sand replacement (Eme & Ekwulo, 2018; Fawaz, 2018; Taha & Nounu, 2009). (TI: 21)

Step 1 follows with the same number of errors. This shows that most of the STIs values the that the research is part of a lively, significant, or well- established research area. This is due to the scientific nature of the research topics (Abdullah, 2016). Despite presenting the needed data to establish its value, the research territory has not been grounded clearly in which the overwhelming interest was not justified:

(2) Example 2

In 2018, there has been an overwhelming interest in the remains of domesticated chickens (*Gallus domesticus*) and a group of researchers argues that it will be a major and unique marker of our changing biosphere. There are roughly more than 22.7 billion numbers of chicken (Katz, 2018) which might later on contribute as food waste, but as our lives are emerging through time, solutions to this problem are still limited from being used as a fertilizer, broth and pet food. (TI: 18)

Step 3, although has significant numbers, is the least used with the most errors. The number of errors suggest the challenges of correctly reviewing the literature available to the field. The most common error is the STIs are claiming importance despite citing only one source:

(3) Example 3

Several studies have suggested that coconut fiber is quite viable as a reinforcement material in concrete, in addition to this, it is an effective method for the disposal of coir mattress waste which will reduce the demand for additional waste disposal infrastructure and decrease the load on existing landfills and incinerators (Aditya, 2015). (TI:3)

It is noted that Steps 1 and 2 are identical in presentation grounding the territory completely by citing relevant researches that will support their claims whereas Step 3 involves reviewing previous researches in which significant number of STIs struggled. This is supported by Shehzad (2008) who stated that most writers engaged in series of sub-steps within Move 1 to position their research territory, making their texts more stimulating and suitable to the research community. In Asaria et al.’s study (2018), it is an interesting finding is the absence of Move 1. This rarely happens since Swales (2004) himself suggests that this Move is frequently used before stating the research result and becomes the three most popular Moves used by English research article writers. This notion supports Sidek’s study (2017) shows high presentation of Move 1 which is employed consistently. This shows that Move 1 is necessary to write and develop their discussion section.

Steps in Move 2

Table 6. Steps in Move 2.
n=24

STEPS	Description	f	%	Errors
1A	Counter-claiming	0	0	0
1B	Indicating a gap	4	16.66667	2

1C	Question-raising	12	50	5
1D	Continuing a tradition	13	54.16667	6
Total			14	

Table 3 shows the frequency (f), percentage (%) and errors found in Move 2 in the 24 STIs examined in this study (n). Step 1A: Counter-claiming got none equivalent to 0%; Step 1B: Indicating a gap got 4 with 16.66667% with 2 errors; while Step 1C: Question-raising got 12 with 50% with 5 errors; while Step 1D: Continuing a tradition got 13 equivalent to 54.16667% with 6 errors. Overall, there are 14 errors found in this move. Step 1A is not used in establishing the niche. If used, STIs should introduce an opposing viewpoint or perspective.

In terms of establishing the niche, the STIs intriguingly exhibit weaker versions but they still were able to use all four steps. Step 1D is the most common with the highest errors showing that most of the research introductions aim to continue a tradition but failed to establish footing. For example:

(4) Example 4

Recent researches about converting gravitational energy to electrical energy had greatly contributed to the conservation of resources but it failed to answer one question (Dhadwal, et al, 2017). Studies said that it is not gravity being converted to electrical energy it is mainly force or mass (Ingale, A, et al, 2019). Such researches uses objects as a primary source of mass but it failed to use human weight as a primary source of mass (Yakubu, 2017). The present research used body heat as a source of energy but not body weight. (TI: 10)

Step 1C follows second both in the most commonly used step and in the most errors among the steps. This shows the importance of presenting the consequences of gaps in prior research that will be addressed but is difficult to establish because of the lack of sources that could ground the claim:

(5) Example 5

While Armstrong (2016) argued that using real charcoal could still work for alternative ink in printers, a close examination proved this finding questionable. A considerable amount of researches have been conducted using charcoal as alternative ink but little research on organic carbonized materials. Despite these early observations, the mechanisms of environmental impact, effectiveness, and cost have remained unclear. Thus, a concern as to how such mechanism can solve the gap continues to grow. (TI: 17)

Step 1B comes third though this is the essence of the niche in which the researcher develops the research problem around a gap or understudied area of the literature. Yet, the TI was not able to manifest the reviewed literature:

(6) Example 6

While Schmitt (2019) argued that BSFL can make more crude protein compared to sardines and anchovies. The only difference of it is that FM (fish meal/fish based pellets) needed anchovies and sardines that can be found in the ocean, while IM (insect meal/BSFL based pellets) can be

grow and culture all year round on land plus it can grow quickly. While existing studies have clearly established the relevance of IM, they still failed to address the problems for the disadvantage properties of the said material, such as its termination or expiration date. Earlier studies have suggested that IM are more affordable and give higher quality compare to FM. (Paul, 2019) (TI: 5)

The examples cited evidently exemplify that STIs have not built a clear critical position to highlight the limitations, inefficiencies, deficiencies, and conflicts of previous studies in Move 2. Swales and Feak (2004) argue that an introduction remains flat when the writer fails to create a space specifically by identifying the gap. This is supported by areas of the genre analysis reported the perceived failure to establish niche in articles (Burgess, 2002; Moreno, 2010; Jogthong, 2001; Fakhri, 2004; Arvay & Tanko, 2004; Hirano, 2009; Shehzad, 2008; Lim, 2012).

Steps in Move 3

Table 7. Steps in Move 3
n=24

STEPS	Description	f	%	Errors
1A	Outlining purposes	7	29.16667	0
1B	Announcing present research	15	62.5	0
2	Announcing principal findings	10	41.66667	0
3	Indicating Research article structure	18	75	0
Total				0

Table 4 shows the frequency (f), percentage (%) and errors found in Move 3 in the 24 STIs examined in this study (n). Step 1A: Outlining purposes got 7 equivalent to 4.17% with no error; Step 1B: Announcing present research got 15 with 62.5% with no error; while Step 1C: Announcing principal findings got 10 with 41.66667% with 1 error; while Step 1D: Indicating Research article structure got 18 equivalent to 75% with no error. Overall, there is only one error found in this move.

Step 3, indicating research article structure, is considered the least essential and can be cut off in writing STIs. However, it has the highest frequency and the least errors which suggest that is the easiest step in writing STIs:

(7) Example 8

The remainder of this paper is divided into five chapters, namely Chapter 1) Introduction, Chapter 2) Framework of the Study, Chapter 3) Research Design, Chapter 4) Analysis and Interpretation of data, and Chapter 5) Summary of Findings, Conclusion, and Recommendation. (TI: 23)

In the case of the first step in the Move, the researcher may opt to use one over the other because of their similar function. Step 1B follows second with no error show that STIs were able to describe the purpose of the study in terms of what it aims to do or accomplish:

(8) Example 9

In this study, the researchers argue that glass wastes are good aggregates in concrete; there is still need to seek more about finding alternatives of sand. When the researchers

explored the potentials of the tempered glass wastes as sand replacement, the data obtained were the basis if it was a good as sand alternative in concrete mixture. Here, the researchers report a new method for finding another alternative of sand. (TI: 21)

Whereas its counterpart, Step 1A with no error opt to present the thesis statement exclusively:

(9) Example 10

In this study, the researchers attempt to make use of livestock wastes such as pig bristles and pig hooves in making a keratin-based organic fertilizer. (TI: 1)

STIs utilizing Step 2 present a brief, general summary of key findings written were that utilized:

(10) Example 11

When the researchers explored the theory of Packing Density, the data obtained led the researchers into concluding that with the support of the said theory, the betterment of making concrete hollow blocks would be possible if the gaps in the cement itself were to be filled with additive materials, in order to achieve more compact, dense, filled-in and durable concrete hollow blocks. (TI: 6)

Move 3 investigated in the present study display tendencies towards announcing work purposively. In particular, the STIs are more inclined to downplay definitional clarifications in Move 3 (Abdullah, 2016). This is supported by Wasima and Abbas (2015) who highlighted that writers announced the research (M3S1) 90 times and gave background information of the research field (M1) 67 times only. This proved that writers' focus was greater on announcing their research purposively even descriptively than providing background information.

Thesis Presentation

Context

STIs tend to complete all the steps in Move 1 specifically in the 22 STIs that used the CARS model. Among them, the most preferred is making topic generalization (Step 2), followed by claiming centrality (Step 1), and reviewing items of previous research (Step 3). However, there were more errors in the least preferred Step 3 which goes to show its unpopular stance in Move 1. Steps 1 and 2 are almost similar in process.

The STIs were able to ground their contexts using Steps 1 and 2 which discusses what currently is happening and why should it be taken seriously. Step 1 establishes the prominence of the thesis topic, in turn, they tend to centralize the research topic by using contextual clues such as citing years of prominence and "interest", "significance", and "favorite topics":

(11) Example 12

In 2001, there has been an overwhelming interest in the development of portable chargers that are now famously known as power banks and has been widely used for power consumption. As the innovation on electronic gadgets continues and different operations are being incorporated, the devices suffer from draining out quickly (Power Banks Depot, 2017; Abhishek, 2015). (TI: 20)

Step 2 discusses the context of today answering the question, "what now?", in order to make statements towards phenomena, current knowledge, and practices in the field:

(12) Example 13

There has been a shift as to what research design is used in exploring the development of power banks where previous studies have created a portable charger that generates power initially from sound waves. It was proved possible that sound waves, a mechanical form of energy, can be transformed into another form of energy to provide power for electronic devices (Bacosa, 2017). (TI: 20)

Step 3 is different compared to Steps 1 and 2 in which STIs relates what has been found on the topic and who found it. This requires students to research further literature to compare the current practice to what has been done:

(13) Example 14

Several studies have suggested that electric generations are possible through utilizing microphone transducers. The oscillation from the sound waves to the diaphragm will affect the magnetic field, causing the fluctuation of conductors where electric current flows (Alankri, Vivek, G. & Vivek, Y., 2014; Pulki et al., 2016). (TI: 20)

Overall, the STIs of the Grade 12 STEM students employed all the moves of the CARS model (Swales, 2004) to validate the significance of the STEM field, uphold their study's importance, and establish their research territory through academic claims or contributions from the field. Furthermore, the prominence of Move 1 is necessary according to Atai and Habibi (2009) as writer recourses to various combinations of steps to impress and convince the academic community of the merit of his study. Darani, Tahririantan, and Afghary (2018)'s findings reveal that the occurrences of Move 1 steps were superior over Move 2 and Move 3. This indicates its critical significance. Thus, the findings of the current study agree with Keshavarz et al. (2007) concerning the prominence of Move 1 which is essential in writing STIs. The majority of the presentations included Move 1 (IT) "establishing a territory" which is in line with Abdullah (2016) results about research articles which can indicate that stating the goal and current capacity is of great importance for slide makers with a high frequency for Move 1.

Problem

STIs were not compelled to complete all the steps in Move 2 since this move only requires one from the various steps that can be utilized. This due to the fact that the problem to be solved in this STEM researches can be approached with a lone solution. Among them, the most utilized is 1D: Continuing a tradition with the highest number of errors, followed by 1C: Question-raising, and 1B: Indicating a gap which follows the trend wherein the most frequently used step has the most number of errors. Step 1A: Counter-claiming is not utilized among the STIs of the Grade 12 STEM students.

Step 1D: Continuing a tradition is the most frequent because researchers are asked to present a research as useful extension of existing researches:

(14) Example 15

Foam Polystyrene is a type of plastic foam material that has certain desirable attributes such as its soft and lightweight nature. Moreover, it's a good insulator against heat and sound. As a result, it is used in packaging for consumers use and become a problematic material for waste management as it seems impossible to decompose (Kibria, Rahaman, Wahid and Salam, 2017). However, polystyrenes can be dissolved with organic solvents such as gasoline that decompose the air inside the polystyrene and turn it into a mixture. This dissolution method is one of the cheapest and most efficient processes for EPS waste management. In its liquid phase it can be molded to different shapes and can act as an adhesive and sealant for broken materials. For its ability be adhesive, dissolved polystyrene can be utilized as a binding agent in creating green concrete tiles (Ngugi, Kaluli and Abiero-Gariy, 2017). (TI: 15)

Step 1C: Question-raising requires the researchers to impose questions suggesting that additional research should be done. This is done by indicating which research are lacks investigation:

(15) Example 16

The use of coconut-based tile, in creating a pavement which generates electricity using the vibrations gathered from a footstep is not considered by the company "Pavegen" due to its risk that it may lessen the generator's capability to gather vibration (Zhao, Tao, Niu, & Ling, 2014). However, recent work by the researchers suggests that with the use of coconut-based pavements. While existing studies have clearly established the relevance of using piezoelectric generator, they still failed to address the use of cocopallet which would render the whole system impermeable and fire resistant. ("Coconut Waste Outshines Timber for Export Pallets", 2019) While Zhao, Tao Niu & Ling (2014) have established the use of cocopallet as the base for the pavement, these findings raised a number of questions including to what number of weight can a cocopallet carry and how much voltage can a single step produce. (TI: 9)

Step 1B: Indicating a gap demonstrate that earlier studies do not sufficiently address all existing questions or problems. This is done by pointing out which research are not answered by previous researches:

(16) Example 17

Alameda (2017) argued that eggshell is entirely made up of calcium carbonate that is needed in making chalks, Inglis-Arke (2016) explained also that seashells, particularly mussel shells, contain calcium carbonate that is mainly used in creating chalks. The only difference of it is that chalks are more fragile compare to seashells making their calcium carbonate components' different. Since seashells has a stronger calcium carbonate, the compounds of these shells could be used to strengthen the chalks as it presents the great inconvenience of the dust that releases the chalk, both when writing and erasing, causing many allergies, in addition to the dirt that represents the dust that is released and accumulating on the floor, clothes (Haffar, 2016). While existing studies have clearly established the relevance of alternative chalks, they still failed to address the problems for the disadvantaged properties of the said material, such as its dust emission and durability. (TI: 2)

Although Move 2 does not require the STIs to use all the steps, there were STIs that used two or more steps. This

builds up the problem more effectively as long as the steps do not conflict with one another. The example below utilized Steps 1C: Question-raising and 1D: Continuing a tradition:

(17) Example 19

While Jamal et al. (2013) and Hassan et al. (2014) argued that harvesting sound energy from farther distances could still work for generating voltage output, a close examination proved this finding questionable. A considerable amount of researches have been focusing on harvesting sound energy through speakers and noise pollution from the busy roads but little research on a more accessible and traditional source of sound energy such as musical instruments. Earlier studies have suggested that the piezoelectric device must be near or attached to the sound source for better voltage output results. To verify this finding, more work must be urgently done. (TI: 22)

In this examination of Move 2, the STIs were able to exhibit various steps in deepening the problem, however, this move poses challenges among the STIs specifically, the lack of sources that could ground the claim, lack of cohesion and cohesiveness among the presented problems. It is also noted that 1A: Indicating a gap was not used may be because of the aforementioned challenges which requires thorough review of the literature. Moreno (2010) noted that gap indication is not a must. Burgess (2002) revealed that nearly 50% of STIs in Spanish eliminated Move 2. Darani, Tahririantan, and Afghary (2018) found out that the various steps within Move 2 (indicating a gap) showed a lack of rhetorical inclination that opposed the foregoing genre-based findings. Jogthong (2001) reported an obvious absence of Move 2 in 45% of the Thai papers analyzed. This is backed up by Samraj (2002) which highlights that some research areas had limited number of researches to establish a gap. The study of Jalilifar (2010) revealed lack of knowledge of the rhetorical specification of introduction and little information towards the patterns employed in a particular subdiscipline. In addition, the findings in this study challenge those of those established by Burgess (2002), Jogthong (2001), Samraj (2002), and Jalilifar (2010). Nevertheless, presenting the problem in scientific research is necessary to build up what is needed to be done to solve it. Swales (2012) argued that the major purpose of indicating gap (M2) is creating a research space the researchers' work which serves justifications for its contribution. This allows the research to be identified in the vast field of research. In addition, indicating the gap provides other researchers the insight of exploring new areas of research. On the whole, Move 2 functions as mini-critique (Wasima & Abbas, 2015) which establishes the niche for the research and becomes source of motivation for the researchers.

Solution

Among the moves, Move 3: Occupying the niche yields no error in all the examined STIs. Also, all the steps were seen among the STIs examined in this study. STIs may opt to use Step 1A: Outlining purposes or Step 1B: Announcing present research and then proceed in writing Step 2: Announcing principal findings but Step 3: Indicating

Research article structure is optional and may not be used at all.

Step 1A: Outlining purposes is less preferred compared to Step 1B: Announcing present research. In this step, the STIs presented indicated the purpose of the research. This is possible by simply stating the thesis statement:

(18) Example 18

The researchers attempt to improve the quality of non-loading hollow concrete blocks by using Coconut Coir Ash (CCA) as an aggregate in comparison with commercial NLHB in terms of mechanical properties. (TI:3)

Step 1B: Announcing present research is similar to Step 1A but it describes the research in the current article. In this step, the STIs announced the research's purpose:

(19) Example 19

Here, the researchers report a new method for replacing cement in hollow blocks and improving its durability. (TI:6)

Step 2: Announcing principal findings in the STIs gives a glimpse of the conclusions of the present research. This is done by providing what has been done:

(20) Example 20

It has also been proven that the pavement is impermeable because the ends of sample boards are coated with an impermeable coating such as a wax emulsion product or silicon sealant. (TI:14)

Step 3: Indicating Research article structure, although not essential, still is the frequently used step among all the steps in this Move. In this step, the STIs announced the structure of the present research:

(21) Example 21

The researchers have organized the rest of this paper in the following order: Chapter 1) Introduction, Chapter 2) Framework of the Study, Chapter 3) Research Design, Chapter 4) Analysis and Interpretation of data, and Chapter 5) Summary of Findings, Conclusion, and Recommendation. (TI: 11)

Occupying the niche points to a thorough account of the research purpose. This pinpoints what the research is all about and how the solution will be done to the context and problem that was presented, thus called occupying the niche. All STIs were able to flawlessly apply Move 3. This is in line with Jalilifar (2010) who claimed that scholars seem to disclose the purposes of their work in their STIs. Moreover, Fallahi, Moghimi, and Mobasher (2007) noted that the steps 1A, 1B, 2, and 3 was exploited in majority of articles written in English. Similarly, there was also a greater tendency by graduate students towards explicitly presenting the solution. Move 3 was found to a much greater extent as Swales (2004) noted that this step is utilized 'especially in papers whose principal outcome can be deemed to reside in their methodological innovations like the Sciences. Subsequently, occupying a niche is a frame of reference for discussion of what is universal practice in the academic community (Lyda & Warchal, 2014).

Conclusion(Times New Roman, bold, 12)

The current analysis of STIs of the of the Grade 12 STEM students employed all the steps of the CARS model. As an attempt to describe the implementation of the John Swales' CARS (Create A Research Space) model (2004), it was

found out that a) All three moves are necessary in writing STIs, b) Move 2, although the most common, still is the most challenging step to write, c) establishing the context, problem, and solution are essential in writing STIs. First, the STIs of the Grade 12 STEM students employed all the moves of the CARS model (Swales, 2004) to validate the significance of the STEM field, uphold their study's importance, and establish a research space through present research claims and previous contributions. This brings us to the conclusion that the noticeable rhetorical structure tendencies can be traced in terms of move combinations. The noticeable use of contextual layers surrounding student-produced texts should be taken into account not solely disciplinary values and but rhetorical tendencies should be analyzed in terms of discursal, cultural, and lack of rhetorical awareness' factors.

Secondly, the Move 2 in the STIs attempted to deepen the problem further by exhibiting various Move 2 steps but this move garners errors in cohesion and cohesiveness because of the lack of sources that could ground the claim. It is also noted that 1A: Indicating a gap was not used. In relation to this, M1S3 (Reviewing the items of previous research) has the highest number of errors in Move 1 which involves reviewing past researches. This only shows the struggles of the research students in finding enough sources to ground the problem effectively through citing what has been done and what is needed to be done. Nevertheless, its frequency shows that presenting the problem in scientific research is necessary to create a research space that the researchers' work which serves justifications for its contribution. This contribution becomes motivation for the research to fill in the gap.

Lastly, this study showed that grounding the context, establishing the problem, and outlining the solution were necessary in writing STIs. These are shown conceptually in Swale's CARS model (2004). Establishing the territory allows the STIs to provide relevant context to the topic of research. Establishing the niche permits the research to provide insights in dissecting what the problem is and what has been done previously to solve it. Occupying the niche points on how the problem will be solved effectively based on the context and problem that was presented. This rhetorical tendency becomes a necessity because it is like building block in establishing the thesis.

Nonetheless, it must be specified that the analysis of the STIs can only yield a limited sample of the writing practices involved, restricted to a certain genre and a certain time frame. The papers analyzed were produced under the guidance of the researcher-practitioner under one institution, hence the features noticed may not be generalizable. As a recommendation, other factors would need to be taken into account, such as what constitutes successful thesis introduction writing, other rhetorical models that can be used in the senior high school, and analysis of other research genre in the level.

By means of becoming aware of the rhetorical organization most widely utilized in the academe, senior high school students might be in a better position to make informed rhetorical adoptions based on the Swales' CARS model (2004) as a potential template. Such an analysis, therefore, maybe beneficial to the teaching of research subjects in the

Senior High School level; development of instructional materials, and curriculum development; and provide implications through shedding light on textual and academic norms.

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