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Activating Schemata in ESL Writing

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Activating Schemata in ESL Writing

A dissertation submitted in partial fulfillment
of the requirements of the degree of
Doctor of Philosophy in English

by

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Abstract

My research aims at exploring the contribution of various types of schemata to learners' text comprehension and text production, especially ESL (English as a Second Language) writing, to better understand how ESL learners, especially Vietnamese graduate students, use diverse resources in schema activation to facilitate their processes of learning to write in the academic setting. To better understand these processes, the researcher synthesized previous studies together with conducting interviews with four Vietnamese graduate students and analyzing their writing samples to investigate the relationships among types of schemata: formal, content, and rhetorical schemata, which can be significant in ESL writing and composition pedagogy. Formal schemata refer to learners' awareness and competence in technically linguistic expressions; content schemata refer to learners' knowledge of reading and writing topics; and rhetorical schemata refer learners' awareness of the contextual situations in which texts are created. The analyses in this research have found a substantial contribution of the three types of schemata to the reading and writing processes. The analyses in my research can possibly provide a better understanding of schemata to facilitate ESL learners' reading and writing competence.

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Chapter 1: Schemata in ESL Writing

Introduction

Researchers in language and literacy education have investigated diverse methods of researching reading and writing from various perspectives, such as, cognitive approaches and new literacy studies in ethnographic research. These approaches have contributed significantly to language and literacy instruction. Cognitive approaches to writing have contributed to the understanding of writers' recursive writing processes. New perspectives in literacy examine writing activities in relation to contexts. Regarding reading and writing in contexts, one of the inevitable components that contributes to text comprehension and production relates to learners' prior experiences and background knowledge. Although there has been substantial research in examining the contribution of these components in reading, there may be scanty materials investigating how learners' previous experiences and background knowledge have contributed to writing. My research goal is to examine these components and their implications to better understand writing and writing instruction.

My interest in this research topic has originated from my teaching experience and several English courses I have taken. I attended a teaching workshop about reading instruction for teachers' professional development in Vietnam a few years ago. One of the activities that made a good impression on me was called K-W-L strategy, representing the three major activities in a reading lesson. K represents "know;" W means what learners "want" to know, and L asks learners what they would like to "learn." Students were instructed to write down their knowledge or experiences related to the topic of the reading text in the K column. During or after reading, students wrote their own questions together with the instructor's questions in the W column. Finally, students wrote in the L column what they already learned, including their answers to the

comprehension questions and the interesting ideas learned from the passage. If they could not find answers from the text, they would consult other sources to further investigate answers to those questions. This reading strategy was adapted from Donna Ogle's work (1986) for active reading that provides readers with the purposes of reading and allows them to use their prior knowledge to learn the new content of reading texts.

On the same research topic, I also attended a reading pedagogy workshop, which was part of a five-month-course for Vietnamese teacher trainers of English I took in Singapore in 2010. In this workshop, we discussed the role of learners' prior knowledge and experience on the comprehension of texts. I had a chance to read and became familiar with Kenneth Goodman's (1967) "Reading: A Psycholinguistic Guessing Game," analyzing how readers make sense of texts by using both top-down and bottom-up approaches, all of which involve short-term and long-term memories. The top-down approach refers to readers' use of prior knowledge to comprehend the text content; the bottom-up approach refers to applying linguistic cues to verify the correctness of their previous predictions of meanings. Both top-down and bottom-up processes can be used in the pre-reading stage, preparing readers to fully understand the text through the use of prior knowledge and textual cues. This explanation of the reading process provides learners with a useful strategy in reading, encouraging them to use their prior knowledge that facilitates text comprehension. Prior knowledge refers to readers' experiences and previous reading texts that relate to the reading topic. It can include readers' awareness of cultural differences in the reading text. Take an example of this, "She broke a bottle on the ship." A reader who has not been exposed to the cultural phenomenon of breaking a bottle as secular activity for launching a new ship, may interpret the sentence as an accidental action. However, those who have been exposed and understand the cultural practices of launching a new ship are

more likely to understand this sentence in two different ways: as a secular activity and as an accidental action. Thus, prior knowledge includes readers' prior experiences and previous reading texts that help them identify the layers of text meanings. In this case, differing cultural frames can hinder ESL understanding of the target's language reading and writing. However, prior knowledge can facilitate readers' processes of making sense of texts.

When preparing for doctoral qualifying exams, I was introduced to Frank Smith's (1994) "Understanding Reading: A Psycholinguistic Analysis of Reading and Learning to Read." Smith's (1994) view towards reading relates to readers' prior knowledge. Smith's psychological analysis of reading explains that readers predict meanings and select the most probable possibilities based on linguistic knowledge until they reach the most acceptable match between their predictions and linguistic expressions. The readers' selection depends closely on their prior knowledge, or "schemes," a term used by Smith (1994), to provide a variety of possibilities in meaning prediction.

I was also introduced to Cris Tovani's *I Read it, But I Don't Get It: Comprehension Strategies for Adolescent Readers*. Tovani introduced various reading strategies by recounting practical classroom situations. The theoretical underpinnings of Tovani's reading strategies originate from the above two authors' psycholinguistic and cognitive analysis of reading, for example, setting a purpose for reading, relating prior experiences and previous texts to the present reading text, asking and answering questions about the text, monitoring reading speed, skimming, scanning, making prediction, and drawing inferences.

My interest in this research topic originates from my experience with the graduate courses – Linguistics, Rhetoric, Composition, and Literacy Studies. One of the strategies I learned during taking courses and preparing for the qualifying exams was that I needed to write

summaries, responses, and questions for the materials I had read. Asking questions before reading motivates me to read actively because I read to search for answers to my questions. Asking questions also encourages me to activate my prior knowledge and experiences, which may have connection to meanings of texts. Asking questions while reading and after reading connects the text to other sources, and links my own experience to new knowledge. Writing summaries is a great way to facilitate my understanding of texts and retain my reading records for later referencing. From this experience, I have realized a profound connection between reading and writing, and the significance of previous knowledge, or schemata, to reading.

Encountering new concepts from the courses I have taken has widened my previous belief. I used to think that text meanings are merely inherent and static in the technical expressions of language. Learning about the new concept does not necessarily mean denying the previous idea that meanings are not inherent in language expressions, but it expands the previous notion to a wider perspective that meaning is constructed on the basis of readers' schema, which is culturally and experientially determined. The experience at the conference, from the courses taken, together with reading the materials have motivated me to examine how to activate learners' schemata to facilitate their learning. The already known knowledge are called schemata. Schema theory was first introduced by Frederic Bartlett (1932) and further developed by David Rumelhart (1980) to explore knowledge as past experiences in forms of units or blocks of knowledge. Schema theory has contributed to reading research and reading instruction; thus, it is worth exploring how this theory can be studied in relation to writing and writing instruction.

With today's fast development in the digital age, research and language skills are of great importance with the wide availability of information and the greater need for communicating through written language, including reading and writing skills. Reading skills have proved to be

significant to process materials for social communication and interaction. Readers are required not only to understand texts, but also encouraged to be able to evaluate reading materials. Social requirements, such as literacy skills in professions, have made these literacy skills more demanding, but learning to read and write is a long and challenging process. Still teenage learners and even college students find it challenging to read effectively. Instructors have witnessed this common phenomenon with “I read it, but I don’t get it.” Thus, research in reading and reading instruction have made better ways to understand the reading processes: not only in the traditional cognitive method, such as protocol analysis, but also through new literacy studies to find ways of better understanding the reading processes and their pedagogical implications.

The same issue can be seen in writing and writing instruction. There have been various issues that inexperienced and experienced writers may have encountered. Thus, investigating the writing processes may provide researchers and instructors with a better understanding of how writing works, and how learners encounter writing issues. Just as schema theory has helped reading with useful strategies to make sense of texts, the schema theory in reading may be related to writing that might provide composition instruction with possible strategies for dealing with certain writing issues. For example, readers have problems with how to construct meanings from texts, and by the same token, writers may have similar issues with how to construct meanings through texts. Readers experience issues with reading without understanding, and similarly, writers can encounter difficulties with writing blocks, without knowing what to write. The concept of writing blocks refers to writers’ difficulties with the writing process when they are unable to compose a text. Good readers have purposes of reading, and similarly, good writers set their purposes of writing. Thus, inexperienced writers may encounter the issues of lacking a purpose of writing. Good readers make use of schema, prior knowledge and experience, to make

prediction, draw inferences, and relate their own experiences and prior texts to the reading text, and thus, good writers may also make use of their schema to make questions, do research and answer those questions based on what they have read, experienced, observed, and write about their answers. These activities can be considered as sub-categories of writing activities from good writers. However, inexperienced writers may just sit down, think hard, but may still suffer from the blocks of writing.

Furthermore, researchers have examined writing processes in writers of English. As English as a Second Language (ESL) writing is a branch of composition studies, this research was conducted to understand and identify the composing characteristics of ESL learners. Although I anticipate that there may be little difference between English writers and ESL writers, this research aims at examining further to understand ESL writing. Thus, I choose to investigate ESL writing as the area of research, and examine schema theory in ESL writers.

The Purposes of Dissertation and Research Questions

Much research has been done regarding schema theory in reading, with the acknowledgement of two types of schemata: formal schema and content schema (Carrell and Eisterhold, 1983), but there has been little research into the role of schemata in ESL writing. Research and instruction in ESL writing, with the dominant method of five-paragraph essays, have focused on the means to an end and mostly use writing as a method for developing language skills. Although this method has been widely used and has helped learners with the outline and strategies for writing, this approach may have overlooked the role of communication in ESL pedagogy. My research also aims to possibly fill this gap by raising the need to relate the

significance of communication to ESL writing. So far, there has been research that advocates the significance of audience awareness and social appeals to facilitate ESL writing (Connor 1987).

Although schema theory applies in reading and examines how texts are processed, this theory may not have explored this phenomenon in relation to writing. Thus, my research aims at investigating ESL learners' previous literacy practices on their second language writing, investigating ways of bridging the gap between existing literacy and new knowledge to help learners bring out the best and make use of their previous background knowledge. The findings may help the researcher to better understand students' learning difficulties, their use of previous literacy, and strategies for learning to write in a new academic community. The findings can also help provide a better understanding of the roles of schemata to bridge the gap of previous literacy to new literacy learning, and how to transition learners smoothly from a community to another. When understanding ESL writing processes using types of schemata, educational administrators and instructors will probably better employ effective theoretical underpinnings and classrooms practices. Thus, my research aims at answering the following questions:

1. What types of resources do successful Vietnamese academic writers draw upon as they activate formal, content, and rhetorical schemata?
2. What challenges do these writers encounter when they write for academic purposes in English and how do they overcome these challenges?

This dissertation aims at two main purposes: (1) using the models provided by successful, experienced Vietnamese students who are writing for academic purposes, to demonstrate to teachers how they can teach their students to activate formal, content, and rhetorical schemata for writing assignments; (2) to explore how schema theory, which has been used to study reading, can contribute to our understanding of how successful writing works.

Schema theory has been studied in reading research, which has provided radical perspectives about reading, not only as a static and cognitive process, but also as an interactive transaction between writers and readers. In this regard, texts may offer multifaceted layers of meanings, and writers make sense of text meanings based on their prior knowledge and experience. To apply this theory to writing, my research explores its relation and implications for ESL composition to help learners make use of different types of schemata to facilitate their processes of learning to write in a specific community.

Methods of Research

To explore ESL learners' use of schemata, I used qualitative methods of discourse analysis and personal interviews with four Vietnamese graduate students at the University of Arkansas. For discourse analysis, I collected writing samples from each of the subjects. I conducted interviews with each subject twice – one aimed at understanding learners' previous literacy learning and the other at investigating their difficulties and strategies for learning to write in English.

The purpose of choosing these participants was to find out how advanced learners made use of their rich resources in L1 (Native Language), namely formal, content, and rhetorical schemata in the academic setting. Discussing L1 resources, Jessica Williams proposes that experienced writers can make good use of their L1 resources and linguistic proficiency when learning L2 (Second Language) (Williams 2005, p. 26). Thus, my research hopes to identify how these two factors contribute to their learning processes and their writing practices. Furthermore, in the Vietnamese context of education, writing is not the focus of attention for learners at a lower level, but if learners have the intention of advancing their language

proficiency, especially writing for research and further study, they need to learn how to write effectively. Thus, writing courses in the Vietnamese context are often offered to learners at a higher level of L2 proficiency.

The analyses in my research have found a relation among three types of schemata in the reading and writing processes, the processes that not only involve linguistic, psycholinguistic, and sociolinguistic perspectives, but also pragmatic perspectives. These processes of text comprehension and text production are not only based on cognition, but also metacognition, and contextualization. These terms refer to mental processes; methodological strategies; and personalized motivation related to communicative contexts, respectively. The analyses of my research have connected major and minor areas of study to provide an overview of schema-theoretical perspective, namely rhetoric, ethnography of literacy, second language writing, contrastive rhetoric, genre study, discourse theory, reading-writing connections, schema theory, and linguistics.

Outline of Chapters

Chapter 1 is an introductory chapter, introducing the research topic, significance of research, introduction, research questions, research methods, and outline of chapters.

Chapter 2 discusses the importance of formal, content, and rhetorical schemata and their significance.

Chapter 3: describes research methods and details of participants

Chapter 4: analyzes data from the interviews and the subjects' samples to support the significance of types of schemata in the writing process of the subjects.

Chapter 5 discusses the implications of schema theory for ESL writing and writing instruction.

Chapter 6: discusses pedagogical implications for teaching beginning ESL writers

Chapter 2: Types of Schemata

The goal of the dissertation is to explore how successful ESL writers use their diverse resources of schemata to write in the academic setting. Their schema activation processes involve the three types: formal, content, and rhetorical schemata. This chapter reviews the significance of the three types of schemata, which were found by examining their writing samples and responses from the interviews. The first part discusses formal schemata and their significance by examining forms in ESL writing, contrastive rhetoric theory in relation to ESL learners' issues with forms, schema theory in reading, and reading-writing connections. The second part explores the concept of content schemata and their contribution to writing by relating this concept to the three areas of study, namely the theory of rhetoric, the concept of discourse community, and the notion of intertextuality. The final part explains the concept of rhetorical schemata and discusses the contribution of rhetorical schemata in the light of the theory of rhetoric and speech act theory.

Formal Schemata and Their Significance

ESL Learners' Writing Issues with Forms

Researchers in the field of second language writing have investigated ESL learners' writing problems (Flowerdew, 1999; Silva, 1997). A number of cross-linguistic studies (Bazerman, 1988; Flowerdew, 1999; Silva, 1997) found that ESL writing problems originate from the differences in forms between English writing and ESL learners' first language as well as the syntactical impact of their first language on the English language. For example,

Flowerdew (1999) examines the situation of scholarly publication in Hong Kong by non-native speakers of English. The empirical study collected questionnaires to elicit responses in four areas: the subjects' exposure to English, their attitudes towards publishing in English, their difficulties, and strategies for successful publication. In investigating the difficulties encountered by these subjects as non-native speakers of English, Flowerdew (1999) finds that the major difficulties of the subjects in publishing academically were technical problems they experience when writing in English, and these issues were considered by the subjects as more serious than other aspects, such as rhetorical pattern, innovative thinking, and literature review (p. 140). This finding is in line with the reviews of other studies, showing that there have been several major writing issues related to forms, such as grammar, textual organization, use of citation, aside from other issues, such as structuring of arguments, making reference to the published literature, using "hedges" to indicate caution, relating text to the audience, making knowledge claims, and establishing authorship (Adams-Smith, 1984; Bazerman, 1988; Dudley-Evens, 1994; Johns, 1993; Mauranen, 1993; St. John, 1987 cited in Flowerdew, p. 127). In another study related to writing issues with forms, Tony Silva (1997) examines the differences between ESL writing and native English speakers' writing in various areas, including forms (textual patterns, cohesion, sentences, and words), rhetorical strategies, and composing processes. Silva (1997) finds that ESL writers had more constraints especially in forms, particularly lexical resources and unfamiliar textual patterns (p. 216-217).

Regarding forms in ESL writing, Jessica Williams (2005) discusses the relation between proficiency in linguistic knowledge and competence in writing. Williams (2005) mentions that in theory there are two distinct views regarding the complicated relationship between linguistic knowledge and L2 writing: (1) writing is learned once and may be transferrable from L1

competence to L2 contexts; (2) L2 writing depends upon linguistic knowledge that can be acquired and learned through the exposure of input, such as extensive and intensive reading (p. 26). The former view may be complicated to determine the transferrable impact from L1 to L2 because automatic transferrable skills from L1 to L2 contexts are complex, for writing involves various factors, such as linguistic competence, social context, background knowledge, and types of writing tasks. To explain the influence of L1 on L2 writing, Williams (2005) alludes to a theory of reading. This theory holds a popular accepted attitude towards the influence of L1 reading competence to L2 context, called "Language Threshold Hypothesis." This hypothesis states that L1 reading proficiency can be tapped into L2 reading context when learners have reached a particular linguistic proficiency level (p. 26). Although this specific level is still unknown, L1 writing may affect L2 writing competence when learners have reached a specific threshold of linguistic competence. The latter view, in which L2 writing relies on the exposure of input, including linguistic knowledge, can be explained by the theory of Stephen Krashen's (1981) "comprehensible input" theory, which states that the greater the exposure ESL learners experience is in L2 contexts, the easier it is for L2 learners to acquire the target language, both in terms of linguistic knowledge and language use. Given these analyses, both views show that writing in L2 contexts is influenced by the contextual knowledge and linguistic competence. Thus, the two distinct views aforementioned may not be opposing, but mutually complementary. Both views show the important role of linguistic knowledge and contextual knowledge in L2 writing, and the processes described in both views may occur simultaneously in L2 writing. Even when there are transferrable skills from L1 to L2, learning writing skills and acquiring writing competence in L2 require the instruction of forms and the exposure of input in L2. Likewise, L2 learners' writing processes during the instruction of forms and exposure of input in L2 are also

influenced by the contextual knowledge of L1 and L2. In both cases, L2 instruction and acquisition are of considerable significance in learning L2 writing, and so are linguistic competence and contextual knowledge. More advanced learners, who have reached the threshold level, can make use of their L1 rich resources in their L2 writing. For beginning learners, their limitation on L2 proficiency may hinder them from tapping into L1 writing competence. Therefore, there is a substantial contribution of L2 linguistic knowledge to ESL writing, including but not limited to lexical resources, syntactical structures, and discourse patterns.

Forms as a Means of Communication

Forms not only play a role in L2 writing as discussed in the above studies, but can also serve as a means of communication, one of which is the concept of “genres” as studied by John Swales (1990). Swales (1990) defines a genre as a “class of communicative events, the members of which share some set of communicative purposes” (p. 58). As genres manifest the types of events in communication, genres can possess several indicated textual features and achieve the means and purposes of communication. Swales (1990) attributes the definition of genres to the study of schemata by explaining how schemata provide clues to reading and writing processes. According to Swales (1990), genres are the formation of “content schemata” and “formal schemata.” Content schemata derive from facts and concepts, which are obtained from previous experience and prior texts. Formal schemata consist of informational and rhetorical structures acquired and learned from prior texts (p. 84). Thus, learners’ explicit awareness and understanding of genres will facilitate text comprehension and production. Apparently, based on Swales’s (1990) analysis, genres relate to both formal and content schemata. Thus, since genres themselves convey meanings, they can help learners predict meanings of texts based on interpreting and analyzing the informational and rhetorical structures of genres.

Although there have been critiques in the application of genres, arguing that genres may hinder creativity, criticism, and imagination, Swales (1990) claims that genres have little detrimental influence on these aspects. He argues that direct genre instruction combined with other variable skills can actually facilitate learners' understanding of content and provide them with necessary linguistic input (p. 91). Swales (1990) advocates the genre-based approach, suggesting that genre-based approach not only provides the "maps of new territories" but also "the means for their exploration" (p. 92), and as Himley (1986) cited in Swales (1990) suggests, genres are considered as "instruments of rhetorical action."

Contrastive Rhetoric in Understanding Learners' Writing Issues with Forms

Regarding writing issues with forms, contrastive rhetoric provides theoretical underpinnings to help explore these issues. To do so, this section describes the origin of contrastive rhetoric and applies this theory to explain the significance of formal schemata, which contribute to better understanding and analysis of ESL learners' writing issues.

Contrastive rhetoric has been developed in its incipient stage and studied by scholars in the past fifty years since it was first introduced by Robert Kaplan's (1966) study. Originally it explored different textual features in written products of ESL learners, which was termed "contrastive analysis" (Williams 2005, p. 24). In its first introduction, it was widely and immediately applied in the field of L2 writing as a useful tool to address linguistic issues in L2 learners' academic writing. Contrastive analysis examines L2 learners' linguistic problems based on the characteristics of L1. For example, some Vietnamese learners may have difficulty in using articles in English because Vietnamese language does not have the concept of definite or indefinite articles used in English to denote definite or indefinite objects. Instead, Vietnamese

rely on words and context to describe the differences in meanings between the use definite and indefinite articles. For instance, the English phrases of “the table” and “a table,” which mean slightly different in English, are both translated into Vietnamese as “một cái bàn” without any distinction of definite or indefinite referents. The articles “the” and “a” are translated literally to Vietnamese as a number, “one,” or “một,” so the literal translation of the articles does not manifest their functional meanings.

The origin of contrastive rhetoric traces back to the pioneering study by Robert Kaplan (1966) and subsequent criticism of this area. Kaplan (1966) analyzed organizations of students’ writing, and identified 5 types of paragraph development that reflect different rhetorical tendencies. He concluded that the Anglo-European language has paragraph organization that is in a linear development pattern; the Oriental language has indirect ways of paragraph development; the Semiotic language has a pattern, which is diverted and non-linear like a zigzag form; and the Roman and Russian languages have an indirect and irrelevant pattern of paragraph development.

Kaplan’s different rhetorical patterns of paragraph development were criticized for several reasons: for their insensitivity to cultural and social differences (Hinds, 1983), for considering the negative influence of first language on second language writing (Raimes 1991), for oversimplifying Aristotelian rhetoric because it only focuses on arrangement while dismissing the other four canons in rhetoric (Panetta 2001). Kaplan later admits limitation of his analysis, and acknowledges the theory of language relativism as the main influence (Connor 1996; Connor, 2002; Panetta, 2001). Language relativism refers to the influence of language on perceptions, so it is related to Sapir-Whorf theory. Sapir-Whorf theory examines the influence of language on perception and thoughts. The theory has two versions: the weak version denotes that language

influences thoughts; and the strong version states that thoughts are determined by the use of language.

Criticisms of the influence of Kaplan's study were discussed in some articles. For example, H. G. Ying (2000) argues that Kaplan's claim about the influence of Sapir-Whorf hypothesis on the origin of contrastive rhetoric is untenable because language relativism originates from German ideas about language determinism on perception. Meanwhile, Kaplan's (1966) research explores the influence of rhetoric and culture on the use of language. Ying (2000) argues that these two notions are not compatible. In response to Ying's claim, Paul Kei Matsuda (2001) specifies that the two comparative components are different. Whereas Kaplan's model shows the influence of culture on the use of language, the Sapir-Whorf hypothesis shows the influence of language on thoughts, and these two comparative notions are two different components. Despite such controversies over the influences on the origin of contrastive rhetoric, this theory has provided insight into understanding ESL learners' writing issues related to forms, since the theory investigates ESL learners' difficulty with the use of language.

Contrastive rhetoric study has been expanded to refer to the study of L2 learners' characteristics in writing style to diagnose L2 learners' problems in writing. For example, English writing has the characteristic of linear features of development, with the focus on developing theses or claims, which are supported by convincing explanations and evidence. In some cultures, writing has a more indirect way of idea development. Acknowledging these differences allows instruction to foster learners and understand their resistance in writing. Original contrastive rhetoric was overlapped with contrastive analysis, as it only focuses on linguistic features. The area of study was then redefined and expanded by scholars, such as Ulla Connor (1996), to address its limitation. Connor (1996) defines contrastive rhetoric as follows:

Contrastive rhetoric is an area of research in second language acquisition that identifies problems in composition encountered by second language writers and, by referring to the rhetorical strategies of the first language, attempts to explain them. (p. 5)

Based on this definition, contrastive rhetoric provides comparative analyses and differences in rhetorical patterns and writing styles between the learners' first language and second language. These comparative analyses help learners realize that their composing issues may result from differences in rhetorical strategies between their first language and target language. Learners' awareness of this contrastive rhetoric can be reinforced by their L2 formal schemata. Although there has not been complete contrastive analyses in different languages, except for Kaplan's analysis, which is still limited, contrastive analyses can raise ESL learners' awareness of differences in their first and second language to help them avoid the mistakes made in learning to write in L2. Instructors can generate contrastive analyses from instruction and feedback to raise students' awareness of the differences.

Schema Theory in Reading

The previous analyses show the relation between forms and learners' writing issues, and between formal schemata and writing competence. The knowledge of forms, including genres, or types of textual patterns, contributes to composition skills; thus, the prior knowledge of formal schemata may play a significant role in the writing process. Therefore, schema theory may provide theoretical underpinnings that can be studied for the application in composition pedagogy and ESL writing.

Schema theory was first studied to explore implications for teaching reading. As this theory is contributive to the study of reading and reading instruction, it can be contributive to study its implications for writing and writing instruction. The subsequent explanation will

provide the origin of schema theory, and relate the theory of reading-writing connections to show that writing instruction can be benefited from understanding the writing process through the schema framework.

Schema theory was introduced by Frederic Bartlett (1932) as the framework that characterized learners' previous background knowledge. David Rumelhart (1980) further describes this theory to explore knowledge as a mental process in forms of units or blocks of knowledge, denoting that schemata are basically a way of using and facilitating knowledge process (p. 34). Schema theory refers to prior knowledge that has been previously constructed in learners' mind to guide learners through the process of making meaning with texts. In this regard, texts are considered as context-specific, in which meanings of texts are not just technically fixed or expressed. In addition, meanings within texts are considered as the "transaction" between readers and writers. Text interpretation allows for unlimited mental activities between readers and texts based on individuals' affective, intellectual, and experiential processes (Rosenblatt 2005). This transaction shows dynamic systems of meaning, in which text interpretation include both the negotiation between readers and texts and the interaction between readers and writers. Readers use their schema, or existing knowledge, to construct meanings based on availability of textual features. Thus, Richard Anderson (1995) defines "schema" as "an abstract knowledge structure that captures regularities of objects and events and should include all variation of the known cases in a flexible way" ... and "the schema is generated by the repetition of the same occurrence in such a way that the brain will preserve the common features" (Anderson, 1995).

The theory of schemata in reading was developed and discussed in studies about reading by Kenneth Goodman (1967) and Frank Smith (1994). Goodman (1967) considers reading as a

“psycholinguistic guessing game,” in which readers use their schemata to predict textual materials until they reach their accepted negotiation between the text and their understanding. Goodman (1967) explains that reading is “a selective process that involves partial use of available minimal language cues selected from perceptual input on the basis of readers’ expectation” (Goodman 1987, p. 127). Specifically, readers use a top-down approach to predict the content of texts, and then use the bottom-up approach with available language cues to validate the previously anticipated content. This conceptual understanding of the nature of reading was also discussed by Frank Smith (1994). Smith (1994) states that reading is the process of readers’ prediction by using their schemata to select details from the reading texts, and by using available syntactic and semantic features to verify their prediction.

In studying schema theory and its pedagogical application, Patricia Carrell and Joan Eisterhold (1983) explore the process of reading as the interaction between text and readers’ background knowledge, which is considered as “culturally based and culturally biased” (p. 553). In terms of reading theories, Carrell and Eisterhold (1983) propose in their discussion of schema theory that there are two kinds of schema: formal schema and content schema. Formal schema, related to text structure, refers to readers’ knowledge in rhetorical and organizational structures, such as diverse genres with various organizational patterns of texts. Content schema indicates knowledge of the topic related to the text. For example, schema for writing a narrative would include three parts: exposition, climax, and resolution, which describe the background information of the story, major conflicts, and the end of the story, respectively. Some other examples of formal schemata are distinguishing features of expository texts, including five types of expository rhetorical text organization: “collection- list, causation-cause and effect, response-problem and solution, comparison-comparison and contrast, and description-attribution.” (Mayer

1975, 1977, 1978 cited in Carrell and Eisterhold, 1983).

Carrell and Eisterhold (1983) discuss how schemata play a role in the reading comprehension process, functioning as an interactive mechanism of two opposing processes: bottom-up and top-down. Bottom-up schemata function as data-driven mechanism, in which readers activate available knowledge of the topic, rhetorical and linguistic structures to correspond with texts. Top-down schemata function as a conceptual-driven mechanism, which uses high-level and general schemata to make predictions about texts (p. 555). This top-down process requires learners' conceptual abilities and higher-order thinking skills, such as prediction and generalization. Schema theory in understanding reading may be of significance to apply in writing, as found in some research into learners' improvements in writing thanks to their understanding and using textual patterns. Several studies (Meyer 1975, 1982; Carrell 1984) have found that linguistic knowledge, such as the understanding of genres and organizational patterns of texts, can facilitate the understanding of texts. If such formal schemata contribute to text comprehension, it is worth examining their possible contribution to text production. As there is a connection between reading and writing, there may be a relation of schema theory from reading to writing. A great number of studies have been conducted to show reading-writing connections.

Reading and Writing Connections

The idea of a relationship between reading and writing relates to Krashen's (1984) theory in second language acquisition, in which second language learners are more likely to acquire and learn new languages by greater exposure to "comprehensible input." Based on this theory, reading can provide necessary formal and content input for developing and improving writing. Regarding this connection, Joan Eisterhold (1990) discusses this relationship between reading

and writing in first and second language, and attempts to explain L2 issues based on the analysis. Eisterhold (1990) analyzes three types of relationship between reading and writing – directional relationship, non-directional, and bidirectional relationship.

According to Eisterhold (1990), the directional relationship refers to the influence of one skill on the other, or the connection of one skill towards the other in one direction. This perspective is based on the fact that reading and writing share the same compatible components, and that the ability to acquire components of one can be transferrable to the other. For example, the rhetorical pattern, such as the compare and contrast pattern, which can be identified in reading, can facilitate learners to apply and construct such patterns in writing. For the reading-to-writing direction, there have been various opposing perspectives of researchers about the match and mismatch in the directional relationship between reading and writing. For example, Sandra Stotsky's (1983) findings suggest that additional reading provides more effectiveness in writing than instruction in grammar and writing; but instruction in reading alone may not necessarily lead to improvement in writing. In another study, Barbara Taylor and Richard Beach's (1984) findings suggest that instruction in writing results in effectiveness both in reading and writing abilities, and instruction in reading can help learners improve writing. Their study investigates how instruction in reading expository texts facilitates students' writing in that corresponding pattern. For the other direction of writing-to-reading relationship, the research by Stosky (1983) shows that instruction in writing can help reading comprehension and the retention of information and skill development, such as summarizing and paraphrasing. In addition, a synthesis of studies shows that instructions in writing subskills, such as sentences, paragraphs, and discourses structures, can lead to the improvement of reading comprehension (Belanger, 1987). It can be concluded that the evidence supports the directional relationship between

reading and writing, but the instruction in one direction should be specific enough for the skills to be transferrable and contributive to the other direction.

According to Eisterhold (1990), another hypothesis is the nondirectional relation between reading and writing. In this direction, reading and writing are considered as individually constructive processes underlining proficiency. Thus, if they share cognitive structures and processes, then the increase in one ability can lead to the improvement of the other (Shanahan 1984 cited in Eisterhold 1990).

Eisterhold (1990) names the third hypothesis as the bidirectional relation. This view considers an interactive and interdependent relationship between reading and writing. In this regard, reading and writing underline independent proficiency skills and share multiple relations. Furthermore, the nature of this relation can change depending on the stage of development. For example, Shanahan and Lomax (1986) find that the influence of reading on writing is greater at the lower level of proficiency, which means that the “interactive model of this relationship” works better at the lower level.

All of the three models of relationship show a complex relation between reading and writing, but each hypothesis has its own pedagogical implications. The directional relation shows a mutual influence between reading and writing, and this method is applied in teaching reading as linguistic input for writing. The nondirectional hypothesis considers the interactive influence of reading and writing and considers each skill as the constructive processes that share proficiency skills. Thus, teaching specific structures and processes can be used for both skills. The third hypothesis – the bidirectional relation – shows a combination of views of reading and writing as interactive and interdependent. This perspective considers reading and writing as having mutual influence, but also having its own underlining proficiency. Understanding

different hypotheses of reading-writing relationship provides better theoretical background for relating the schema theory of reading to establishing the schema theory of writing. The connection between reading and writing has provided evidence to substantiate the significance of specific underlining proficiency skills for improving reading and writing competence by the instructions of formal schemata.

The Significance of Formal Schemata in Writing Instruction

As mentioned earlier in Carrell and Eistlerhold's (1983) work, formal schemata, one of the two types of schemata: formal schema and content schema, were described as rhetorical and organizational patterns of text. The concept of formal schemata is defined as "background knowledge of the rhetorical structures of different types of texts" (Carrell, 1983, p. 81). In the context of my research, the meaning of formal schemata has been expanded to comprise diverse subcategories of linguistic and metalinguistic knowledge, including but not limited to rhetorical and organizational text patterns. These can include morphemic, lexical, and syntactical knowledge of the language. This expansion does not necessarily mean to overlook the importance of the precedent meaning. Rather, in formal schemata, the knowledge of organizational and rhetorical patterns can be the priority for readers to construct meanings. The inclusion of the expanded elements may be necessary to help learners make sense of texts and compose texts effectively.

Formal schemata are necessary for pedagogical implications in reading and writing for several reasons. First, form does present meanings; thus, learners' mastery of forms may facilitate their development of reading and writing skills. In schema theory in reading, Smith's (1994) term of surface structure denotes readers' analysis of graphic information, such as morphemic, lexical, and syntactic knowledge whereas "deep structure" underlines the contextual

predictions of meaning based on learners' background knowledge of the topic. According to Smith (1994), a fluent reader predicts content by maximizing the use of deep structure and surface structure to verify the match between content and form. This explanation of the reading process is analogous to Carrell and Eisterhold's (1983) analysis of an interactive mechanism of two opposing schema processes: top-down and bottom-up processes. Whereas the top-down process maximizes the contribution of "deep structure" or predictions based on schemata, the bottom-up process verifies comprehension by minimizing the laborious process of the feature analysis of surface structure. In this analysis, readers' use of greater deep structure can facilitate the understanding process, but the surface structure also plays a role in verifying the construction of meanings.

Second, several studies have found that readers' knowledge of formal schemata can facilitate their reading and writing competence (Meyer, 1975; Meyer, 1982; Carrell, 1984; Carrell, 1987). In her research about the role of understanding the rhetorical text structure on reading comprehension, Bonnie Meyer (1975, 1982) finds that students can recall better content, demonstrate better understanding of texts, and perform better on good reading comprehension on standardized tests. The author gathers five different types of texts, which are considered as having distinct features to separate text types, namely causation, comparison, problem/solution, description, and time-order. These students were asked to recall the content immediately and again after one week using a protocol method. From the analysis, Meyer (1975, 1982) concludes that those students, who used the text structure in their recalls, were more likely to grasp more content and details than those who did not use the text structure.

In another study by Carrell (1984a), with the research structure similar to Meyer's (1975), Carrell (1984a) analyzes ESL students' recalls of texts of the same content with different

text structures, such as comparison, problem/solution, causation, or description, and finds that students who recalled the text based on the structure of the text were better at text comprehension and the retention of text content. Carrell (1987) relates recent findings on reading research about the interaction in reading to apply to ESL composition. The author suggests that ESL learners should be introduced with top-down rhetorical organization as a tool for writing expository text. Specifically, students can be taught with plans in organization to accomplish specific goals in writing. Furthermore, students can be instructed on how to use linguistic devices to signal text organization to communicate to readers more effectively in writing (Carrell 1987, p. 47). Research in this area has found evidence to substantiate the effectiveness of instructing formal schemata on improvements in reading and writing. Thus, instructing textual patterns may facilitate text construction.

Content Schemata and Their Significance

The Concept of Content Schemata

The writing process requires necessary components for smooth performance; namely: tools, materials, and methods. These three elements are analogous to three areas of the schemata: formal, content, and rhetorical schemata. Formal schemata provide necessary tools, such as linguistic means for writers. For ESL writers, formal schemata are one of the largest obstacles. However, formal schemata are insufficient to provide smooth performance in text production. Writers need materials, or content, for the production of text.

The concept of content schemata was introduced by Carrell and Eisterhold's (1983) as

“background knowledge of the content area of a text” (Carrell & Eisterhold 1983, p. 560).

Content schemata relate to knowledge and experiences acquired by readers through life experiences or exposure to texts. For example, a text about how to fix a car discusses the mechanism of vehicle operation and the repair process of its malfunctioning features. The more knowledge of this topic readers have, the easier it is for them to make sense of this text. Readers who are familiar with the mechanism of cars are better at activating the previously acquired knowledge to transfer this understanding to new information. The background knowledge of this content, also called content schemata, facilitates readers to understand new texts.

In the constructivist approach to reading, researchers have found out that meanings in texts may not only be technically inherent in forms (Carrell & Eisterhold 1983; Smith 2004), but also provide multifaceted presentations of meanings. Readers use prior knowledge and experience to construct meanings while making sense of texts. Louise Rosenblatt (2005) believes that reading is a transaction between writers and readers, an active process of interacting between readers and writers, not merely a passive process of decoding meanings from forms.

As reading and writing have connections, writers’ use of content schemata in reading may share similar strategies in writing. Content schemata in writing relate to writers’ background knowledge of content and their expertise in a particular field. For example, in order to write a text about how to cook a delicious meal, the author of this new text needs to have knowledge about cooking or experiences in applying the existing recipe. The more knowledge writers have about the topic, the better the writing content can be shared with readers. Aside from sharing the knowledge of the topic, writers offer their own interpretation and solutions to existing issues. This contribution to text production provides richer resources to readers. Thus, content schemata contribute significantly to meanings as well as originality of new texts.

The contribution of content schemata can be explained based on a theory of rhetoric, the concept of intertextuality, and the notion of discourse community. These three areas show related concepts to help explain the significance of content schemata. The common notion in these three areas is that texts are potentially active and bound in contexts. Because of these characteristics, texts require their original content to respond to contextual situations. The following sections explain the significance of content schemata in terms of these three areas of study.

The Significance of Content Schemata Explained in the Light of the Theory of Rhetoric

The significance of content schemata can be explained based on a theory of rhetoric. According to William Covino and David Jolliffe's (1995) definition of rhetoric, the term is defined as "a primarily verbal, situationally contingent, epistemic art that is both philosophical and practical and gives rise to potentially active texts" (p. 5). This comprehensive definition of rhetoric relates to major characteristics for text creation, one of which is the realization that rhetoric is a "philosophical and epistemic" art. Based on this understanding, rhetoric provides guidelines for texts to employ certain characteristics that appeal to its intended audience and purposes, the characteristics that guide the objectives of text production to the nature of knowledge creation. As a "philosophical and epistemic art," rhetoric facilitates the consolidation and creation of knowledge. Thus, one of the qualities of a convincing argument in an effective text is that a text should offer new perspectives and innovative knowledge. All of these elements require rhetors to be the masters of content and possess expertise in the topic of discussion. To do so, writers need to activate their content schemata and apply them for creating innovation and authorship.

For the assessment of writing, content is one of the components to evaluate the quality of

written works. Readers' tastes about text quality can be diverse, but they may have certain expectations for the content of texts. Good text quality may require an inquiry in the innovative content and new perspectives into an existing phenomenon. All of these require writers' profound experience and mastery of the topic in order to transfer the quality of a written product. Thus, content schemata contribute to the success of the writing process.

The Concept of Intertextuality and Content Schemata

As texts adhere to epistemic nature, the quality of texts should employ knowledge creation, idea innovation to demonstrate originality. Granted, there is a question of originality in writing: to what extent are texts considered as original to avoid the issue of plagiarism? The notion of content schemata in relation to the concept of intertextuality can partly respond to this question.

By definition, intertextuality is the concept that characterizes texts as having traces of other texts. James Porter (1986) maintains that "all texts are interdependent: We understand a text only insofar as we understand its precursors" (p. 34). Porter (1986) reviews several canonical texts to illustrate that texts inherit "ideas" from prior texts while creating their own "original content." As texts have traces of other texts, the concept of intertextuality relates to the theory of schema, especially content schemata. As readers make sense of texts, they activate their schemata, their previous experiences related to linguistic and cultural background, to interpret new texts. Likewise, in order to compose a new text, writers also have to activate their content schema. Composing entails traces of existing knowledge, of understanding and analysis of previous content with the offer of authors' rhetorical stance and personal perspectives. Obviously, originality in composing requires significant contribution of content schema.

The idea of intertextuality also reinforces the hypothesis that text creation does not appear independently, but occurs in relation to previous situations that provide the exigence for writing. When learners understand that texts contain the traces of other texts, they are more likely to identify the significance of previous knowledge in creating new texts. The idea of originality may not entail a completely innovative idea, but originality offers new perspectives based on previous analysis and understanding of existing knowledge. In order to provide originality, writers need their own responses, solutions, perspectives, and rhetorical stances. In this case, both the theory of rhetoric and the concept of intertextuality are not in conflict, but in fact, complementary. Subsequent texts provide diverse rhetorical stances and perspectives. Writers inherit traces of other texts, but simultaneously synthesize, generalize, and propose new texts of their own rhetorical stances to solve existing issues, filling unresolved gaps, and advocating innovation. These activities happen when writers combine the inheritance of intertextual traces and creation of personal originality. In this process, content schemata have a substantial contribution.

Content Schemata and Discourse Communities

The significance of content schemata can be viewed from the perspectives of the theory of discourse community by John Swales (1990). In his works of studying the nature of a discourse community, Swales (1990) introduces and analyzes specifically six characteristics of a discourse community. These characteristics include the common shared goals among the community; the specific mechanism of intercommunication; the participation for information exchange and feedback; its specific genres; its own lexis; and the level of expertise (Swales 1990, p. 24-27). One of these important characteristics requires members to share information and feedback, the mechanism that places an important role in the epistemic nature of a discourse

community. In this mechanism, members should be familiar with the content of the discourse community in order to continue the conversations from other members. When they proceed themselves to master the content, they will be able to obtain sufficient information for sharing their contribution to the community.

Furthermore, given the significance of information exchange in a discourse community, the writing process should require writers to contribute knowledge in that community. To contribute their roles and communicate engagingly, writers should be informed of the topic of discussion and knowledge of the field. The experience and knowledge operate as necessary materials for text production. The more expertise writers have in the field, the better the content of their texts. This criterion is in line with the popular belief that a “good” piece of texts needs to communicate particular content that contributes to knowledge. In other words, writing should achieve the epistemic criterion. When writers are aware of how important it is for information exchange and feedback to enter a community, they are more likely to engage actively in the community. This awareness helps them learn about previous dialogues of the continuous conversation, provide background information for their innovative ideas, and create authorship in writing. Thus, content schemata are significant to help writers aware of their communicative purposes by exchanging information and feedback, sharing innovative content and contribute their roles to the community.

Rhetorical Schemata and Their Significance

Rhetorical Schemata

Aside from formal and content schemata, writers need to be aware of the context in which texts are created. When writers are aware of this context, they understand the purpose of communication. Writers' necessary awareness of rhetorical situations leads to the need for another type of schemata – rhetorical schemata. Rhetorical schemata refer to writers' awareness of rhetorical situations of their composed texts and their use of persuasive strategies to appeal to the audience. This awareness helps writers understand their intended purposes, audience, and exigence of composing texts. In other words, rhetorical schemata include rhetorical strategies that help writers understand communicative purposes, social appeals, and active potentiality of texts.

The Significance of Rhetorical schemata

The gap in rhetorical schemata has also been studied in previous research. Ulla Connor (1987) investigates the system of describing and evaluating argumentative patterns in student writing across cultures and languages. Connor (1987) analyzes 10 composition samples from each of student groups from four countries: England, Finland, German, and the United States. The analysis is based on three levels of discourses: linguistic, psycholinguistic, and sociolinguistic. These analyses focus on genre characteristics, speech acts, and social appeals (p. 57). In terms of genre characteristics, Connor's (1987) analysis of argumentative texts includes a problem-solution pattern with four structural units: situation, problem, solution, and evaluation. For the analysis of speech acts, Connor (1987) uses the sequences of speech acts in an argumentative text as asserting a claim, justifying a claim, and inducing the original claim. This

sequence is based on studies by Stephen Toulmin (1958) about the uses of argument: data, claim, and warrant. The third level of the system is the social appeals of argumentative writing, which requires the awareness of audience and persuasive strategy with a focus on social effects. Connor (1987) argues that the first two levels of discourse are insufficient with the lack of social perspectives, and that is why social appeals should be complemented for argumentative texts (pp. 60-61). It can be inferred that although formal and content schema are significant, sociolinguistic perspective in writing, including the awareness of audience and social appeals, has been overlooked and needs more examination in pedagogical research to facilitate students' writing. Since writing contributes to communicating and performing actions through words, writers need not only linguistic competence and knowledge of content, but also purposes of social communication.

The performative action and communicative purposes of texts relate to writers' rhetorical schemata. This type of schemata is explained based on theory and research in rhetoric. Rhetorical elements have also been applied in pedagogical implications for ESL writing, for example the five canons of rhetoric (invention, arrangement, style, memory and delivery), the three appeals (ethos, logos, pathos), and rhetorical situations (purpose, audience, exigence). Some of these components have been applied in ESL writing instructions, for example, invention, arrangement and style. However, ESL writing may be more focused on formal schemata and may have overlooked the role of communicative purposes to help learners aware of the rhetorical situations of composed texts.

As different discourse communities may have different and specific conventions and expectations, new members entering into a new discourse community have to learn new conventions and expectations to enter the targeted community smoothly and successfully. In

other words, writers have to be aware of the constraints in text production. Writers are bound by the expectation of their intended audience to achieve the communication goals. Although writers are free to create original content and potentially contribute knowledge to the field, they need to conform to expectations of the community. Thus, writers effect change in audience in one way, but are constrained by contexts. In other words, writers must be aware of the exigence and understand the rhetorical situations of how texts are created. This knowledge of rhetorical constraints is more likely to enable writers to produce effective texts with their aware of audience, purpose, and the context in which texts are created.

Another example of rhetorical schemata can be explained by the notion of pragmatics – speech act theory – first introduced by an Oxford philosopher, John Austin (1962). Austin (1962) hypothesizes three levels of performative acts in speech: locutionary act, illocutionary act, and perlocutionary act. Locutionary act denotes the simple act of uttering the language. Illocutionary act is inferred from the performative act of the intended meanings through language, for example, informing, or ordering. Perlocutionary act refers to actual performance from the receivers of message. Perlocutionary act stimulates responses from receivers, resulted in their feelings and actions.

To analyze this potential act in utterances, take an example of a conversation between a child receiving a phone call from her sister’s friend. When the caller asks, “Is your sister home?”, it seems to be an interrogative statement requiring further information, but the question can function as an implied request, prompting the receiver to call her sister for receiving the call. The intended meanings in the example may not be fully interpreted without the analysis of its illocutionary and perlocutionary acts.

Based on Austin's theory of speech acts, language has their pragmatic functions together with linguistic forms and meanings. Pragmatic functions relate to rhetorical schemata in two ways. First, language has potential acts. In this sense, the theory of speech act relates to one of several notions of rhetoric: the potentiality of pragmatic performance from speech. As rhetoric provides intended and unintended active texts, they can affect the audience and trigger their potential acts. Second, utterances have their potential illocutionary and perlocutionary force beyond their inherent meanings. Therefore, aside from literal meanings inherent in texts, text interpretation and potential responses depend on the receivers. In this sense, potential meanings interpreted by the hearer or the reader depend on contexts of communication. As meanings of texts depend on contexts, awareness of their discourse community has great influence on readers.

The same mechanism applies to writers when they process writing to communicate effectively. They need rhetorical schemata because of two reciprocal procedures. They need to be aware of pragmatic functions of their created texts: the extent to which their texts can influence readers and effect change. Thus, rhetorical schemata refer to writers' awareness of their purpose or communication goals. In order to do so, writers need to be aware of the art of persuasion embodied in texts. Writers, who are aware of logos, ethos, and pathos, can be more likely to appeal to their readers. However, applying this art of persuasion in composing texts does not mean abusing it to manipulate readers, but applying it to achieve the epistemic art, to protect the "truth," to create, and to contribute knowledge to their discourse community. This stimulation of innovation and contribution leads to a reciprocal process, the process that requires writers' awareness of their audience and discourse community to achieve their communication goals. Aside from effecting change towards readers and contexts, writers are also constrained by their audience and discourse community. When writers are aware of these constraints, they are

more likely to construct their rhetorical schemata, which enable them to create texts that matter. To do so, writers need to be aware of the continuous conversations occurring within their discourse community, in which writers are one of the members that contribute their voices to these dialogues. Writers' rhetorical schemata refer to their understanding of what has occurred in this on-going conversation to respond to the urgency of communication. As a result, writers' rhetorical schemata include the reciprocal process of effecting change through their purposes and being constrained by the audiences and discourse communities. This reciprocal process includes three main components of a rhetorical situation: purpose, audience, and exigence. These three components are of significance for writers, and serve as a part of writers' rhetorical schemata.

This theoretical analysis can be illustrated by the example of writing tasks in ESL writing. In some tasks, ESL learners are required to write about a topic with the purpose of developing linguistic knowledge. In other tasks, ESL learners are asked to respond to real-life events. These two types of writing task design can affect ESL learners' L2 writing. The first task type focuses on language practice, and the second can cover the two goals: writing for language practice and writing with purposes. For Vietnamese learners, response in writing to real-life events may be unfamiliar because they have been instructed with writing for language practice. However, changes in the nature of assignment design and curriculum instruction can raise learners' awareness of rhetorical schemata.

In brief, activating schemata can help writers better understand the nature of reading and writing in general, and in ESL students in particular. Reading and writing processes are attributed to, but not limited to, three areas: formal schema, content schema, and rhetorical schema. Formal schemata relate to forms: linguistic knowledge and competence. They play a role as a tool in the writing process. Content schemata, which refer to knowledge of the topic,

require writers to be active readers and researchers to collect, categorize, and analyze data to provide their own perspectives as an authoritative stance. If they have been members of a discourse community, they share that knowledge to the community. This type of schema can serve as materials in the process of text production. The third type, rhetorical schemata, refers to knowledge of rhetorical strategies to help writers compose convincing and effective texts to communicate, to learn, to perform actions, to contribute knowledge, to join the on-going conversation in their discourse communities, and make personal awareness and social changes. Some types of schemata may need more reinforcement depending on learners' levels. For example, ESL beginner writers may need more focus on formal schemata. Nevertheless, regardless of learners' levels, when writers understand and apply the components of schemata in writing, this awareness may help them to facilitate their writing processes.

Chapter 3: ESL Learners' Cultural and Linguistic Resources in Schema Activation

The purpose of this dissertation is to examine how ESL graduate students made use of their cultural and linguistic resources in schema activation to write for their academic majors and explore their challenges and strategies for writing academically. To examine this topic, this third chapter aims at describing the research methods and details of the participants. The first part of this chapter discusses the qualitative methods of interviews and discourse analysis. The second part discusses how the subjects made use of their cultural and linguistic resources to activate formal, content, and rhetorical schemata. This second part also introduces general information regarding the participants' linguistic backgrounds, previous learning experiences in English, their writing experiences, and their challenges and strategies for writing. This third chapter describes the subjects' detailed background information and explores their writing samples' analyses in order to provide data for discussions and findings in the subsequent chapter.

Data Collection

Description of the Research Process

I conducted semi-structured interviews with four Vietnamese graduate students at the University of Arkansas and collected their writing samples written during the time they took courses at this university. I conducted interviews with each subject twice – one aimed at examining learners' previous literacy learning, and the other at understanding their difficulties and strategies for learning to write in English. The questions for the interviews were structured into two parts with the purposes of eliciting data from the subjects as much as possible (See Appendix 1 for the complete list of questions used in the interviews). The first part of the

interview aimed at eliciting background information from the subjects. Thus, the first part includes questions that asked the subjects about their learning experiences in their previous institutions, their writing experiences at their present programs, and their attitudes towards writing. These questions provided a general picture of these participants' cultural backgrounds and their writing experiences. The second part aims at understanding these subjects' challenges in writing academically and their strategies for overcoming these difficulties. Thus, the questions for the second interview included questions that elicited answers from these subjects' difficulties and strategies for writing in their majors.

These data from the interviews together with subjects' samples were analyzed to understand formal, content, and rhetorical schemata used by these subjects as they wrote responses in their current majors. I met with the subjects during the summer of 2016. The first interview was conducted in the first half of the summer, and the second at the end. One subject had time constraints, so I combined the two interviews together into a longer one to cover the content of the two interviews (See Appendix 1 for the complete list of questions used in the interviews). In the interview questionnaire, the questions I used to ask the participants aimed at eliciting responses in five areas: (1) previous learning experiences, (2) present writing processes, (3) attitudes towards writing, (4) difficulties in writing, and (5) strategies for writing (See Appendix 2 for the summary of participants' responses from the interviews). I chose these five areas because participants' responses in these areas could enable me to examine how cultural and linguistic backgrounds can influence their writing in English and how they overcome challenges and used strategies for composing.

Research Method: Personal Interviews

The purpose of the interviews is to understand the subjects' awareness of the types of schemata and to understand their writing challenges. Not all of the participants' responses to the questions were selected and analyzed in the findings and discussions. However, I provided an overview and coding of their responses in a table (See Appendix 2 for the summary of participants' responses from the interviews). In choosing the excerpts from the participants' responses, I selected the most prominent data that support the characteristics ESL learners' use of their schema activation to facilitate their writing in the academic setting. I analyzed the subjects' responses to understand their awareness of the types of schemata and their challenges in writing. With these data, I combined the analysis of their use of schemata in the samples and their responses in the interview questions to explore these subjects' writing processes in schema activation.

Research Method: Analysis of Samples

The following discussions examine major characteristics of writing in the samples collected from the participants. These observations provide some conclusions to better understand the characteristics of the subjects' writing processes. To analyze the subjects' samples, I used discourse analysis to explore how each participant handled their writing. The purpose of analyzing discourses in the samples is to examine the subjects' writing features, to explore the types of schemata used in their writing processes, and to understand their writing difficulties. Analysis of their writing samples allows the researcher to identify whether there is a match between the subjects' awareness of the significance of schemata and their actual use of schemata in their writing processes.

To understand their writing features, this research explores several important elements regarding composing features and rhetorical knowledge: (1) genre; (2) organizational structures; (3) linguistic competence (clarity and cohesion in language use and mechanical conventions) (4) quality of arguments (coherence and persuasiveness in claims and support); (5) participants' awareness of audience and rhetorical stances; (6) contribution of knowledge to their discourse communities (See Appendix 3 for the summary of participants' performance in the writing samples). The reasons for choosing these features originated from the analysis and significance of the three types of schemata as discussed in chapter two. Formal schemata include the understanding of genres, organizational structures, and linguistic competence as discussed in the definition of formal schemata. Content schemata refer to the topic matter of texts, and thus it includes the eligibility and quality of arguments. Rhetorical schemata relate to the knowledge of the writers' discourse communities and their awareness of rhetorical situations.

Description of Subjects

Participants' Responses

My subjects were four Vietnamese graduate students in various disciplines at the University of Arkansas, including Poultry Science, Curriculum and Instruction, Cell and Molecular Biology, and Civil Engineering. These students had been in the United States for at least two semesters and had been in their doctoral programs for at least one year when the interviews were conducted in the summer of 2016. As graduate students, they were supposed to write for proposals to attend conferences, academic papers for class, scholarly articles for publications, and dissertations before graduation. Since these subjects were more likely to use

writing more extensively than undergraduate students, my research focuses on ESL graduate students rather than ESL undergraduate students.

These graduate students received their undergraduate degrees in Vietnam, graduating from Vietnamese universities before applying for graduate studies in the United States. All of the participants have studied English since junior high school with the standard curriculum for all students in Vietnam. The curriculum heavily focused on grammar and reading, with little practice in speaking and listening. These participants studied English for communication when they started their undergraduate study. They also had to practice English substantially and achieve proficiency necessary for admission to graduate programs at universities in the United States¹. Thus, these participants attended intensive classes in general English and especially writing skills. Based on their writing samples and on their proficiency level for university admission, these graduate students can be considered as advanced learners of English with decent writing skills.

The first subject was a female doctoral student, Phu², in Poultry Science. She had been in the United States for two and a half years when I conducted the interviews with her. She had been in her program at the University of Arkansas for the same amount of time. She usually wrote a major paper every year in English, proposals for conferences, and her dissertation. She rarely wrote outside the classroom, but she reported that she wrote emails twice or three times a week to communicate with others in her program. Phu expressed her positive attitudes towards English and its importance in her major, as she mentioned, “I love English...It is necessary to

¹ Most graduate programs at universities in the United States require a minimum TOEFL score of 90 or IELTS score of 6.5. These scores can be equivalent to upper intermediate or advanced levels.

² For privacy purposes, I used pseudonyms to refer to the subjects.

write scientific papers for my research” (N. Phu, personal communication, July 2016). In her first semester, she took a writing course at the University of Arkansas called ELAC (English Language and Cultural Studies), which focused on Research Writing in the STEM³ fields. In this course, she learned how to write in STEM areas focusing on the following genres: summaries, critiques, and proposals.

One of the prominent learning characteristics about the first subject, Phu, is that she found it easier to write in English than in Vietnamese. She also noted that she adapted the rhetorical style of writing English to writing in Vietnamese. She reflected characteristics of “good writing” in English: logical ideas, original content, sufficient data, accurate information, correct citation and grammar, academic vocabulary, conciseness, paragraph development with controlling ideas. She was aware that those characteristics were flexible and suitable in different contexts. When asked whether there were any similarities or differences between writing in English and Vietnamese, she replied that the differences lie in citation and conciseness. She emphasized that writing in English required “clear ideas and topics,” and that ideas should be expressed in a concise and straightforward way (N. Phu, personal communication, July 2016). Her responses showed her understanding and awareness of formal schemata in writing.

The second subject was also a female doctoral student, Hue, majoring in Curriculum and Instruction in the Department of Education. When I had interviews with her, she mentioned that she had been in the United States for one and a half years and had been in her program for the same amount of time. She had frequent writing assignments in her program with a one-to-two-page paper every week to respond to discussion posts, article reviews, and final papers. She seldom used writing outside the classroom and mostly wrote emails for communication. Hue was

³ STEM is the abbreviation of Science, Technology, Engineering, and Mathematics.

the participant who wrote the most of all the other subjects because of the requirements in her courses.

One of the notable details from the second subject's responses is that it was not difficult for Hue to have ideas, but she mentioned she had struggled to express ideas appropriately. She was concerned whether her writing was intelligible by native English speakers or whether her expressions were influenced by the first language. To overcome this concern, she shared her strategies of "imitating the native language use," using highly specific and appropriate vocabulary, in which she "googled" any phrases related to the content she hoped to use for her intended ideas. Hue also mentioned her ideas of "good writing" in English: persuasive, understandable, well-organized, sufficient in ideas, appropriate in vocabulary use, convincing with evidence and explanations (N. Hue, personal communication, July 2016). When asked about the differences between writing in English and Vietnamese, she explained that English writing has "patterns," which included thesis, support and evidence with conciseness and persuasiveness while in Vietnamese, writing was "impressive and not straight to the point." Hue's comment on the differences between writing in English and Vietnamese was somewhat similar to Phu's remark. Hue's responses also showed her significant understanding and concern about formal schemata in ESL writing.

The third subject was Nga, who had been in the United States and in her doctoral program, Cell and Molecular Biology, for two years. Most of her writing was lab reports and literature reviews. She did not use much writing outside the classroom and often used emails for communication. She told me that she loved learning English, but was not very much interested in writing. She had positive attitudes towards learning English as she expressed, "knowing another language makes me feel excited because I can know another culture through that language. I am

trying to make improvement in writing. It is hard sometimes to express ideas in the most concise and interesting way” (N. Nga, personal communication, July 2016). She took a writing course, Research Writing in STEM, at the University of Arkansas during her first semester, focusing on writing summaries, critiques, proposals, and research papers.

One of the prominent details about the third subject, Nga, is her linking ideas between learning a language and knowing a new culture. She considered English learning as cultural exchange and knowledge access. In the class she took, Research Writing in STEM, she learned how to construct a research paper, with typical components: Introduction, Literature Review, Method, Data, Results, and Discussion. She could reminisce on the way of structuring arguments in a paper with “ideas – support – validate.” With the awareness of rhetorical situation in writing, she mentioned that she was taught to write with “purpose” and “audience” in mind. In her view, “good writing” should be “understandable, interesting, clear and straightforward” with “good organization and outstanding content.” I consider responses from the third subject as the demonstration of her understanding and use of various schemata: formal, content, and rhetorical schemata. Nga was aware of the writing conventions, the genre used in her major, outline of research writing, the model of argument, the significance of content contribution in her major, and the rhetorical situation of her writing.

The fourth participant, Hong, was interviewed when she had been in the United States for two years and had been in her doctoral program, Civil Engineering, for one year. She rarely had to write assignments in her courses. Normally, she had to write course reports twice a year, and she did not write outside of her classroom except for email communication in her department.

Hong’s responses to her difficulties with writing contradicted other participants’ views. While the first three participants were more concerned about language use, Hong’s writing

difficulty focused more on content. Hong expressed her attitudes towards writing; “it is fun, and just needs a lot of effort... Learning how to write is just mimicking someone else” (N. Hong, personal communication, July 2016). Hong made this remark when I asked her whether her English learning experiences would differ if she were a native English speaker learning to write in English. The purpose of this question was to elicit answer from the subject to know whether formal schemata in these ESL learners had hindered the subject from expressing ideas in English. When asked if she had any difficulty with expressing ideas in English, Hong replied that she did experience difficulty, but she could overcome it by using alternative and simpler ways of expressing content. Hong’s attitude towards forms, “just mimicking someone else” and strategies for alternative ways of expressions showed that she was aware that she needed forms to express her ideas. On the surface, it seemed that comments about using forms of the fourth subject, Hong, and the second subject, Hue, were opposite. While Hue was more concerned about using authentic language, Hong was more focused on strategies for alternative expressions. In fact, Hong was in the same stance with Hue in terms of their appropriation of authentic language use. Hue employed the strategies of “imitating the native language use,” using highly specific and appropriate vocabulary by googling and using phrases related to the content she was writing. Hong’s strategies were also “mimicking someone else,” learning and using authentic language written by experienced authors.

In Hong’s view, “good writing” should be “clear and logical” and “bring out emotion.” Even though the interviewee did not specifically clarify what she meant by “bring out emotion,” the researcher interpreted her ideas in the view of rhetorical theory as appealing to readers and contributing to knowledge. When asked to clarify what she meant by “bring out emotion,” she added, “You have a story to follow. That story can bring some knowledge or just another

person's point of view. It's all about connecting the lines...how to make it logical." In these responses, Hong's responses to her difficulties with writing were different from Hue's views. While Hong's attitude focused more on content, Hue's concern related to language usage.

Participants' Use of Cultural and Linguistic Backgrounds in their Schema Activation to Write Academically

The subjects in my research did not have regular habits of writing, except for the requirements of coursework (course papers, lab reports, theses, and email communication). The subjects did not use writing for practical purposes outside the classroom, but writing skills were useful for their academic careers. The participants reported that they understood the features of "good writing," organizational structures of the intended genres, the importance of writing in their profession, rhetorical situations, and writing strategies. They learned these features at previous institutions, but their cultural and linguistic backgrounds might have influenced their writing processes. The design of my research is to examine how they make use of these resources to write in English. Their awareness of these aspects can be examples of their use of different types of schemata in their writing processes.

I considered these learners as advanced learners of English based on their test scores when they were admitted to their graduate programs at a university. To be admitted to graduate courses at a university in the United States, ESL learners have to achieve the IELTS or TOEFL scores of at least 6.5 in IELTS and 90 in TOEFL. These scores are equivalent to upper-intermediate or lower-advanced levels. I chose these four ESL learners as the subjects on the basis of their test scores that enabled them to be admitted to their graduate programs. All of these subjects had IELTS scores of 6.5 and higher. Another reason for choosing these subjects was because of their experiences in writing. Their writing scores had to meet the requirements of

their graduate programs, in which they were required to achieve intermediate levels in writing. As graduate students, they needed to write for their disciplines, course work, and research. Thus, they had more writing experiences than undergraduate students. As they had more experiences in writing, they could reflect more on their writing processes, recount further experiences that could help them overcome their writing challenges, and explicitly explain about the characteristics of writing between the native language and the target language.

I consider these subjects as successful ESL learners because they had reached advanced levels of English. Although they were advanced learners of English, their English competence was not as advanced as that of native speakers of English. The reason is that they were ESL learners, and although they could achieve advanced levels of English, they might encounter linguistic interferences that had caused limitations on their natural language use. On the other hand, although they might have encountered linguistic interferences, they could also use diverse resources in cultural and linguistic background to facilitate their writing. To help understand how they could use these resources when they activate the three types of schemata in their writing, the following parts describe the participants' cultural and linguistic backgrounds that were closely related to their writing experiences.

The participants might have made use of their cultural and linguistic resources in their academic writing. The types of resources used by these subjects when they activated formal schemata related to the English classes they had already learned in the previous schools. They reported that they were taught to focus more on forms and grammatical accuracy. Later on, in other English classes on English writing, they were taught with the emphasis on forms in writing. Thus, the subjects were more likely to be concerned with formal schemata. The subjects learned to use formal schemata in different ways: in accurate and highly specific word choice, structure

use, organization, and text types. These features of writing were the subjects' primary concerns because the writing curricula in the previous institutions emphasized the accurate use of English writing as the good features of English writing and evaluated their writing competence on the basis of these characteristics.

As mentioned above, the subjects' previous learning experiences might have affected the way they learned English and the way they composed. The first influence is their curricula of English learning at previous institutions. These subjects started learning English at junior high schools. They reported that when they learned English at high schools, the majority of the curricula focused on linguistic knowledge and reading. Their previous English courses allowed little time for practicing listening, speaking, and writing skills. Because of these imbalances in their curricula, the subjects were more likely to develop grammar and reading skills. At high schools, these subjects failed to communicate effectively in listening and speaking. At their university education, these participants started to focus more on practical communication, namely listening, speaking, and writing. Thus, previous learning experiences with focus on forms influenced the ways learners' concerns with forms in their learning and composing processes.

Another influence of previous learning experiences on learners' focus on forms related to academic vocabulary. These learners' vocabulary in academic English originated from the English programs they previously took at high schools and university studies. They learned academic English at starter level, and their vocabulary resources originated from previous curricula and texts selected by course curricula, and standard textbooks assigned by the Department of Education for use throughout the country. The subjects in my research had limited access to resources in learning English at high school years, but when they started English courses at universities, they could access other resources online or from other imported or

domestic materials. The disadvantage of this phenomenon is that these subjects had limitation to authentic language use. However, as these subjects had access to course books and text books from the curricula and academic resources, they had more access to academic language use. Thus, these learners could draw upon these resources to write academically and made use of them for their academic writing. These learners took extra classes at high schools and consulted other available English course books available outside of the curricula. Although they did not have considerable access to authentic language in communication, they could have exposure to academic English reading and writing by learning from these materials.

Furthermore, the type of testing and assessment might have also affected the way these participants learned English. Assessment only focused on grammar and reading. Other skills might be tested, but indirect testing was used to assess speaking and writing skills. For example, instead of directly testing how candidates performed in speaking, alternative forms of assessment required learners to write and fill in blanks of intended responses to provided dialogues. Other forms of indirect testing in writing skills required learners to rewrite sentences using alternative structures while keeping similar meanings with the provided sentences. Example of indirect testing in reading involves cloze reading, which asks test takers to fill in blanks of passages with or without given cues. Therefore, because of the mismatch between the learning goals and forms of assessment, these learners might just focus on learning what to be tested, rather than learning practical communication skills in English.

Because of the nature of indirect assessment, the subjects in my research were used to learning English with the focus on developing linguistic knowledge and reading. Although this phenomenon could be one of the disadvantages in the subjects' communication skills, this situation could play a role in their linguistic resources when they activated their formal schemata

in writing. They may lack practical skills in communication, in listening and speaking, but they could improve their reading skills and use these skills to assist them in reading and writing for their majors in their graduate programs.

In conclusion, the methods for this research, personal interviews and discourse analysis, were used to explore the resources used by the participants when they activated formal, content, and rhetorical schemata. The above description of the participants explains the participants' cultural and linguistic characteristics relating to their academic writing experiences. As described above, these learners' linguistic background might have influenced the way these ESL learners learned to write academically in their new academic settings.

Chapter 4: Use of Schemata in Texts Composed by ESL Graduate Students

My dissertation aims at understanding how ESL graduate learners use their cultural and linguistic resources to activate schemata in writing and how they overcome the challenges in writing. To do so, this chapter focuses on the answers to these questions by using the data collected from the interviews and analyses from the subjects' writing samples. Based on data analysis, I hope to understand whether the writing processes of ESL learners to write in a new language are influenced by the role of schemata in their composing processes. The findings suggest that learners who used various types of schemata in writing proved to achieve effective writing competence. This part also explores how the subjects used writing strategies with the three types of schemata to overcome their challenges in writing.

How Did the Four Subjects Activate Their Schemata?

The samples show that the subjects attempted at activating types of schemata in their writing processes. Their applications of schema activation were in line with their awareness of the importance of schemata. First, I examined how these subjects activated formal schemata by analyzing discourses in several areas, namely: genres, organizational structures, linguistic competence, and quality of arguments. To explore how the subjects activated their content and rhetorical schemata, I analyzed how their awareness of rhetorical situations and knowledge of the writing topic contributed to their quality of writing.

The exploration of personal interviews and discourse analysis show the following characteristics. In terms of formal schemata, the subjects experienced two major phenomena: their limitation in formal schemata, including linguistic knowledge and competence, to process

materials for text production, and their concerns with authentic language use. These ESL writers might find it more difficult to convey ideas than create content, especially in their fields. In terms of content schemata, there are two prominent characteristics of the subjects regarding their awareness and application of content schemata: content schemata can facilitate the writing process; and activating content schemata can help writers construct informative content or original ideas. In terms of rhetorical schemata, the participants showed their awareness of rhetorical schemata in writing in two ways: becoming part of their discourse communities and targeting their writing purposes and audiences. These graduate writers were aware of sharing and contributing content to their disciplines, and writing with their purposes and audiences. These are the characteristics found in the collected data. The following sections dissect and analyze each characteristic in details.

Participants' Responses Regarding Formal Schemata

The role of formal schemata is significant not only for native English writers, but also for ESL learners. This role is more crucial for ESL learners as they need to learn the new language. For most ESL students, they may experience two major phenomena. The first one is their limitation in formal schemata, including linguistic knowledge and competence, to process materials for text production. In my interview with the subjects, they expressed that they were concerned about being unable to express their ideas in native-like English. Three out of the four participants mentioned their major difficulties in expressing ideas appropriately in English.

For example, Hue's difficulty in writing was choice of words and ways of expressing meanings. Hue reported that expressing ideas in English was "one of the biggest difficulties."

When she was writing, she was thinking in Vietnamese. As some Vietnamese phrases and expressions appeared in her mind, she was wondering if English had equivalent expressions so that readers of English could make sense of her intended meanings. Additionally, she also made attempts at imitating the authentic use of language, but was not confident if her use of language was suitable. When asked about her difficulty in expressing ideas, she responded as follows:

For example, when I am thinking about what to write, there are a lot of ways of express ideas in my first language, including using the expressions. In our first language, we have proverbs, like “killing two birds with one stone.” ...So, naturally, because of the influence of the first language, I often prefer to use those expressions. But then I stop and think: Do they understand me when I am writing this way. So that is the first difficulty. The second one is: basing on what I have been reading and hearing people saying, I want to use expressions that the native speakers of English often use. But I am not sure about that because I am not that proficient.⁴

Hue’s difficulty with appropriate language use related to other participants’ concerns.

When I interviewed Phu about her difficulty with writing, she mentioned that she found English difficult to learn because of her limited vocabulary. Phu regarded extensive vocabulary repertoire as a necessary condition to express ideas. She related the difficulty in writing to the lack of direct context. In speaking, gestures could be used as strategies to carry meanings while this lack of strategy may only be replaced by writers’ full description of contexts. Phu shared her alternative strategy used in writing to improve appropriate language use: the use of thesaurus and collocation dictionaries.

Phu’s spoken language was excellent, and that was why she confessed that her speaking skill was her favorite. Based on my analysis of Phu’s samples, I find that she had decent command of language use. Her writing had clarity and good organization. The following

⁴ Subjects’ responses in the interviews and samples were quoted as exactly as they manifested in original talks and texts without grammatical corrections.

paragraph is an extract from one of the two samples she provided. This paragraph was the conclusion in her summary of the previous research in her field, Poultry Science (See Appendix 5).

Furthermore, this research has showed that low GAL SBM diets need less supplement oil compared with the control, while they still keep the normal growth performance and carcass yield of broilers. This advantage may be caused by better amino acid amount and higher AME_n. In conclusion, this research has introduced and evaluated a novel ingredient candidate for feed formulation in poultry production. It also showed the week effect of feed energy levels in younger broiler growth performance and carcass.

Phu's above sample demonstrated her command of linguistic use, clarity in meanings, and conventions of summary writing. The concluding paragraph summarized the finding and its significance in her discipline. Based on Phu's writing samples and her awareness of writing conventions, there was a match to conclude that good composition skills are compatible with writers' awareness of writing conventions, including formal schemata. When I interviewed Phu, she shared her strategies for writing and her perception of good composition skills, which aligned with expectations in her academic writing and her discourse community. Phu mentioned that good writing entailed: logical ideas, accurate information, correct citation, sufficient content, novel content, correct grammar, academic vocabulary, conciseness, main ideas with topic sentences. The following is her response to the idea of good composition skills:

Good writing should be logical writing, logical in the idea, correct citation, get the correct information from the paper that we cited, have enough meaning. As I said, the sentence should be concise and precise in science, and the whole content should reflect the problem. Like if we write a paragraph, we should have the answer in scientific in the paragraph we should try to answer why, when, how, for example, and we should have the main sentence. Good writing also has good structure and academic vocabulary.

Similar to Hue, Phu's main concern was also appropriate language use, highly concise and accurate use of phrasing. One of the characteristics of good writing mentioned in Phu's

responses was academic vocabulary. When I asked her to specify the idea of academic vocabulary, she replied as follows:

For example, I'm working with the genes, when we see under the PCR machine, we see the gene is going up, or increase, then it's better to say up-regulated, not increase. ...when we try to use vocabulary as accurately as possible.

Another participant, Nga, also had a relatively similar attitude towards learning to write. Nga expressed her concern about appropriate use of language by referring to this concept as: concise, interesting, and suitable. She emphasized the importance of word use, variety of vocabulary and sentence structures. The following is Nga's responses in the interview about her difficulty in writing:

When I need write a SOP to apply for scholarship, I find it really hard to write my ideas in a concise and interesting way...Sometimes, it's hard to find the right word, so finding a word that is suitable in the context is hard to me. Sometimes I cannot find a variety of vocabulary to make my writing more interesting, and you cannot just repeat one word over and over again. When I write, sometimes, I am unrecognizable that I use a translation from Vietnamese to English, and I can make a run-on sentence without making the sentence into focus.

Her awareness of good writing was in line with her writing competence as shown in the sample. Reading the conclusion in her short paper, I found that her writing shows her focus on diversity of vocabulary and structures. For example, her below sample shows the flexible use of alternative phrases: “in curing IBD⁵” and “in the treatment of IBD”/ “further research” and “recent studies”/ “lead to” and “result in.” In addition, Nga was aware of the development of the text by starting with the general statement and supporting it with explanation and discussion of the beneficial effects of dysbiosis in treating IBD. She concluded with the importance of the

⁵ IBD is the abbreviation of Inflammatory Bowel Disease.

findings that “dysbiosis” can be the measure for the treatment of IBD patients. As Nga was aware of her audience, those in her fields, she used terms, such as IBD and dysbiosis.

*In summary, diet plays an important role in affecting the microbiota of IBD patients. Shifting dietary habit can lead to the changes in microbiota which may result in IBD. Dysbiosis is consistently observed in IBD not only in microbial composition but also microbio function. It is possible that if we can ameliorate the dysbiosis, IBD may be cured. Therefore, understanding the abnormal microbiota as well as factors affecting it in IBD patients can be major progress in curing IBD. Recent studies help to clarify the composition of microbiota in IBD patients, which can lead to better understanding in dysbiosis in these diseases. In fact, the discovery of *F. prausnitzii*'s anti-inflammatory affects as well as positive effect of dietary components such as turmeric and honey are a really good start for future research in using new approach in the treatment of IBD. However, clinical studies are necessary to confirm if these are effective treatments for IBD.*

As Nga noted in her interview, she had an issue with run-on sentences and conveying clarity in her writing. In her above sample, although meanings are clear, it somewhat lacks cohesion in linking ideas within the paragraph. Nga also noted that she had not been aware that her habit of composing excessively long sentences might hinder clarity in meanings. It was not until she started her class, ELAC, in the first semester that she learned how to write concisely and clearly in the STEM field. In the interview, all of the subjects were aware that they needed to make their writing “interesting, clear, and concise.” The idea of clarity and conciseness may be an issue not only for Nga but also for most ESL students. As advanced learners of English with relatively necessary writing skills for their disciplines, the subjects in my research showed their awareness of formal schemata: cohesion, coherence, and word use.

Another prominent characteristic of writing is that these ESL writers might find it more difficult to convey ideas than create content, especially in their fields. One of the reasons for this phenomenon is that the subjects in my research were graduate students, who had been in their majors for a certain duration. They were both aware of the importance of knowledge in their

field, and had also learned their disciplinary knowledge from previous institutions. Thus, the participants were more concerned about appropriate language usage.

Only one participant, Hong, prioritized her difficulty as “ideas.” When asked to explain her difficulties with “ideas,” she mentioned that her major difficulty was “generating, conveying and reorganizing ideas.” Although her primary concern was “ideas,” her explanation showed that this major concern also included the issue of “conveying and reorganizing ideas.” Despite the concern about ideas, Hong’s difficulty in writing was also related to forms – ways of conveying and organizing ideas – or formal schemata.

This difficulty in the use of lexis was also reported in Jessica Williams’ work. Williams (2005) notes that L2 learners have difficulty in reading and writing because of limitation in vocabulary (p. 24). Reading intensively and extensively can help them with learning linguistic and content knowledge. Reading helps them expand their vocabulary. Lower-level writers have a narrow range of vocabulary. This limitation prevents them from using a word with definite denotation. Learners may use high frequency words, such as the word, “say” instead of more specific vocabulary, such as “affirm, contend, and utter.” This limitation impedes their ability to articulate their intended meanings. For example, a word in English may have a variety of synonyms with slightly different meanings that facilitate learners’ ability to express ideas accurately and sophisticatedly. L2 learners have limited use of these diverse resources. Thus, this theoretical underpinning leads to classroom practices where learners can be provided with more language input in learning vocabulary. There are several methods used in teaching vocabulary, such as word clusters and academic word lists. However, these methods are not as context-specific as exposure to authentic texts and contextual writing. Thus, to provide more input to

ESL learners, it is necessary to combine both methods – more exposure to authentic reading and writing together with formal schemata in vocabulary resources and usage.

ESL Learners' Use of Content Schemata

There are two prominent characteristics of the subjects regarding their awareness and application of content schemata: content schemata can facilitate the writing process; and activating content schemata can help writers construct informative content or original ideas.

The subjects showed their understanding of the importance of content schemata in their composing processes. Nga's difficulty in creating content may be solved by her own strategies relating to her awareness and significance of content schemata. She commented that her writing could be more resourceful when she read and synthesized a great variety of reading materials. Only when she had full understanding of the topic, was she able to write about her topic considerably. This instance shows the significance of content schemata, the need for reading-writing connections, and reading strategies, both extensively and intensively for learners to contribute to content.

Regarding her difficulty with content in writing, Nga noted that it depended on situations. If she had to write a topic she was really interested in, she would find it less difficult. Apparently, the more content schemata writers have, the less difficulty they encounter, which shows how important it is for writers to be aware of and engaged in content schemata to write effectively. This is an extract from my interview with Nga to describe the importance of familiarity with topics in writing.

It depends on what the topics I'm writing. For topics that I'm really interested

about it; I know about it, I can have a lot of ideas. But for others, I don't have ideas. For example, when I'm writing for the GRE⁶, sometimes when I see the topic that I need to discuss, I don't know about that field, so I don't have a lot of ideas to write about it.

To deal with the problem in the lack of ideas, Nga shared her strategies to overcome it – reading as a solution. She gave writing literature review as an example. She had to read extensively and intensively about other studies in order to write substantially about the subject. Thus, as an experienced writer, she was aware of the significance of content schemata.

I think when I lack ideas, reading is a solution. For instance, when I write a literature review, I need to think about what I should include. To know that, I need to read more articles to have more ideas about that.

The following is her other response to my question about one of her difficulties in ideas:

That's another problem, too. Sometimes, it's hard to organize ideas in a logical way. You have a lot of ideas, but you don't know how to make it into a coherent paragraph...I need to know how to put the ideas in a correct way and to form a sentence. Which should I start first, and then how I can develop that main topic into detailed ones, and make it more interesting and more relevant. Sometimes you write a sentence, and then you don't know how to develop that idea anymore.

Nga stopped her response after she said she was stuck in the sentence without knowing how to develop it. I was interested in Nga's description of her writing process and the stuck point she encountered in the lack of ideas. I asked about her strategies for being stuck in idea development; I asked her what she would do next if she was stuck in idea development. The following is Nga's response:

I may go over and look back on the ideas that I have [written]⁷ to see that is there any ideas that link each other that I can use to support the one that I stuck. Or sometimes

⁶ The GRE (Graduate Record Examinations) is a standardized test as the admissions requirement at most Graduate Schools in the USA. It is administered by ETS (Educational Testing Service), a non-profit testing and assessment organization with its corporate headquarter in New Jersey.

⁷ Words in brackets [] are my own additions to make meanings from the transcripts of the interviews easier to understand since the speech from the interviews may not provide full grammatical utterances.

I just don't use that idea anymore and just change to another one... I have the idea in mind. If that idea is really an important one to that topic and really relevant, I will choose it as the main idea and I will try to find another relevant evidence to support that.

All of the four participants fully emphasized that content played an important role in an effective piece of writing. The subjects' responses to the question of "good writing" were all related to content. These participants used different adjectives and phrases to refer to good characteristics of content: logical, sufficient, novel (Phu's responses in the interview); synthesis of all ideas together and reflection of why, when, how; understandable, persuasive, creative, using reason and support (Hue's responses in the interview); understandable, interesting, clear, straightforward, outstanding (Nga's responses in the interview); clear, logical, and bring out emotions (Hong's responses in the interview). In Hong's view, content should be "clear and logical" and "bring out emotion." Even though the interviewee did not clarify what she meant by "bring out emotion," I interpreted her ideas in the view of rhetorical theory as appealing to her readers and creating new content based on previous knowledge. Though all participants used different ways to describe characteristics of content, they all had similar views towards the significance of content in writing. The participants were also aware of synthesizing previous and available content in order to compose their original writing.

Participants' responses in the interview and their samples have shown that content schemata have a significant role in the process of composing, helping writers to connect what they have known to what they are able to create. This process is in line with the theory of rhetoric and the concept of intertextuality. As writers make use of content schemata, they can appeal to readers with creative and original content by using, incorporating, evaluating available texts and creating their own understanding.

Participants' Use of Rhetorical Schemata

The participants showed their awareness of rhetorical schemata in writing in two ways: becoming part of their discourse communities and targeting their writing purpose and audience. These graduate writers were aware of sharing and contributing content to their disciplines. They were also aware of participating in the continuous conversations of their community. These writers presented their research based on learning from previous literature and other conducted studies. The samples collected from the subjects showed that the participants possessed skills of synthesizing previous sources and providing their own critical observations. For example, Phu's papers were assignments that required summary and review of previous research.

Throughout the two experiments, the authors have carefully organized the research to have necessary data for detail assessments of animal performance during six week period. However, the litter moisture was not measured to give tighter conclusion about PD. ...The information in the paper is easy to follow and well organized. The introduction addresses the reason why seeking new ingredient is important for poultry production and the objective of this research is obviously mentioned. The data were presented clearly and the differences were discussed with logical references. However, the physiological results are not discussed, although they are similar among treatments. This is a good research and if low GAL SBM diet has economical price, it should be applied in the poultry production.

In the above sample, Phu commented on the achievements and limitations of previous research, showing her critical analyses of existing literature. In this concluding paragraph, Phu also included her evaluation of the previous research both in content and forms. This may be one of the skills she had learned in English courses, which had helped her to write summaries, critiques, and proposals. The following paragraph is the extract from her second sample, also the summary of previous research in her field: "The Efficacy of Mycoplasma Gallisepticum K-strain Live Vaccine in Broiler and Layer Chickens" by N. M. Ferguson-Noel and S. M. Williams. (See Appendix 5). Based on the information in her summary, I read the original research by Ferguson-

Noel and Williams and her summary, and found that she provided this critique in her summary:

The results indicated good potential of K-vaccine compared to the other commercial vaccines and the data were convincing. However, some data were not clear in terms of number animals were tested. In the experimental design, the number of birds were selected for testing were 10 but in the results, there were not enough tested animals such as some ratio that had 9/9 or 5/8 (Table 1, 2, 4). Furthermore, the effect of K-vaccine would be more completely evaluated if further approach on egg production or fertility in trial 2.

When asked about the awareness of audience and the purpose of her papers, Phu responded that she was aware of her audience, the scientists in the field, and her perception about the importance of content she contributed to the field:

Scientists will read my paper, scientists in the field will read my papers, I did think about that. That's the reason why I said that the words that I choose should be academic in the field that I'm working, so that they will understand easily.

The content of the paper depends on the journal that you target, for example, if you target a high impacted journal that the data that you have should be a lot, and novel. It needs to be confirmed tightly...Also, sometimes, we will have a mini review or big review. You will have a mini review in a few pages. Big reviews will be longer, and it depends on the type of original research.

Phu also mentioned that expectations of writing were not applied to all contexts. In fact, her perception of writing helped her to compose content that met expectations of her discipline.

The idea of good writing come from my master program. Some of the professors in the classes that I attend. I had to write reports or mini reviews, and I learn some when I started the PhD program. I learn it from the class ELAC, so all the things. Also, we have a talk and our colleagues and professors, and I synthesize all of the ideas. Good writing does not apply to all contexts.

Phu was aware of the differences in writing in various contexts, the appropriate and accurate use of vocabulary. This following is her comment about the use of language in contexts:

For example, in texting, it depends on the contexts...When we do texting with friends, we can use some slangs, so it will make the conversation more close, and we kind of be with them. We can see if we use a lot of academic words in conversations and texting, they will think that would be fun.

The four participants in the interviews showed a relatively decent contribution to content. They had studied writing in their fields, so they understood the major conventions of particular assigned genres and specific lexis in their field. Among the participants, Nga was the one who mostly focused on her purpose of the paper. She reported that she intended to revise the paper as part of the submissions to a conference presentation. The following part is the abstract from her paper, which demonstrated the significance of her research (See Appendix 7 for Nga's full writing sample).

Inflammatory bowel disease (IBD) is indicated as an immune system disorder in the intestine. The treatments of IBD still require extensive medical treatment and surgery. The objective of this review is to clarify the correction of diet and IBD as well as gut human microbiome changes in IBD. From these perspectives, innovative potential treatments for IBD will be introduced. This review verified that the effects of diet on IBD was clearly reflected by increasing number of IBD incidences in countries that adapt a high fat-sugar and low fiber content diets. Firmicutes appears to consistently reduce in IBD patients. Potential approaches (probiotics, turmeric, honey) which is based on the knowledge of diet and dysbiosis in IBD can be promising treatments for the disease although it is necessary to have more clinical studies before these treatment can be utilized for human.

One of the most important elements in rhetorical schemata in writing is the exigence, the intended communicative purposes of writers in a particular context. The participants were aware of the significance of their writing. During the interviews, Phu, Nga, and Hong mentioned how important it was to contribute to their writing to their fields. When I asked about their samples, they revealed that they were going to revise the samples for conference presentations, and further paper publication. Phu's samples were the summaries of previous research, which she would use for literature review in her dissertation study. Nga's small-scale research was conducted in order to present new findings in her field. Even though the participants' samples were responses in class requirements, they not only targeted those to pass the class requirements, but also aimed at audience and purposes of their writing. These participants applied rhetorical schemata in order to

present new knowledge in their fields and take part in the continuous conversations of knowledge in such communities. The subjects showed their attempts at becoming part of their discourse communities and entering these as accepted members. This motivation might have encouraged their productive texts. Furthermore, by analyzing the samples, I have found features of effective texts, which are aligned with what participants understood as effective writing. In other words, they were aware of formal, content and rhetorical schemata.

Conclusion

The participants selected for my research were successful learners of English who appeared to be willing to study English as well as high awareness of the importance of English in their profession. These successful learners had experienced learning English from previous institutions at their high schools and universities in Vietnam, in English speaking countries, Australia, and the United States of America. They had a relatively broad master of English conventions in writing based on their responses and understanding of English writing. The samples also demonstrated their mastery of content in their disciplines. The decent content in the samples showed their attempts at becoming successful members when entering their discourse communities. Mastering the content was one of their strategies in writing in the requirements of their majors. Aside from the content, these graduate students were aware of the importance of contributing the content of their writing to their disciplines. They also placed the importance of correct conventions, natural language use as the criteria for effective writing. All in all, these learners of English indicated that when learners were aware of the writing conventions with a mastery of content, together with understanding the importance of their writing in their disciplines, they were motivated to write. The cognitive process of their writing as well as their

metacognitive skills had facilitated their writing skills with the contribution of types of schemata, namely formal, content, and rhetorical schemata.

Chapter 5: Educational Implications and Schema Activation in ESL Writing

The previous chapters explore scholarly works related to the study of schemata and collected data related to participants' use of schemata in ESL writing. This chapter focuses on pedagogical implications for the learning process and ESL writing. Specifically, the first part discusses the role of schemata in the process of learning. The second part explains the pedagogical implications of each type of schemata for ESL writing.

Schemata and Their Relations to the Learning Process

Schema theory can be used to explain the learning process. For example, John Swales (1990) hypothesizes that prior knowledge not only consists of previous experience and prior texts, but also instigates the interaction between facts and concepts by “calling up” interactive “procedures and routines,” which are also called “Scripts,” “scenarios,” “frames,” and “routines” (Swales 1990, p. 84-85). Swales (1990) mentions that “procedures have to be unlearned and relearned in unaccustomed cultural situations where different schemata may be the norm” (p. 85). In this regard, Swales (1990) stipulates that learning is adjusting and regulating schemata to fit with new unfamiliar cultural situations, and that the subjects undergo the unlearned and relearned process. This view of explaining learning may contradict the recent theory of “transformative-generative” theory of knowledge. This transformative theory hypothesizes that learning is the process of knowledge construction (Mezirow 1995). In the construction process, new knowledge is built based on a learner's previous experience and prior texts, and does not necessarily negate the previous knowledge. Learners may experience conflicts between the old and the new – the prior experience and the new knowledge. In fact, the application of schema

theory is to solve these conflicts, to help explain the smooth transition between the old and the new. Schema theory does not mean to negate prior knowledge because negation may cause confusion and contradiction. Instead, schemata encourage learners to be aware of the discrepancies between the previous experiences and the new knowledge so that learners can learn to develop critical views and create original ideas.

For example, in the interviews with the subjects, I realized that the participants made use of their previous knowledge to learn new knowledge. Nga's research into new findings demonstrated her knowledge making, but she could create such new content by reviewing and applying what she had learned. Nga reviewed and learned the effect of diet on IBD (Inflammatory Bowel Disease) from available sources. Based on her understanding and review, she analyzed and clarified the correlation between diet and IBD. She stated the goal of her research was identifying such relations and introduced possible treatment of IBD based on diet (See Appendix 3 for Nga's abstract of her study). The analysis of her writing shows that Nga constructed her new knowledge based on her research on the topic. Thus, activating schemata in learning helps learners be aware of the gap in knowledge, identify this gap, make use of the availability of resources, and review them to facilitate learners' knowledge making. The evidence from the analysis of the four subjects supports schema theory studied in previous literature by Fredric Bartlett (1932) and David Rumelhart (1980). Schemata are units or blocks of previous knowledge formed through experiences. Activating schemata is making use of learners' previous experiences to facilitate the learning process. Thus, the nature of learning emphasizes knowledge creation based on knowledge inheritance.

According to the aforementioned nature of learning, schemata possess the following three characteristics. First, schemata provide learners with explicit instruction for the differences

between the old and the new, and thus help learners be aware of the gap and fill this gap in their knowledge. Schemata provide better understanding towards the process of learning, which does not negate previous experience and does not overlook the new knowledge. Instead, schemata help learners explicitly realize the differences between the old and the new, encouraging them to make use of the old for the construction of the new. Learners become more critical of previous knowledge to transform the old to the new knowledge. This characteristic can be shown by the analysis in chapter three. The analysis shows that the participants were aware of the importance of reviewing literature to write for their report and research. Nga's research reviewed available literature, the correlation between IBD and diet, to apply her research to the treatment of IBD through diet. Hong's paper studied the reaction of substances to apply her research to improving water systems. By activating their schemata, the participants identified the gap and applied their research to practical life.

Second, schemata relate to personalization in teaching and learning. Personalization refers to learners' most suitable methods of learning. Learners bring their own experience and knowledge, and then activate their own schemata to facilitate learning. Learners make use of their schemata to identify the expectations from previous cultural situations and then apply them to new social contexts which they intend to enter. In my research, the participants brought their previous schemata to contribute to their communities by their own understanding and research. The participants made use of their schemata, which were personified and unique in each individual to apply their literacy resources to learning new knowledge.

Schemata allow students to act as ethnographers (Heath, 1983), bridging students' "funds of knowledge" (Moll, 2005) and schooled literacy to bring out the most from learners, acknowledging their background literacy to the classroom settings, and avoiding the assumptions

of “cognitive deficit” that prematurely judges learners’ capability without investigating the nature of the persisting problems and students’ own literacy resources. Scholars in the fields such as Perez et al., Pahl (2005) and Rowsell (2005) call for curricula in culturally and linguistically diverse classrooms to be the bridge that links home literacy and schooled literacy to promote the acquisition of literacy through meaning making by community association, peer collaboration to encourage interaction and use of classroom language for student centered classes (Perez et al., 2005; Pahl & Rowsell, 2005).

Third, schemata can help learners raise their cognitive and metacognitive awareness. Schemata not only provide them with tools, materials, and methods for text comprehension and text production, but also make them aware of the purposes and authenticity of their learning processes. The analysis of the participants’ use of rhetorical schemata in chapter three shows that once the participants were aware of the discourse communities they entered, they were more likely to target their discourses to become the members of those communities. Learners can activate schemata by using their cognitive capability in reasoning. They can also activate schemata by using their metacognitive awareness in understanding the authenticity and purposes of writing. Metacognitive awareness helps learners understand the best methods that are most suitable for them. For example, the participants in my research showed their capability of using their own strategies for coping with difficulties in writing. Nga revealed that when she was stuck in idea development, she could employ one of her strategies of “reading as a solution” (N. Nga, personal communication, July 2016).

In order to activate the three types of schemata effectively, it may be important for learners to employ three methods for effective learning: cognition, metacognition, and contextualization. Cognition refers to the conceptual thinking that enables readers/writers to

process concepts by various cognitive tools, such as generalization, inferences, analysis, deductive and inductive thinking, and syllogism. The nature of learning may not only relate to learning existing knowledge, but also create authorship, innovation, and logical conceptual thinking.

Schemata activated in reading and writing involve cognition because reading and writing are the processes that shape intellectual capability and involve critical thinking. These abilities help writers avoid fallacies in judgment to understand and protect the “truth.” In the reading process, learners use their reasoning as one of the cognitive tools to make sense of texts, establishing their appropriate predictions based on their schemata, and verifying their understanding based on analyzing the availability of textual features. In writing, learners use cognitive tools to make knowledge, and present plausible claims with logical supporting facts. Cognitive competence enables learners to identify existing gaps, resolve issues, and offer their original solutions. These cognitive abilities also help them avoid writing fallacies, or erroneous traps in reasoning. Thus, cognitive capabilities are one of the important tools for learners in literacy learning.

In fact, the participants in my research were aware of the importance of cognitive analysis in their writing. All of the participants’ responses to the question of good characteristics of writing involved cognitive capabilities. The participants used different adjectives and phrases to refer to good features of content: logical, sufficient, novel (Phu’s responses in the interview); synthesis of all ideas together and reflection of why, when, how; understandable, persuasive, creative, using reason and support (Hue’s responses in the interview); understandable, interesting, clear, straightforward, outstanding (Nga’s responses in the interview); clear, logical, and bring out emotions (Hong’s responses in the interview). Although they used different criteria

for good characteristics of writing, all of the participants mentioned one common feature of good content: “logical.” Obviously, content schemata are closely related to cognition. This feature is in line with existing literature as discussed in chapter 2. The concept of content schemata introduced by Carrel and Eisterhold (1983) was constructed with the references to psycholinguistic model that involves cognition. As schemata possess intellectual conceptions, activating schemata in writing requires the methods that help learners grow intellectually. By using reasoning in writing, learners can apply the model of reason by using claims and support, as studied by Stephen Toulmin’s (1958) uses of argument: data, claim, and warrant. For curriculum designers and instructors, it may be useful to apply this model to facilitate writers’ logical reasoning in writing. Learners should be provided with instructions in identifying fallacies in reasoning. Then, learners can apply these skills to write logically, reasonably, and convincingly.

The second element in the contribution to the process of reading and writing is metacognition, which is learners’ ability to monitor their methods of learning, including but not limited to the methods or subcategories of reading and writing strategies. Metacognition is the process, in which learners monitor and understand their writing processes, perceive the nature of writing, and find the best writing strategies that are most appropriate for them. It is similar to the metacognitive approach about learning to learn. If learners of literacy are aware of the nature of reading and writing processes, they are more likely to apply such understanding and use those strategies for literacy learning. When they understand the theory of schema, they are more likely to activate schemata and make use of them for text interaction. The ability to monitor their learning methods can be a useful tool to empower their learning. As discussed in chapter three, participants were aware of their difficulties and employed various strategies to deal with their

writing issues. In dealing with appropriate language use, accurate and concise phrasing, the participants shared their various strategies. Phu used thesauruses and collocation dictionaries to express alternative content in appropriate language usage. Hue employed the strategies of “imitating the native language use,” and “googling” any phrases related to the content she hoped to use for her intended expressions. (N. Phuong and N. Hue, personal communication, June 2016). Thus, these ESL writers understood the conventions of writing in their discourse communities and employed their own appropriate strategies for learning.

Metacognitive skills are conducive to learning, and metacognitive awareness provides learners with thinking and learning strategies. These methods of writing not only require participants to understand how the conventions work in the new discourse community, but also encourage them to reflect on them effectively. Without the awareness of the conventions and expectations of the new discourse community, beginning learners might be in the situations of Gee’s (2001) “mushfake” or Batholomae’s (1985) “inventing the university,” in which learners imitate the stance of the target discourse to engage in and assimilate to the discourse community. Gee (2001) proposes that the successful framework of learning includes the process of both acquisition and learning, and thus requires the combining process of both “mushfake” and “awareness.” For example, one of the most recent trends in writing instruction that acknowledges this framework is the model of “writing about writing,” a metacognitive awareness of learning developed by Elizabeth Wardle and Doug Downs (2007). This approach enables and empowers learners to know the nature and methods of writing by learning and doing research about writing.

The third element in this interactive model of learners’ necessary capabilities is contextualization. This component means that learners can apply theory and accommodate their learning needs to real-life experiences. It is also connected with learners’ motivation and

inspiration from literacy acquisition and learning. As reading and writing processes are not confined to technical thinking, these activities are related to social and cultural communication. The capability of contextualization allows learners to identify and execute their literacy performance because of the urgency of communication, and helps them realize the role and purposes of reading and writing in real-life communication. In reading, contextualization can be the higher level of comprehension called appreciation, which can be obtained from readers' inference of texts from their experiences. This capability enables them to effect change for better improvement of life experience and social condition. In writing, one of the examples of appreciation is understanding how literacy can perform and transform life and society. This ability enables learners to understand the meanings of literacy and encourages them to acquire and learn necessary skills. Appreciation makes learners aware of the significance of their learning goals and the importance of literacy in epistemic construction, social construction, life mission, and social transformation. Appreciation in learning refers to learners' awareness of their contribution to learning. Appreciation in learning relates closely to rhetorical schemata. As discussed in chapter two, when the four participants were aware of rhetorical schemata, they understood that they had become part of their discourse communities and would actively participate in the continuous conversations in their communities. They would shape their writing for their audience and purpose to contribute to their discourse communities and social life.

Pedagogical Implications for Formal, Content, and Rhetorical Schemata

The theoretical underpinning of the relationship between formal and content schemata is that writing courses include two complementary procedures: learning to write and writing to learn. The first procedure provides learners with tools like language to communicate with texts.

While formal schemata are of significance, student writers may find it more engaging to create texts that are meaningful. They learn to write in order to resolve an issue, or to understand a particular topic in real life. Thus, learning to write is to explore specific and practical topics of interest and significance. Furthermore, the creation of texts should be meaningful in specific contexts and should provide the needs for writing to apply to their professional areas and careers. Therefore, learners' writing processes include the following components: learners' acquisition and awareness of formal schemata, learners' awareness and willingness to explore subject matters, and learners' ability to relate the objectives of composition skills to real-life experience and professional needs.

These perspectives have implications for designing writing courses that can provide learners with combining composition skills with the knowledge of their majors. This approach has been much discussed in previous literature of writing for specific purposes, such as ESP/EAP (English for Specific Purposes/English for Academic Purposes). In these ESP/EAP courses, content schemata can provide significant implications. ESP/EAP courses provide learners with the opportunity to make use of their professional knowledge in their majors when they learn to write. These learners simultaneously learn composition skills and explore further knowledge of their interest and topics of significance. Furthermore, their writing can be assisted by activating their existing content schemata, which they have already acquired and reinforced through this exploration of their writing. It may be important to consider the combination of composition skills and learners' needs for practical purposes because learners simultaneously learn to communicate through texts effectively while also having opportunities to explore their topics of interest and significance.

Although these practices can be considered practical for learners, learning to write may

require a higher level of contextualization. This aspect can be applied to the education of liberal arts. According to this perspective, learners are members of their particular professions, but they are also a part of a community and society. They not only learn to communicate for their professional work, but communicate to learn from their social communities. However, the dual tasks – practical orientation and liberal perspectives – are challenging. These tasks, vocational goals and academic research, may need further investigation for educational and pedagogical implications.

Implications for Formal Schemata

The relationship between contrastive rhetoric and formal schemata may provide pedagogical implications for ESL writing. One of the examples is the teaching of textual features, such as expository texts. In a study related to contrastive rhetoric, William Grabe (1987) aims at investigating whether expository prose can be identified as a distinct genre and if it has sub-types. Grabe (1987) uses corpus analysis with sophisticated statistical analyses (e.g. factor analysis, ANOVA, MANOVA, Duncan Means) to group a number of different academic samples. The results from the calculation leads the author to conclude that expository prose can be defined as a distinct genre, with its subcategories of text-types. If these subcategory texts are defined with certain text characteristics, then it can be one of the applications of textual organizations and features of ESL writing instruction. For example, Grabe (1987) finds that this expository prose had the repeated textual and linguistic forms in both syntactic variables (e.g. relative clauses, nominalizations, passive, infinitives), and cohesion variables (e.g. lexical synonyms and antonyms, lexical inclusion...) (p. 118). This finding suggests that the instructions of formal schemata can provide necessary linguistic instruments for learners to facilitate their writing skills.

Therefore, if learners are aware of the textual features of the genres they need to learn, they are more likely to find it easier to write. In fact, the responses from the participants showed that they could use their formal schemata, specifically their understanding and application of genres, to write for their majors. Nga described what she had learned from the class she took about constructing a research paper with typical components: Introduction, Literature Review, Method, Data, Results, and Discussion. Phu applied her content schemata, writing summaries, to review literature for her research.

As expository prose is a distinct genre with its own textual patterns, it should require its own instruction. Although other genres, such as, narrative, and letters, can improve writing, these types are different genres. Thus, interdisciplinary courses with specific genres cannot be generalized to provide complementary skills in all writing situations. Learners can grasp particular genres practically and authentically to use in a specific context, but different genres require distinct sets of instruction, and thus may not be transferrable to another context. Thus, course development should employ particular genres for particular learning outcomes. To activate learners' formal schemata, ESL writing courses can provide them with understanding conventions in contexts. They need to understand types of genres and text types that are related to their majors to achieve communicative purposes. When ESL learners are able to understand the structural features of each genre, they can apply them correctly and appropriately in the specific context of communication in order to achieve their communicative purposes.

As for vocabulary repertoire, ESL learners should be provided with necessary and popular corpuses that have high frequency for their discourse communities. These corpuses can be introduced simultaneously with the introduction of the corresponding genres, in which the vocabulary frequently appears. For example, the participants in my research had to learn specific

terms to write for their research. When they wrote for literature review, they were explicitly instructed with verbs of high frequency, such as state, affirm, contend, suggest, hypothesize, which help them express ideas with diverse, specific, and accurate phrasing to introduce existing material in literature review. Responses from the participants showed that all of them were concerned about appropriate language use. Therefore, explicit instruction of this linguistic resources should be highly recommended. As discussed in Swales's (1990) concept of discourse community, lexis is one of the characteristics that shapes the discourse communities. Aside from this method, ESL learners should have considerable exposure to authentic linguistic resources by intensive and extensive reading. Thus, learners' exposure to linguistic resources and instructors' explicit instruction of linguistic corpuses can substantially facilitate ESL learners' writing for their disciplines.

Implications for Content and Rhetorical Schemata

One pedagogical implication for applying content schemata is teaching disciplinary writing. This approach to instruction requires learners to use writing for problem-solving in particular fields, writing that enables learners to use their expertise and provide solutions for gaps in their existing disciplines. In this way, learners have a chance to activate their content schemata and make use of them for inquiry into their disciplines. If students learn to write in their discipline, it will be an advantage for them to bring out their expertise, their funds of knowledge, which facilitates the activation of content schemata.

Content schemata provides another theoretical implication for reading-writing instruction in composition and ESL writing classes, which relates to combining extensive reading. These activities facilitate the writing process by providing sufficient materials as the input sources for successful outcomes of text production. Aside from combining a plethora of reading, writing

courses may be designed to facilitate learners' inquiry into problem-solving and knowledge creation, and to use writing as a mode of learning. This is a step for writers to foster innovation and construct authorship in writing.

In writing assessments, instructors may evaluate the success of text production, not just by evaluating learners' ability to encode texts on papers with correctness, but also by considering learners' capability of synthesizing previous texts, incorporating previous knowledge to learn new knowledge, and offering solutions to existing gaps in knowledge. This aspect requires learners to foster their research skills, not merely in terms of academia, but in real life, the skills that are so prominent when information is ubiquitous in the digital age. The more available information becomes, the more crucial it is for receivers to possess capability to search, synthesize, and criticize it.

Activating Learners' Schemata in Disciplinary Courses

Why does it matter to activate schemata for ESL writing courses? Designing and curriculum instructions may require much more than just this part of the chapter can cover, but this section provides some specific instances in which activating schemata in ESL writing can be beneficial in reading and writing courses.

For ESL learners who start taking undergraduate courses, they need writing skills to prepare for their college writing. For ESL graduate students, when starting to take graduate courses and doing research, they need academic writing skills to meet the objectives of their study. They need to write for courses, lab reports, proposals for conferences, and articles for publication in their fields. The goal of the course is to prepare them for writing in their disciplines.

Therefore, the course content is disciplinary with a focus on learners' topics of familiarity and interest. The underlining theory of this content is to activate their content schemata. Learners in a ESL writing course, specifically graduate ESL students, can learn to write academically and use their writing to conduct research in their disciplines. This approach allows them to make use of their existing knowledge in the field, giving them opportunities to have materials to write on a topic of their familiarity and interest. This content-focused course enables writers to be aware of their discourse communities. When they take the course, they not only practice writing, but also use writing to learn and conduct their disciplinary research. They are learning to write and writing to learn for their major. They use their writing to learn the content of their course. They are aware that when they write, they are responding to the existing conversation; they are participating in the on-going conversations in the fields; and they are contributing their original ideas to knowledge of their majors.

Freedom to choose topics in the course may create some difficulties for instruction. How do instructors manage a plethora of diverse topics selected by individual learners? Are there any issues relating to the nature of topics; for example, what if students choose sensitive topics? What issues may arise when each student has his/her own topic that is distinct to other students' disciplines, and they are not mutually interested in their peers' topics? And finally, as topics chosen in a curriculum are based on the usefulness to learners with a higher level of evaluation, how can learners' selection of their own topics provide the depth of meanings?

These questions can be addressed based on theoretical and practical underpinnings. Theoretically, if researchers in the field of ESL writing agree that writing skills in one course may not be completely transferrable to other disciplines, and that there are no universal courses in writing that can meet the needs of writing for writers of other majors, then there should be an

ESL writing course that is practical and authentic to meet learners' needs. Even though students can have their own selection of topics for their exploration and research, the majority of reading selections can be reserved for curriculum designers and instructors to evaluate and choose readings to instigate further discussions. The selection of readings may be dependent on students' majors and may be subject to change based on learners' interests. Instructors may be open to students' selection of topics, as long as their choice will not interfere with the learning goals. In fact, the diverse topics chosen by students to explore and research may provide them with opportunities to learn other topics offered by their peers. They can learn from one another and share their knowledge. As learners are undergraduate and graduate students, they can have a sense of choosing their own topics.

Regarding learners' selections of topics, ESL writing courses may need to have a close connection between reading and writing. Theoretically, reading and writing are highly connected, so ESL writing courses should provide students with metacognitive awareness of this connection, and to use this awareness to read extensively and intensively for them to explore knowledge and write their original content. When learners choose to read their topics of interest extensively, this experience provides content schemata to facilitate writing. Learners can also make use of this content schemata to their research. When ESL writing courses allow learners to select reading materials, they need to be able to evaluate their reading selections. To evaluate the quality of texts, instructors can require students to provide annotated bibliographies, including summaries, responses, and significance of the readings to their research. This incorporation of reading and writing extensively not only allows learners to practice writing, but also helps them to reinforce reading comprehension.

Conclusion

One of the limitations of my research was that all of the participants were female, thus the results should take into account of this limitation. Although I anticipate there would be little difference in the responses of the male and female ESL learners in learning to read and write, further research should be done to address this limitation, either including a combination of male and female participants in the group of one study or conducting another study with the inclusion of only male participants.

Another limitation is that one of the subjects had time constraint, so I combined the two interviews into one interview to cover all of the interview questions. Although the responses from one interview could be slightly different from separating the two interviews, I found that the answers from this subject did cover all of the content that I anticipated from the interviews.

Learning to read and write can be demanding and rewarding. As reading and writing may not only include the processes of decoding and encoding language, but also involve the cognitive, metacognitive, communicative processes along with social practice and development. Writing effectively should involve learners' types of schemata. Writing is not merely learning conventions with accurate grammar and vocabulary, and in the same token, it cannot be separated from content. It is a contextual process of continuing a conversation in a discourse community, in which writers are members of their own communities and respond to this conversation to contribute their informed knowledge and original ideas. Thus, they should be equipped with not only cognitive capabilities, but also metacognitive awareness of the nature of writing. This awareness cannot be raised and learned overnight, but it is a long and challenging process, in which learners acquire competence in formal schemata, and develop their interest in contributing content to the conversation in the future community they will be interested in

entering. When learning to read and write, learners are introduced with the methods of thinking, developing various skills of generalizing, analyzing, persuading, synthesizing, researching, and creating, just to name a few. Literacy skills help learners have access to methods, develop skills, and explore multiple world views, and thus are more likely to open to changes for the better. Nevertheless, learning to read and write is a long and hard process for most learners. For those inexperienced learners and ESL students, it may take much more time and effort to write competently. Thus, activation their existing types of schemata may assist their reading and writing processes.

Chapter 6: Implications for Curriculum and Pedagogy for Beginning ESL Writers

The previous chapter explores educational implications for the learning processes and discusses pedagogical implications for each type of schemata: formal schemata for genre instruction to facilitate ESL writing; content schemata for the inclusion of intensive and extensive reading for disciplinary courses; and rhetorical schemata for the curriculum design that makes use of learners' awareness of the significance of writing: learning to write as mode of innovation and learning as knowledge contribution to discourse communities. This last chapter explores implications for curriculum and pedagogy for beginning ESL writers. Specifically, this chapter discusses several scaffolding activities that can be used in writing instruction so that beginning ESL learners can make use of their formal, content, and rhetorical schemata. For curriculum instruction, schema activation aims at facilitating beginning ESL learners' writing by providing writing courses with the combination of the types of schemata.

Activating Formal Schemata for Beginning ESL Learners

Formal Schemata: Vocabulary and Structures

As discussed in chapter 2 regarding the difficulties of ESL learners' writing issues with forms, ESL learners' difficulties in writing are caused by their limitation in using accurate and sophisticated vocabulary to express meanings clearly and precisely. The data from the interviews and the samples show that the subjects in my research encountered the same issues with forms – accurate vocabulary use in contexts and flexible structures for idea expressions. Although these subjects experienced the same issues with forms in the use of vocabulary and structures, they could activate their formal schemata to overcome these difficulties.

The interviews showed that the subjects were concerned with vocabulary use. Thus, helping learners with vocabulary use can help activate learners' formal schemata. Curriculum designers can take this specific difficulty into consideration to include learners' vocabulary learning. There are several strategies for scaffolding ESL learners' vocabulary development. According to the data from the interviews, the subjects used various strategies for their vocabulary use. Phu used synonyms to diversify her expressions and used dictionaries to check the accuracy of word use. One example of the usefulness of an advanced dictionary for writing is to check the word class to be sure words are used as nouns, verbs, or adjectives. For example, if the word "express" is used to construct a sentence, it is used as a verb, but when the sentence requires a noun, it should be changed to "expression" to be used as a noun. In another example, the verb "utter," is transferred into "utterance," a different way of noun forming. As different words require their own regularities to change their word class, it is always best for writers to check the correct word use in case these writers need to make sure about the word use. As ESL learners, especially Vietnamese students, might not be aware of the change of word class for accurate use, this is one of the strategies for using vocabulary accurately in a sentence.

This strategy can be helpful for beginning ESL learners because they may not be aware of the accurate use in sentences due to the differences in usage between their native language and target language. For example, English has is a different way of using word classes from Vietnamese language. In English, different forms are used to denote a word class as a noun, a verb, or an adjective. The Vietnamese language also distinguishes word classes with nouns, verbs, and adjectives. However, an additional word should be used to denote a different word class, such as the adjective, "đẹp" as in "beautiful," should be added with an additional word to make it a noun "cái đẹp" as in "beauty." The addition, "cái," is used to denote a noun. This is an

example among various differences between English and Vietnamese. Therefore, it is important to provide word families when teaching vocabulary to beginning Vietnamese learners. When instructors introduce a new word, for example, “enable,” it is always necessary to note the word class as a verb, and introduce words of the same family, namely, “ability” as a noun, and “able” as an adjective. Moreover, it can be helpful to provide them with a list of suffixes that denote nouns, verbs, and adjectives. For example, words with suffixes, such as “-ility” or “-tion,” are formed as nouns.

To make use of these cultural and linguistic resources and activate formal schemata, the aforementioned teaching technique can be one of the ways to facilitate vocabulary development for ESL beginning Vietnamese students. Furthermore, for beginning ESL learners in academic settings, curriculum designers and instructors can provide academic word lists, word clusters, collocation dictionaries, and thesaurus. Academic word lists are group of words with high frequency of use. When learners are provided with the list of words together with their word families, they can easily look up and use these words to facilitate their writing. As noted in the interviews, the participants were concerned about the correct use of vocabulary together with choosing highly specific words. Providing academic word lists is one of the techniques that helps beginning ESL learners activate their formal schemata when they first learn to write. They can make use of the resources they have learned from the previous settings and apply them for writing in similar or different contexts. To activate this resource, it may be important to provide the vocabulary in contexts, and not merely providing lists of words. These lists can be generated by ESL learners through reading texts or from their diverse exposure to English. This technique helps them to be familiar to contexts, and thus make it easier for them to make use of the words

in contexts. In the academic word lists, there should be columns with the classes of words and word families.

Another example of academic word lists is providing learners with words that are necessary for use in academic setting. For example, beginning ESL writers may find it difficult to introduce other authors' ideas. Thus, it can be helpful to provide them with a list of reporting verbs, or structures of reported speech. This is one of the example of the lists: introduce, claim, state, maintain, prove, hypothesize, postulate, suggest, recommend, conclude, summarize, identify, just to name a few. They can annotate any examples of usage in their reading texts in order to understand the shades of meanings to use the verbs accurately.

Word clusters is another instruction technique that provides ESL learners with formal schemata to activate in writing. Word clusters are a group of words with a similar topic. This technique originates from the challenges encountered by ESL learners. As discussed from the interviews, the subjects were concerned with how to use highly specific words accurately to express intended meanings clearly. Thus, providing word clusters and instructing the use of thesaurus are one of the ways that helps beginning ESL learners distinguish different shades of meanings in words of similar meanings and make use of synonyms to diversify ways of expressing sophisticated ideas.

In the interviews, three of the subjects, Phu, Hue, Nga, mentioned their difficulties with choosing accurate words to express her correct intended meanings. Vocabulary use is challenging for even experienced learners. Beginning ESL learners who have little exposure to English may find it quite challenging to use vocabulary accurately. Thus, to make use of formal schemata for beginning ESL learners, curricula should provide necessary forms to be used in contexts. For example, using collocation in introducing new terms and making use of available

expressions from the contexts of reading can help learners with available forms for use.

Collocation refers to using groups of words naturally. Take, for example, native English speakers use the phrase “make a speech” instead of “do a speech.” This instruction technique may raise learners’ awareness of authentic language usage.

Another way of vocabulary learning is a corpus-based technique, in which researchers in linguistic studies identify high frequency words that can be used for specific purposes. To make it less difficult for beginning ESL learners to make use of their vocabulary resources, it can be useful to provide them with necessary, useful, and high-frequent corpuses in the academic setting. These learners can make use of these resources and activate their schemata to write in this new academic setting. As shown in the interview, one of the strategies that the participants used was searching frequently used words in specific contexts.

The above techniques are one of the ways to help activate beginning ESL learners’ formal schemata. As beginning ESL learners are new to writing and their discourse communities, they need necessary resources, one of which is lexis. Vocabulary development – academic word lists, word clusters, collocation and thesaurus – are ways that provide them with resources to activate formal schemata.

Aside from word use, the subjects in my interviews showed their concern about conveying ideas accurately and effectively. One of them, Nga, showed her concern in studying structures. As an experienced learners of English, she had learned English in extensive classes at high school and writing classes at universities. She was aware of the importance of learning structures. In fact, Vietnamese learners have struggled with using English structures because sentences are formed differently in both languages. Influenced by their linguistic resources, beginning ESL learners may find it challenging to write accurate and sophisticated sentences

effectively. These structures make these learners aware of the differences between forming sentences in English and Vietnamese, other than translating their ideas from Vietnamese into English, in order to avoid writing verbatim from Vietnamese to English. Thus, providing structures are ways of helping them to activate their formal schemata.

Formal Schemata: Genres

When ESL learners understand the importance of genres, they can make use of forms to express meanings. As genres carry their means of communication, it can be useful for beginning ESL learners to understand forms and use these forms to write for their academic majors. However, it is a challenging task to present the use of forms to ESL beginning learners, especially when they are new to language, let alone instructing them to make use of forms to produce writing pieces through genre use. Thus, it requires step-by-step scaffolding instruction that meets three criteria. These steps help learners get familiar with intended genres in their disciplines: (1) exposure to reading those genres; (2) analyzing features of genres used in the reading texts; and (3) applying those genres to express intended meanings.

Activating Content Schemata for Beginning ESL Learners

Beginning ESL learner may be at any age, even children, teenagers, or adult learners. Thus, each type of learners may bring different types of content schemata. It depends on the age and experiences that instructors can help them activate their content schemata. If learners are adult, they may bring out full of experiences related to the writing topics and make use of these resources to make it beneficial for their writing processes. For beginning ESL learners in the academic setting, activating content schemata involves their knowledge and experience in their majors. As shown in the interviews and analysis of the subjects' samples, the experienced

learners had mastered their subject content, which facilitated their composing processes. The subjects had been in the majors, and they understood that the more they read about the topics, the easier it was for them to write about those topics. Thus, if beginning ESL learners are instructed with the awareness of content, it will facilitate their writing processes with brainstorming writing topics.

In order to activate content schemata in beginning ESL learners in academic setting, it may be useful to allow these learners to select topics of their interest or topics in their academic majors. As shown from the data in the interviews with the subjects, the more learners read about the topics, the better it is for them to use these resources as the follow-up activities for writing. Thus, it can be useful for beginning ESL learners to read intensively and extensively, discuss, and respond to these texts. Answering expanded questions from the reading texts helps these learners think about the answers, research for their answers, and write about their responses.

The pedagogical steps of activating content schemata for beginning ESL learners can basically involve the following steps: selecting topics; reading texts, analyzing text content, discussing questions about the text, doing more search about the topic, and writing about their responses. These steps are one of the ways to elicit beginning ESL learners' previous knowledge and experience and motivate their reaction to previous texts and facilitate their writing about the topic of their interest. Although these steps have been previously conducted in the classroom. The major addition to this pedagogical procedure is the close relation between reading and writing; the necessity of making use of learners' knowledge for conducting responses to available text; and the possible awareness of the differences between what they have already known and what they are learning from the new texts. The purposes of this procedure may

possibly facilitate intensive and extensive reading, and can simultaneously create opportunities for learners to think critically.

Activating Rhetorical Schemata for Beginning ESL Learners

Activating rhetorical schemata for beginning ESL learners can be challenging because learners have to understand the context of text production so that they can be aware of their audience, the purpose of their written text, the potential effects of texts on their readers, and the discourse community in which their texts are created. In traditional pedagogy, writing skills are normally focused on language practice. Also beginning ESL learners are usually young learners. Thus, these learners' writing processes seem to disregard the knowledge and application of rhetorical situations on writing.

To help activate rhetorical schemata for beginning ESL learners, it may be necessary to consider the characteristics of these learners. Although beginning ESL learners can be young learners with limited schemata, they can make use of their own cultural and linguistic resources. When these learners are aware of rhetorical schemata, they are able to write with more motivation. They will focus more on content and the quality of their writing. They will use forms to serve the purpose of creating content rather than focusing mainly on accuracy. Although accuracy is important as well, major focus on forms will hinder creation of content. To create a sense community for response to their writing, it can be beneficial if these learners can share their work to their peers by either publishing to the group's community, to online platform with activities, such as posters' sections, oral presentation and discussion.

There are several steps for pedagogical techniques in activating rhetorical schemata for beginning ESL learners. Writing tasks can be a mini project, or a small-scale research project

that focuses more on their interest and accomplishment. First, set up a task that creates an urgent need in real-life situation with a sense of purpose for these learners to accomplish. This sense of purpose can help activate their rhetorical schemata. This task should be designed to help these learners get familiar with the topic so that they can activate their content schemata. Thus, they can choose their own tasks of their own concerns, but with instructor's advice. Second, these learners can carry out the task and take notes while performing the tasks. Third, they can write about their observations, findings, comments, and lessons learned. At this stage, beginning ESL learners can find it challenging to express their thoughts to writing. However, instructors can provide necessary forms to help activate their formal schemata. Forms they learned in their own language that can help them apply to writing in English. For example, some beginning ESL learners might have learned how to write a mini project or a lab report in their previous institution. They may reflect on what they had already learned to what they are learning to do the task in English. Fourth, this step helps instructors activate learners' schemata with their sense of audience and purposes of their own writing tasks. These learners share their own work either by oral presentation or publishing their work in class for further discussion, learning, and revision.

These activities can be the chronological steps but can also be recursive because the task requires learners to go back and forth to brainstorm, decide, choose the topic, carry out their own task, and write about their performance. When sharing their work, they can have the opportunity to revise their work. When they perform the task, they may start with taking notes and write the first drafts. Since these steps is time-consuming, it requires students' planning. Although it may seem that learners can spend more time on carry own their tasks than on actual writing and practicing the language, further instruction can minimize this limitation when instructors create an environment for learners to use the language, encouraging them to use the language before,

while, and after writing. Beginning learners can jot down their notes and writing about their performance. Before these activities, instructors may have already provided them with necessary forms by teaching them how to take notes, and provide them with word lists, useful sentence structures, and necessary genres to write about the task.

Although beginning ESL learners need more forms to write in English, activating rhetorical schemata can motivate them to write about their topics of interest. As these types of schemata are related, classroom activities and techniques can be the activation of these schemata simultaneously since the three types of schemata are related and overlapped.

Conclusion

The above discussion focuses on pedagogical implications for teaching beginning ESL writers to help them activate formal, content, and rhetorical schemata. These include the instruction of forms and diverse exposure to linguistic resources for these ESL learners to make use of them in their writing processes. ESL instructors should also raise ESL learners' awareness of the differences in forms between their previous learning experiences, including their L1 resources, and their L2 linguistic knowledge. The step-by-step instruction of forms should also accompany with encouraging learners' interest in response to real-life experiences and events to make use of writing. For beginning ESL learners, both three types of schemata are important, but formal schemata should play a more important role to help them reinforce the use of correct language to express accurate ideas.

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Appendix 1: Questions Used in the Interviews with the Subjects

Questions for Interviews

These sets of questions were used for interviewing the subjects in both thirty-minute interviews. For the first interview, the questions aimed at eliciting participants' literacy learning experiences, focusing on examining rhetorical and linguistic aspects. The second round investigated learners' difficulties and strategies for writing in a new discourse community.

Table 1: Questions for the First Interview

Category	Questions
Current Information	<ol style="list-style-type: none"> 1. How long have you been in the United States? 2. How long have you been in your program at the University of Arkansas? 3. What is your major? 4. How often have you been assigned to write papers in your discipline? 5. What types of written assignments have you been assigned at the University of Arkansas? 6. How often do you use writing outside the classroom? 7. How often do you use writing to communicate outside the classroom context? 8. Did you take any Writing or Composition courses when you are pursuing your current degree at the University of Arkansas? If yes, which course did you take? 9. Do you have positive or negative attitudes towards learning English in general and in English writing in particular? What make you think so? 10. What is your best English skill? Why do you think it is your best skill? 11. What is your favorite skill (Listening, Speaking, Reading, Writing)? 12. What is your favorite subskill (Grammar, Vocabulary, Pronunciation)? 13. How long have you been learning English? 14. Where have you learned English?

Table 1 (Cont.)

Category	Questions
Current Information	<ol style="list-style-type: none">15. How would your English learning experiences differ if you were a native English speaker learning to write in English?16. What make you feel about your attitudes towards learning to write in English?17. Have you ever had difficulty expressing your ideas in English? If yes, what made you overcome this difficulty?18. Do you think in your language or do you think in English while writing?19. Do you think you are very fluent in Vietnamese? Why do you think so?20. Do you like writing in Vietnamese? How often do you use Vietnamese to communicate in writing? Have you ever written a long piece in Vietnamese? If yes, when was that? If no, what was the longest piece?21. Can you tell some differences in the English and Vietnamese ways of writing? How do your structure your papers in Vietnamese writing and English writing?
Attitudes towards “good writing”	<ol style="list-style-type: none">1. In your opinion, what is good writing?2. What constitute good writing? Or what are the features of good writing?3. Where did your ideas of good writing come from? Or, from which sources did your ideas of good writing originate?4. Do you think your ideas of good writing are suitable for all contexts and purposes?5. In the previous institutions you attended, how was your English writing graded? Did it affect the way you learned English? Did the feedback encourage or discourage you to write?6. Are the features of good writing in Vietnamese similar to or different from those in English writing?

Table 1 (Cont.)

Category	Questions
Knowledge of “genres”	<ol style="list-style-type: none">1. What types of texts were you assigned to write? Were you assigned to write essays, reports, narratives, descriptions, instructions, and so on?2. What genres (or types of texts) did you regularly use?3. Of the four rhetorical modes (also called the modes of discourse in rhetoric) - exposition, description, narration, and argumentation - which mode was mostly used for written assignments at your previous institutions?4. Which mode did you feel you are most comfortable writing with? What make you think so?5. What were you expected to write in each mode? In other words, each mode represents a particular structure for your paper, and were you aware of that specific structure when you were asked to write in that mode?6. What do you think about each mode (or type of text structure)?
Previous use of “types of argument”	<ol style="list-style-type: none">1. Did you study composition or English writing at your previous institutions?2. If yes, what were you instructed? If no, which courses were most related to English writing?3. What types of argument did you use to write your written assignments?4. Do you have in mind the purposes of your writing? Are you aware of whom you are writing to, or the audience you are addressing? What do you think are the purposes of writing your papers? Who do you think you are writing to?

Table 2: Questions for the Second Interview

Category	Questions
Learners' Difficulties	<ol style="list-style-type: none"> 1. What difficulties have you had since you started learning English? 2. What difficulties have you encountered when you are writing your assignments? 3. Do you feel stuck while you are composing? Which make you feel stuck? 4. What types of difficulty do you have while writing? These might include difficulties in Vocabulary, Grammar, Ideas, Organization, Sentence structures, Expressions, and so on.
Analysis of Learners' "Stuck Points"	<ol style="list-style-type: none"> 1. (*) Can you identify from your writing samples the places where you got stuck in your writing? (You might feel stuck when you stopped writing for a while and did not know how to write next?) 2. (*) What types of difficulties do you think you encountered? 3. How did you overcome the difficulties when you were stuck in your writing? <p>Follow-up questions for question 1(*) and 2 (*):</p> <ol style="list-style-type: none"> 4. Can you give the scale of difficulty from 1 to 10 (with the highest number showing the highest level of difficulty) regarding each of your stuck points? 5. What made you feel stuck in your writing? 6. Were you stuck in ways of expressing ideas, finding the right sentence structures, the right vocabulary, and the right phrases, or other reasons? 7. Did you feel stuck in how to express ideas appropriately and effectively as you expected? 8. Did you feel stuck in organizing ideas in the whole essay, or ideas within paragraphs? 9. Did you feel stuck because you felt lack of ideas, and you did not know what you wrote about?

Table 2 (Cont.)

Category	Questions
Analysis of Learners' "Stuck Points"	10. Did you feel stuck because you did not know about the assignment requirements? 11. Did you feel stuck because the topics were not of your own choices or interests? 12. Did you feel stuck because you did not know the exact English words and sentence structures to express your ideas?

Appendix 2: Table 3: Summary of Participants' Responses from the Interviews:

	Phu	Hue	Nga	Hong
(1) Previous Learning Experiences	Studied English at public schools since the age of 16	Studied English at public schools since 16 years old	Studied English at public schools	Studied English at public schools
(2) Present Writing Processes	Wrote one paper/year (lab reports)	Wrote once a week (article reviews, final papers)	Wrote papers for coursework (lab report, literature review)	Wrote twice a year (course reports)
(2) Attitudes Towards Writing	Positive Necessary for her major	Positive Useful Rewarding	Positive in English, but not much in writing Cultural exchange Knowledge access	Positive
(3) Difficulties in Writing	Vocabulary Grammar Use of English Avoiding Plagiarism	Vocabulary and Word choice Ways of expressing ideas Structures	Word use (appropriateness, variety) Expression (concise and interesting)	Generating ideas Conveying ideas Reorganizing ideas logically

Table 3 (Cont.)

	Phu	Hue	Nga	Hong
			<p>Sentences structure</p> <p>Organization of ideas</p> <p>Brainstorming topics</p>	
(4) Strategies for Writing	<ul style="list-style-type: none"> - “Relax” - “Print out and read” -Ask a peer to read, comment, and discuss -Read and summarize -Use synonyms, use dictionaries -Learn sentence structures and paragraph structure 	<ul style="list-style-type: none"> -Think in the first language (English) -Look up dictionary for appropriate words -Use thesaurus, collocation dictionary -Search on Google to see how to express context in English appropriately 	<p>Outline</p> <p>Link ideas</p>	<p>Outline</p> <p>Peer review</p>

Appendix 3: Table 4: Summary of Participants' Performance in the Samples

	Phu	Hue	Nga	Hong
(1) Genre	two summaries of two articles	an essay and a report	A long term paper	A long term paper
(2) Organizational structure	Well-structured: introduction summary, material and method, results, conclusion	Well-structured: appropriate components with claims and support	Clear structure	Clear organization
(3) Linguistic Competence	Good use of transitional devices	Paragraphs are sequenced logically and coherently.	Language use is clear with specific terms.	Language use is clear and specific with technical terms.
(4) Quality of arguments (Coherence and persuasiveness in claims and support)	-Ideas are clearly expressed. -Attempts at synthesis of sources	-Clear topics and support. -Attempt at synthesis of sources	-Ideas are coherently expressed. -Attempts at synthesis of sources	-Ideas are somewhat demonstrated coherently. -Attempts at synthesis of sources

Table 4 (Cont.)

	Phu	Hue	Nga	Hong
(5) Participants' awareness of audience and rhetorical stances; (6) Contribution of knowledge to their discourse communities	The summaries reported significant findings in the field as literature review for the participant's research.	The papers demonstrated the participants' knowledge and learning goals in the course.	The paper showed quite clear significance of the research.	The paper introduced the topic and showed the issue, but may not have explicitly demonstrated the significance of research.

Appendix 4: IRB Protocol Approval



Office of Research Compliance
Institutional Review Board

May 27, 2016

MEMORANDUM

TO: Uyen Dang
David Jolliffe

FROM: Ro Windwalker
IRB Coordinator

RE: New Protocol Approval

IRB Protocol #: 16-05-775

Protocol Title: *Writing Cross-Culturally: Accommodation and Enculturation - A Case Study of Four Vietnamese Students at a University in the United States*

Review Type: EXEMPT EXPEDITED FULL IRB

Approved Project Period: Start Date: 05/27/2016 Expiration Date: 05/26/2017

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (<https://vpred.uark.edu/units/rscp/index.php>). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 4 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

Appendix 5: Phu's Writing Samples

Phu's Writing Sample 1

Growth performance and meat yields of broiler chickens fed diets containing low and ultra-low oligosaccharide soybean meals during a 6-week production period

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Summary

Energy ingredients in poultry feed comprises a remarkable cost, but the fluctuated and increased prices of some important energy ingredients such as soybean meal (SBM) lead to the need of maximizing their energy values. SBM has low AME_n to chicken, because of its galacto-oligosaccharides (GAL) component (Choct et al., 2010). Due to the lack of α -1,6 galactosidase in digestive tract, it is hard for chicken to effectively use GAL in soybean meal (mostly raffinose, stachyose) (Gitzelmann and Auricchio, 1965; Cristofaro et al., 1974, Honig and Rackis, 1979). There are many methods used to improve SBM energy utilization by reducing raffinose and stachyose concentrations (Coon et al., 1990; Parsons et al., 2000; Ghazi et al., 2003).

New genetically selected soybean with low levels of raffinose and stachyose has shown higher concentrations of true digestible amino acids and an increase of AME_n in broilers (Baker et al., 2011; Perryman and Dozier, 2012). However, there is no report on growth performance of chicken fed LOSBM and ULSBM in diets, so the research aims to assess the energy and nutrition values of LOSBM and ULSBM compare to CSBM on growth performance of chicken during 6 week-production.

There are two experiments in this research. Broilers were fed 3 types of diet during growing period: starter (1 to 14 d of age), grower (15 to 28 d of age), and finisher (29 to 40 or 42d of age for experiments 1 and 2, respectively) and the feed formulation meets the requirements of NRC

(1994). The soybean that made these ingredients was not genetically modified and was grown from the same location. All ingredients were analyzed for their nutritional components.

Experiment 1 has two treatments with Low GAL soybean meal (LOSBM) or control soybean meal (CSBM) in the diets. While experiment 2 has six treatments with a 3 x 2 factorial design of three SBM types (LOSBM, ultra-low GAL soybean meal (ULSBM) and CSBM) and two levels of AME_n: moderate diet has 3,025, 3,115, and 3,160 kcal of AME_n/kg in the starter, grower, and finisher phases, respectively and reduced diet has 25 kcal/kg lower in each diet phase. There are 600 male one day old chicks (Ross x Ross) randomly arranged in 24 pens in experiment 1 and 1500 in 60 pens in experiment 2 (25 chicks per pen). Birds were recorded for growth rate, feed intake, FCR, mortality, plasma glucose, triglyceride, and nonesterified fatty acid concentrations. They were also assessed for pododermatitis (PD), carcass, abdominal fat percentage and total breast meat yields at 40 (experiment 1) and 42 days of age (experiment 2). Later on, at 41 (experiment 1) or 43 days of age (experiment 2), pH and viscosity of intestinal digesta in foregut and hindgut were measured to evaluate osmotic pressure of GAL in intestine. SAS program was used to analyze the data by ANOVA with a randomized complete block design (pen location is blocking factor).

For the analysis of physical and chemical characteristics, LOSBM and ULSBM in both experiments had lower stachyose, raffinose, ADF, NDF, and cellulose, and higher CP, sucrose, and starch compared to CSBM (Table 1).

In the assessment of growth performance, physiological variables and PD (table 2 and 3), LOSBM group (1 to 14 days of age) in experiment 1 had significantly higher BW gain and lower FCR. This may be due to the weak ability of SBM complex carbohydrates digestion in young chicks (Carré et al., 1995), low fermentation in the chicken intestine and complex carbohydrates' anti-

nutritional characteristic (Choct and Annison, 1990). When LOSBM contains lower GAL levels and ADF, NDF and cellulose contents, it helps the young chick digestion. Besides, there was no difference in other periods in terms of growth performance, mortality and physiological variables. While in the second experiment, the combination effects of AME_n levels and types of SBM were not different. However, a remarkable decrease of FCR in the ULSBM group from 1 to 28 and 1 to 42 days of age was recorded. FCR decrease may be caused by the higher concentrations of amino acids in the diets (Kidd et al., 2005; Dozier et al., 2006, 2007; Corzo et al., 2010). Particularly, reduced AME_n group had no differences in BW gain, feed intake, FCR and mortality compared with moderate AME_n group. Young chicks under 42 days of age did not consume more feed to adjust with lower energy diet. Moreover, the 25 kcal/kg difference between two diet types in this experiment did not effect on bird growth performance. Also, physiological variables data were not different among treatments.

Both LOSBM and ULSBM birds had significant lower percentage of PD compared with the control group, maybe because of much lower GAL in SBM (figure 1). GAL has an effect on increasing litter moisture (Bedford, 1995). Furthermore, LOSBM and ULSBM diets had lower SBM ratio in the feed, so they had lower K level which presents much in SBM and causes higher litter moisture (Eichner et al., 2007); and changes in moisture have influenced PD rate (Martland 1984, 1985; Mayne et al., 2007).

In terms of processing characteristics (table 4 and 5), the first experiment showed the remarkable higher abdominal fat ratio in LOSBM treatment (1.86%) compared with the control group (1.54%). In addition, this trend was also the same in experiment 2: LOSBM treatment has 1.60% fat compared with the CSBM group 1.50% fat. On the other hand, the second experiment recorded the differences in carcass and breast yields among SBM diets, especially higher carcass

yield of ULSBM birds. The lower complex carbohydrates in LOSBM and ULSBM may increase the utilization of amino acids and this leads to higher lean tissue deposition in chickens (Bartov and Plavnik, 1998; Kidd et al., 2004; Corzo et al., 2005, 2010; Dozier et al., 2008; Lilly et al., 2011). With higher levels of amino acids in low GAL SBM diets, more amino acids will involve in energy metabolism. This results in the increase of AME_n, which then makes more abdominal fat. LOSBM diet had the highest AME_n:CP ratio among the three diets and this ratio may be the reason of highest abdominal fat in broilers of this group (Bartov et al., 1974). Two AME_n levels in diets of experiment 2 did not influence carcass index. As the young birds did not eat more to adjust the low AME_n diet, they consumed less amino acid amount which can help in lean tissue development.

Furthermore, this research has showed that low GAL SBM diets need less supplemented oil compared with the control, while they still keep the normal growth performance and carcass yield of broilers. This advantage may be caused by better amino acid amount and higher AME_n.

In conclusion, this research has introduced and evaluated a novel ingredient candidate for feed formulation in poultry production. It also showed the weak effect of feed energy levels in younger broiler growth performance and carcass. Throughout the two experiments, the authors have carefully organized the research to have necessary data for detail assessments of animal performance during six week period. However, the litter moisture was not measured to give tighter conclusion about PD.

The information in the paper is easy to follow and well organized. The introduction addresses the reasons why seeking new ingredient is important for poultry production and the objective of this research is obviously mentioned. The data were presented clearly and the differences were

discussed with logical references. However, the physiological results are not discussed, although they are similar among treatments.

This is a good research and if low GAL SBM diet has economical price, it should be applied in the poultry production.

Tables and figure are from Perryman K R et al. Poultry Science 2013; 92:1292-1304

Table 1 Physical and chemical characteristic of control (CSBM), low oligosaccharide (LOSBM), and ultra-low oligosaccharide (ULSBM) soybean meals on an as-is basis¹

Item, % (unless otherwise noted)	Experiment 1		Experiment 2			Analytical method
	CSBM	LOSBM	CSBM	LOSBM	ULSBM	
DM	91.16	91.69	90.70	91.50	91.90	934.01, AOAC, 2006 ²
CP	47.60	54.59	47.86	53.73	55.63	990.03, AOAC, 2006
Crude fat	1.71	1.12	1.24	0.79	0.77	2003.06, AOAC, 2006
Sucrose	6.95	8.38	7.47	8.71	7.78	Bhatti et al., 1970
Raffinose	0.71	0.21	0.82	0.21	0.07	Bhatti et al., 1970
Stachyose	6.79	1.56	5.08	1.44	0.50	Bhatti et al., 1970
Starch	0.89	1.24	0.81	0.61	0.40	76–13, AACC, 2006 ^{3,4}
ADF	5.54	3.52	5.50	3.39	4.19	973.18 (A-D), AOAC, 2006
NDF	8.09	4.60	8.07	4.84	5.91	Holst, 1973
Cellulose	5.53	3.74	5.71	3.68	4.36	973.18 (A-D), AOAC, 2006
Gross energy, kcal/kg	4,226	4,287	3,998	4,037	4,149	Isoperibol bomb calorimeter ⁵
Particle size, Dgw ⁶	1,300	1,166	1,059	1,279	1,106	S319.4, ASAE, 1993 ⁷
Bulk density, ⁸ g/cm ³	0.53	0.65	0.69	0.75	0.79	USDA, 1953
KOH solubility	82.24	83.44	78.93	84.31	82.58	Parsons et al., 1991
Trypsin inhibitor, TIU/g ⁹	3,429	5,924	3,183	4,323	5,677	22–40, AACC, 2006

¹Unless otherwise noted, all methods of analysis were determined by the University of Missouri Experimental Station Chemical Laboratories, Columbia.

²AOAC = AOAC International.

³AACC = Association of American Cereal Chemists International.

⁴Modified Starch Assay Kit (product code STA-20, Sigma, St. Louis, MO).

⁵Isoperibol bomb calorimeter (Parr model no. 6300) determined by Auburn University Laboratory (Auburn, AL).

⁶Dgw = geometric mean diameter in micrometers, determined at Iowa State University.

⁷ASAE = American Society of Agricultural Engineers.

⁸Determined at Iowa State University.

⁹TIU = trypsin inhibitor units.

Table 2 Growth performance of Ross × Ross 708 male broilers fed control soybean meal (CSBM) or low oligosaccharide soybean meal (LOSBM) diets from 1 to 40 d of age¹ (experiment 1)

Item	BW			
	gain, kg	Feed intake, kg	FCR, ² kg:kg	Mortality, ³ %
1 to 14 d of age				
CSBM	0.330	0.417	1.263	0.0
LOSBM	0.341	0.418	1.226	0.7
SEM	0.003	0.003	0.007	0.3
ANOVA probability				
SBM	0.020	0.696	<0.001	0.306
1 to 28 d of age				
CSBM	1.448	2.113	1.467	0.7
LOSBM	1.417	2.073	1.467	1.7
SEM	0.018	0.014	0.007	0.6
ANOVA probability				
SBM	0.199	0.052	0.972	0.838
1 to 40 d of age				
CSBM	2.681	4.280	1.595	0.7
LOSBM	2.624	4.218	1.594	3.3
SEM	0.021	0.035	0.007	1.0
ANOVA probability				
SBM	0.071	0.213	0.973	0.262

¹Values are least squares means of 12 replicate pens with 25 broilers per pen at 1 d of age. SBM = soybean meal.

²FCR = feed conversion ratio was a ratio of feed intake to BW gain.

³Mortality data were arcsin transformed before statistical analysis

Table 3 Growth performance of Ross × Ross 708 male broilers fed control soybean meal (CSBM), low oligosaccharide soybean meal (LOSBM), or ultra-low oligosaccharide soybean meal (ULSBM) diets with moderate or reduced levels of AME_n during a 42-d production period (experiment 2)^{1,2}

Item	BW gain, kg			
	Feed intake, kg	FCR, ³ kg:kg	Mortality, ⁴ %	
1 to 14 d of age				
CSBM	0.351	0.410	1.166	0.4
LOSBM	0.354	0.411	1.162	0.2
ULSBM	0.357	0.413	1.158	0.4
SEM	0.003	0.003	0.004	0.3
Moderate AME _n	0.354	0.412	1.165	0.5

Item	BW gain, kg	Feed intake, kg	FCR, ³ kg/kg	Mortality, ⁴ %
Reduced AME _n	0.354	0.411	1.159	0.1
SEM	0.002	0.002	0.003	0.2
ANOVA probability				
SBM	0.126	0.742	0.143	0.810
AM E _n	0.534	0.639	0.230	0.175
1 to 28 d of age				
CSBM	1.522	2.052	1.353 ^a	0.6
LOSBM	1.505	2.057	1.366 ^a	0.2
ULSBM	1.551	2.035	1.317 ^b	0.1
SEM	0.021	0.028	0.007	0.3
Moderate AME _n	1.513	2.040	1.349	0.5
Reduced AME _n	1.538	2.057	1.342	0.0
SEM	0.017	0.024	0.007	0.2
ANOVA probability				
SBM	0.474	0.826	<0.001	0.331
AME _n	0.429	0.593	0.194	0.199
1 to 42 d of age				
CSBM	3.008	4.755	1.581 ^a	3.5
LOSBM	2.984	4.687	1.571 ^a	2.1
ULSBM	3.036	4.692	1.544 ^b	0.8
SEM	0.021	0.036	0.005	0.8
Moderate AME _n	2.996	4.657	1.563	2.8
Reduced AME _n	3.023	4.735	1.567	1.5
SEM	0.019	0.045	0.005	0.6
ANOVA probability				
SBM	0.096	0.127	<0.001	0.077
AME _n	0.184	0.114	0.425	0.222

^{a,b}Means within a column for a given measurement not sharing a common superscript differ ($P \leq 0.05$).

¹Values are least squares means of 10 replicate pens with 25 broilers per pen from 1 to 42 d of age. SBM = soybean meal.

²Apparent ME_n concentrations reduced by 25 kcal/kg from moderate concentration (moderate: 3,025, 3,115, and 3,160 kcal of AME_n/kg for starter, grower, and finisher, respectively).

³FCR = feed conversion ratio was a ratio of feed intake to BW gain.

⁴Mortality data were arcsin transformed before statistical analysis

Figure 1. Incidence of pododermatitis in Ross × Ross male broilers fed diets containing control SBM (CSBM), low oligosaccharide soybean meal (SBM) (LOSBM), or ultra-low oligosaccharide SBM (ULSBM) at 42 d of age (experiment 2).

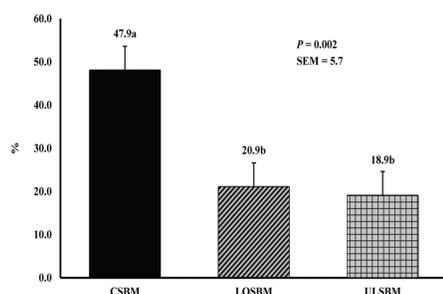


Table 4. Processing characteristics of Ross × Ross 708 broilers fed diets containing control (CSBM) or low oligosaccharide soybean meal (LOSBM) at 40 d of age¹ (experiment 1)

Item	Live weight, kg	Carcass weight, kg	Breast weight, ² kg	Carcass yield, ³ %	Breast yield, ^{2,3} %	Abdominal fat, ³ %
CSBM	2.782	1.960	0.641	70.5	23.0	1.54
LOSBM	2.748	1.951	0.623	71.0	22.7	1.86
SEM	0.017	0.015	0.009	0.4	0.2	0.05
ANOVA probability						
SBM	0.170	0.669	0.118	0.322	0.259	<0.001

¹Values are least squares means of 12 replicate pens with 14 broilers per pen at 40 d of age. SBM = soybean meal.

²Breast is composed of pectoralis major and minor muscles.

³Yield or percentage represents grams of tissue per 100 g of tissue per gram of live weight

Table 5 Processing characteristics of Ross × Ross 708 broilers fed control (CSBM), low oligosaccharide (LOSBM), or ultra-low oligosaccharide (ULSBM) soybean meal-based diets with moderate or reduced AME_n values at 42 d of age¹ (experiment 2)

Item	Live weight, kg	Carcass weight, kg	Breast weight, ² kg	Carcass yield, ³ %	Breast yield, ^{2,3} %	Abdominal fat, ³ %
SBM						
CSBM	3.134	2.248	0.725	71.7 ^b	23.1 ^b	1.50 ^b
LOSBM	3.119	2.245	0.732	72.0 ^{ab}	23.5 ^a	1.60 ^a
ULSBM	3.145	2.273	0.739	72.3 ^a	23.5 ^a	1.58 ^{ab}
SEM	0.022	0.017	0.007	0.1	0.1	0.03
AME _n ⁴						
Moderate	3.128	2.250	0.729	71.9	23.3	1.57
Reduced	3.137	2.260	0.735	72.1	23.4	1.56
SEM	0.019	0.015	0.006	0.1	0.1	0.02

Item	Live weight, kg	Carcass weight, kg	Breast weight, ² kg	Carcass yield, ³ %	Breast yield, ^{2,3} %	Abdominal fat, ³ %
ANOVA probability						
SBM	0.623	0.288	0.256	0.010	0.021	0.027
Energy	0.690	0.522	0.362	0.395	0.251	0.789

^{a,b}Means within a column for a given measurement not sharing a common superscript differ ($P \leq 0.05$).

¹Values are least squares means of 12 replicate pens with 14 broilers per pen at 40 d of age. SBM = soybean meal.

²Breast is composed of pectoralis major and minor muscles.

³Yield or percentage represents grams of tissue per 100 g of live weight.

⁴AME_n was reduced by 25 kcal/kg from moderate concentrations (moderate: 3,025, 3,115, and 3,160 kcal/kg, respectively, for starter, grower, and finisher phases).

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Phu's Writing Sample 2

The efficacy of *Mycoplasma gallisepticum* K-strain live vaccine in broiler and layer chickens

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Introduction

Respiratory disease caused by *Mycoplasma gallisepticum* (MG) in poultry has negative impact on their production worldwide (Carpenter et al., 1981; Mohammed et al., 1986; Ley, 2008) and vaccination could avert the clinical signs and alleviate egg production loss (Carpenter et al., 1981; Hildebrand et al., 1983; Glisson & Kleven., 1984, 1985; Yoder & Hopkins, 1985; Whithear et al., 1990a; R. D. Evans et al., 1992; J. D. Evans et al., 2007). Inactivated vaccines against MG have been used widely to control the disease (Hildebrand et al., 1983; Khan et al., 1986; Karaca & Lam., 1987) and protect egg production loss in hens, but did not show an effective prevention of respiratory disease (Glisson & Kleven., 1984, 1985; Abd-el-Motelib & Kleven., 1993).

F-strain and ts-11 are live vaccines that are used to control MG disease (Adler et al., 1960; Luginbuhl et al., 1967; Whithear et al., 1990a; Whithear et al., 1990b). However, they both have disadvantages such as F-strain has mild virulence to chickens and virulence to turkeys (Rodriguez & Kleven., 1980; Lin & Kleven., 1982; Branton et al., 1988; Abd-el-Motelib & Kleven., 1993) or ts-11 has weaker protection than F-strain (Abd-el-Motelib & Kleven., 1993).

Earlier studies have shown that K-strain had a safe and effective potential as a live vaccine for chickens (Ferguson-Noel et al., 2012). Therefore, the study aimed to evaluate the ability of K-strain compared to F-strain in protection of broilers (trial 1) and ts-11 in protection of layers (trial 2) from of MG disease.

Materials and Methods

MG vaccines and strains: this study used R-strain as a virulent MG strain. Three types of vaccines were used ts-11 (Merial Select, Gainesville, GA), F-strain (Pfizer Animal Health-Global Poultry, Durham, NC) and K-strain (K5831) (the Poultry Diagnostic and Research Center (PDRC), University of Georgia, Athens, GA, USA) vaccines. The ts-11 vaccine is administered by eye drop; F-strain and K-strain are administered by aerosol using a commercial paint sprayer (Preval® Sprayer Division, Precision Valve Corporation, Yonkers, NY). Each bird was sprayed about 1ml of actively growing culture.

Serology: sera were collected and analyzed for MG antibodies by the serum plate agglutination (SPA), the hemagglutination-inhibition (HI) test and enzyme-linked immunosorbent assays (ELISA).

Isolation and identification of mycoplasma from tracheas, choanal cleft and air sacs by cotton swabs and cultivating in Frey's modified broth and agar at 37°C. Then the bacteria were imaged by direct immunofluorescence (Kleven, 2008).

Random amplified polymorphic DNA (RAPD) analysis was used to characterize the MGs that were isolated (Fan et al., 1995).

DNA Extraction and Real-time PCR (RT-PCR) were performed with the larynges of birds in order to differentiate the strains of vaccines and challenge strain.

Evaluation of lesions: air sac lesions, ovarian regression, tracheal lesions and tracheal mucosa thickness were measured and scored.

Chickens and experimental design: In trial 1 (broilers), there were thirty-five one day old commercial broiler-type chicks assigned in 4 colony houses (4 groups). After two weeks, 10 randomly selected chicks were tested for MG and *M. synoviae* (MS) by serology, RT-PCR and

choanal cleft culture. Then two groups (10 chickens per group) were sprayed with F-strain (5.2×10^7 CCU/ml) and K-strain (5.6×10^7 CCU/ml) at three weeks of age. Three weeks later, vaccinated and ten non-vaccinated chickens (control) were sprayed with R strain (3.9×10^8 CCU/ml). The rest 5 chickens were negative control group. After ten days of challenge, air sac lesion, tracheal mucosa, serology, air sac culture and RT-PCR were performed from these chickens.

In trial 2 (layers), one hundred and ten one day-old female chicks were assigned into two floor pens. Also, MG was checked in ten randomly selected 10 week age chickens by serology, tracheal culture and RT-PCR. After two weeks, two groups of chickens (30 birds per group) were sprayed with ts-11 (4.7×10^3 CCU/ml via eye drop) or K-strain (2.4×10^7 CCU/ml). The rest fifty birds were in the non-vaccinated group. 12 weeks later, serological testing was conducted with twenty chickens of each group and at 25 weeks of age, vaccinated and thirty non-vaccinated chickens were all challenged with R strain (1.7×10^9 CCU/ml). There were 20 birds of negative control (no vaccination and no challenge). Ten days after treating, the chickens were examined with air sac lesion scoring, ovarian regression, the tracheal mucosa measurement, serology, air sacs culture and RT-PCR.

The measurements and analysis methods were appropriate and could help to evaluate the vaccine values by molecular technique. The two trials helped to answer the protective abilities of vaccines in broilers and layers. Moreover, the experimental designs of these trials were suitable but it would be better with more number of birds in trial 1. Also, the authors did not explain why they tested for *M. synoviae* (MS) in blood. If K-strain was a new potential vaccine, it would reduce the air sac lesion scoring, ovarian regression, the tracheal mucosa measurement, increased serum antibodies and reduced the number of MG R-strain in air sac.

Results

In both trials, before vaccination all of tested birds were negative to MG and MS. Table 1 showed the results in trial 1 that vaccinated and non-vaccinated birds which were sprayed with R-strain had seroconversion with SPA, HI and ELISA tests, while the negative control group had negative results. In table 2, the air sac lesion score means and the tracheal mucosa measurement means of K-strain and F-strain groups were significantly lower than those of the non-vaccinated challenged control group and not different from the negative control group. After ten days of challenge with R-strain, the K-strain group had lowest percentage of MG in the air sacs (62.5%), followed by F-strain and non-vaccinated groups (80% and 100%, respectively). Also, by using the strain differentiating qPCR, after vaccination, K-strain was found 62.5% of birds vaccinated with this strain compared to 20% of the F-strain group. However, the R-strain was presented only 20% in birds of F-strain group compared to 62.5% in birds vaccinated with K-strain.

In trial 2 (layers), K-strain vaccinated birds at 24 weeks of age had significantly stronger serological response than the ts-11 birds. After ten days of challenge, the serological response of ts-11 group was significantly higher compared to the K-strain one. Moreover, the negative control birds did not have the seroconversion compared to the vaccinated and non-vaccinated challenged birds (Table 3).

Table 4 indicated that vaccinated birds (both K-strain and ts-11) had significantly less air sac lesion score means compared to the non-vaccinated birds. K-strain group had remarkable lower score mean than that of the ts-11 group. The results of ovarian regression and tracheal mucosa measurement had also the same trend when K-strain vaccinated group had significantly less ovarian regression and tracheal mucosa measurement than those of the ts-11 vaccinated group

and both of these groups had significantly lower ovarian regression prevalence and tracheal mucosa measurement than those of the non-vaccinated group. There was no difference in the MG isolated incidence from the air sacs among three groups (ts-11, K-strain and non-vaccinated challenged groups). By using qPCR for strain differentiating, there was notice that mean copy number (MCN) log₁₀ of K-strain in K-strain group was significantly higher than MCN log₁₀ of ts-11 strain in ts-11 group.

The results indicated good potential of K-vaccine compared to the other commercial vaccines and the data were convincing. However, some data were not clear in terms of number of animals were tested. In the experimental design, the number of birds were selected for testing were 10 but in the results, there were not enough tested animals such as some ratio that had 9/9 or 5/8 (Table 1, 2, 4). Furthermore, the effect of K-vaccine would be more completely evaluated if further approach on egg production or fertility in trial 2.

Discussion

The results from two trials showed that birds had been protected by vaccination. In trial 1, the protective values of both K-strain and F-strain vaccines were not different, but in trial 2, K-strain had significant higher protection than ts-11 vaccine. K-strain and ts-11 vaccines significantly reduced the ovarian regression prevalence in the second trial. K-strain and F-strain vaccines significantly decreased the R-strain colonization in birds in trial 1 and K-strain in trial 2. In conclusion, K-strain showed to be a potential vaccine with equivalent protective value compared to commercial live MG vaccines in terms of respiratory and reproductive lesion and colonization of field strain reduction. K-strain should be considered as a new live vaccine for poultry against MG and therefore more study should be conducted to see the best dose of this vaccine.

Table 1. (Trial 1) Serological response from broiler-type chickens at 10.4 weeks of age (7.4 WPV and 10 DPC with R-strain)^a.

Vaccine	Challenged (R-strain)	SPA ^{bc}	HI ^{bd}	ELISA ^{be}
None	No	0/4 (0.0) ^C	0/4 (0.0) ^C	0/4 (0.03) ^C
F-strain	Yes	10/10 (3.1) ^B	9/10 (1.4) ^{AB}	8/10 (1.00) ^{BC}
K-strain	Yes	8/8 (4.0) ^A	8/8 (1.8) ^A	8/8 (2.66) ^A
None	Yes	9/9 (4.0) ^A	7/9 (1.4) ^{AB}	8/9 (2.10) ^{AB}

^aValues within a column with a different upper case superscript are significantly different ($P \leq 0.05$)

^bNo. of positive samples/No. of tested samples (SPA: ≥ 1 , HI: ≥ 20 , and ELISA: ≥ 0.5)

^cMean agglutination grade (from 0 to 4).

^dMean titer log₁₀

^eMean sample/positive ratio

Table 2. (Trial 1) Air sac lesion scores, tracheal mucosa measurements, MG isolation and strain differentiating qPCR from vaccinated and non-vaccinated broiler-type chickens at 10.4 weeks of age (7.4 WPV and 10 DPC with R-strain)^a.

Vaccine	Challenge (R-strain)	Air sac Lesion Score ^{bc}	Tracheal mucosa thickness ^d	MG isolation – Air Sacs ^b	SD-qPCR	
					– Trachea ^{be}	
					Vaccine	R-strain
None	No	1/4 (0.3) ^B	158.2 ± 29.4 ^B	0/4 ^D	0/4 (0.0 ± 0.0) ^B	0/4 (0.0 ± 0.0) ^B
F-strain	Yes	2/10 (0.3) ^B	319.6 ± 216.8 ^B	8/10 ^{AB}	2/10 (0.5 ± 1.1) ^B	2/10 (0.9 ± 1.8) ^B
K-strain	Yes	2/8 (0.3) ^B	329.7 ± 158.3 ^B	5/8 ^{BC}	5/8 (3.5 ± 3.0) ^A	5/8 (1.8 ± 1.5) ^B
None	Yes	9/9 ^D (2.3) ^A	638.4 ± 77.9 ^A	9/9 ^A	0/9 (0.0 ± 0.0) ^A	9/9 (5.5 ± 0.3) ^A

^aValues within a column with a different upper case superscript are significantly different ($P \leq 0.05$)

^bNo. of positive samples/No. of tested samples

^cMacroscopically scored from 0 to 4

^dMean thickness for the group ± SD (µm)

^eMean copy number log₁₀ ± SD

Table 3. (Trial 2) Serological response of layer chickens at 12 WPV with TS-11 or K-strain (24 weeks of age) and 10 DPC with R-strain (26.3 weeks of age)^a.

Age (weeks)	Vaccine	Challenge	SPA ^{bc}	HI ^{bd}
24	None	No	0/20 (0.0) ^c	0/20 (0.0) ^B
	TS-11	No	19/20 (1.4) ^B	4/20 (0.3) ^B
	K-strain	No	20/20 (2.0) ^A	17/20 (1.3) ^A
26.3	None	No	0/20 (0.0) ^c	0/20 (0.0) ^c
	TS-11	Yes	23/23 (3.9) ^A	23/23 (2.1) ^A
	K-strain	Yes	30/30 (3.5) ^B	30/30 (1.9) ^B
	None	Yes	30/30 (3.8) ^A	29/29(2.0) ^{AB}

^aValues within a column with a different upper case superscript are significantly different ($P \leq 0.05$)

^bNo. of positive samples/No. of tested samples (SPA: ≥ 1 , HI: ≥ 20)

^cMean agglutination grade (from 0 to 4).

^dMean titer log₁₀

Table 4. (Trial 2) Air sac lesion scores, prevalence of ovarian regression (follicle atresia), tracheal mucosa measurements, MG isolation and quantitative strain differentiating PCR from vaccinated and non-vaccinated layer chickens 10 DPC with R-strain at 25 weeks of age^a.

Vaccine	Challenge	Air sac Lesion Score ^{bc}	Ovarian Regression ^{bd}	Tracheal mucosa thickness ^e	MG isolation – Air Sacs ^b	SD-qPCR – Trachea ^{ef}	
						Vaccine	R-strain
None	No	0/20 (0.0) ^c	0/20 ^c	79.4 ± 20.4 ^B	0/20 ^B	0/20 (0.0 ± 0.0) ^c	0/20 (0.0 ± 0.0) ^c
TS-11	Yes	11/23 (0.7) ^B	9/21 ^B	290.6 ± 205.8 ^A	19/23 ^A	6/23 (1.2 ± 2.1) ^B	23/23 (7.0 ± 0.7) ^A
K-strain	Yes	0/30 (0.0) ^c	0/29 ^c	105.8 ± 39.3 ^B	25/30 ^A	25/30 (4.4 ± 2.1) ^A	16/30 (3.2 ± 3.1) ^B
None	Yes	30/30 (2.7) ^A	24/28 ^A	354.9 ± 114.3 ^A	20/29 ^A	0/30 (0.0 ± 0.0) ^c	30/30 (8.2 ± 0.4) ^A

^aValues within a column with a different upper case superscript are significantly different

($P \leq 0.05$)

^bNo. of positive samples/No. of tested samples

^cMacroscopically scored from 0 to 4

^dEvaluated by gross examination, immature ovaries not included.

^eMean thickness for the group ± SD (µm)

^fMean copy number log₁₀ ± SD

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Appendix 6: Hue's Writing Samples

Making mistakes while learning languages is a natural occurrence. According to Gass and Mackey (2007), when learners interact with native speakers or more proficient learners, they “receive information about the correctness and, more important, about the incorrectness of their utterances” (p. 178). This kind of information serves as a signal or alert that helps learners make necessary adjustments to their output so that it is more comprehensible and target-like. Sometimes the signal is straightforward and easy to see, while at other times it could be more subtle. The following analysis of a short conversation will show how the interviewer gives signals to Xue, a Chinese learner of English, and what her reactions were.

Xue seemed to focus on both meaning and grammatical accuracy in this interaction because she constantly rectified herself, as can be seen in these examples:

... because Chinese... China... enter the WTO...

Chinese... China has a lot of chance to communicate with a lot of countries from all over the world.

When we take... took English classes ...

Nonetheless, she consistently used the word ‘grammars’ numerous times. The first time was when she was describing her English classroom in China:

We have a big classroom, and, often, in class teacher uhm... always standing in front of the blackboard, and he or she will begin to talk about English grammars...

The interviewer did not correct her since this did not lead to a serious breakdown in communication. However, as she continued to use the same word erroneously, saying “because Chinese are always focus on grammars, and actually I don’t like grammars at all,” the interviewer decided to give her corrective feedback by asking again, “So your class focuses on grammar?”

Unfortunately, Xue did not notice the error correction provided, which was evident in her elaborating on the reason grammar was focused in her language classroom:

Yeah. Because we have took a lot of examinations. And of course, for Chinese student the most important things (...) is to take a college entrance examinations. So there ... there is a lot of pressures on us, and so we have to learn those grammars, boring grammars.

If she had realized her mistake, she would not have persistently repeated ‘grammars’, which is the wrong form, or used a plural demonstrative adjective ‘those’.

When the same inaccuracy recurred for a 6th time with Xue saying, “They [students] want to take a chance to go into the university and they will have a bright future, so we have to learn the grammars,” the native interlocutor attempted another recast, this time in the form of an affirmative sentence, which is more direct than the previous interrogative recast:

So you have to learn grammar.

Xue’s reply, “Yeah. But when I entered university, I don’t usually learn grammars because I don’t like them,” suggested that she was still not aware of the negative feedback.

Thus Xue continuously produced the word ‘grammars’ seven times. Her usage is definitely wrong. Although ‘grammar’ means “the rules in a language for changing the form of words and joining them into sentences” (Oxford learner’s dictionaries), it is always uncountable in this context. Perhaps Xue was thinking about grammar rules, so she mistakenly thought that ‘grammars’ could be used interchangeably with ‘grammar rules’. It is common for second language learners whose first languages do not have final ‘s’ sounds to be over alert to English ending ‘s’ sounds to the extent that they end up adding an ‘s’ sound to words that do not have ‘s’ in the end while forgetting to articulate it when it does exist at the ending position in other words. Nevertheless, Xue’s use of the false plural demonstrative adjective ‘those’ (“... so we have to

learn those grammars”) and plural object pronoun ‘them’ (“I don’t usually learn grammars because I don’t like them.”) to refer to ‘grammar’ showed that she really believed ‘grammar’ is countable, and she did not make a phonological error but a morphological one.

At the end of the interview, surprisingly, she produced the precise word ‘grammar’:

Yeah, um, when I learn grammar, I will focus on those uh... hard parts and... but I don't like that, but I have to learn that (...)

According to Schmidt’s Noticing Hypothesis (1990, 2001), “second language learners could not begin to acquire a language feature until they had become aware of it in the input.” (Lightbown and Spada 2013: 115). Thus, Schmidt would point out that in this example the learner (Xue) did not notice that her use of ‘grammars’ did not match the target language rule as provided implicitly by her interlocutor, and consequently her ignorance led to repeated missteps until she was finally aware of it and produced the word ‘grammar’ precisely. Krashen’s Monitor Model (Lightbown and Spada 2013), on the other hand, might explain that Xue was eventually able to monitor her correct production of ‘grammar’ when she had had plenty of time, was concerned about producing correct language, and had learned the relevant rule that ‘grammar’ is an uncountable in English in this sense. I would agree with the Noticing Hypothesis, because Xue was really concerned about speaking English properly and even rectified her own mistakes twice when mentioning ‘Chinese’ instead of ‘China’. The problem was that she had not turned on her attention to her interlocutor’s recasts. As a recast is implicit by nature, Gass and Mackey (2007) acknowledge Lyster’s (1998a, 1998b) perception that it may be mistakenly “perceived as responding to the *content* rather than the *form* of an utterance, or as an optional and alternative way of saying the same thing” (p. 185). Gass and Mackey (2007) therefore agree with Mackey, Gass, and McDonough (2000) that “learners may not repeat or rephrase their original utterances

following recasts, and they may not even perceive recasts as feedback at all” (p. 185). Xue must have thought that the interviewer was commenting on the content of her spoken discourse rather than giving feedback on her morphological error.

It is nevertheless possible that in the end Xue was still not aware of the discrepancy between her use of ‘grammar’ and that of her interviewer but only made it right by accident. Therefore, it could be impetuous to conclude that the negative feedback in this interaction is effective. Mackey, Gass, and McDonough (2000, as quoted in Gass and Mackey 2007) found from their study of second language learners’ perceptions about feedback in conversational interaction that “learners were most accurate in their perceptions about lexical and phonological feedback and were generally inaccurate in their perceptions about morphosyntactic feedback,” (Gass and Mackey 2007: 192) For this reason, Gass and Mackey (2007: 189) caution: “whatever the data source, the important point is not to rely solely on the transcript of the interaction but also to investigate the link between interaction and learning by whatever means possible.” This was the first time Xue uttered the right form of ‘grammar’ and we do not know when she would say it accurately again, and how often she would do that to decide if she really had learnt this language feature. Researchers often employ pre-tests and post-tests as well as introspective or retrospective protocols such as language-related episodes where “learners consciously reflect on their own language use” (Gass and Mackey 2007: 185) to measure the effectiveness of the feedback being used.

How I would respond to the same misconception in my classroom depends on the English level of my students and the purpose of the interaction. If my students are advanced learners of English, I might give similar implicit recasts since they are proficient enough to notice the negative feedback and could be able to fix their own mistakes. On the contrary, I would just

disregard the fault if it was made by a low English proficiency student, because I want the student to feel relaxed speaking the language, and because it would not lead to a serious misunderstanding. Otherwise if my focus were not content but grammatical accuracy, I would give the student an explicit corrective feedback. Since this is a minor mistake in my point of view, I would not give any classroom activities on it unless we were having a grammar lesson on countable and uncountable nouns. In either case, my preferred feedback types are prompts and metalinguistic feedback rather than recasts because it is difficult for less proficient learners to detect such implicit feedback.

In short, I believe the kind of feedback given in response to learners' errors should be considered based on the aim of the activity and the proficiency level of learners. Moreover, additional tools should be employed to measure the effectiveness of any type of correction.

Reference

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Hue's Writing Sample 2

The first three chapters of the book give the most fundamental information about the sound system of English. Several phonetic symbols used in this book are different from the ones I am familiar with. I usually look up phonetic transcriptions from Oxford learner's dictionary, where /ɒ/ is used instead of /ɑ/ (as in 'pot'), /ɔ:/ is used instead of /ɔ/ (as in 'bought'), /eɪ/ instead of /ey/ (as in 'say'), and /aʊ/ instead of /aw/ (as in 'now').

I think it is more systematic and reasonable to tell a short vowel sound from a longer one when the latter is written with two dots following the phonetic symbol. Thus, it is much easier to recognize the distinction between /ɪ/ and /i:/, /ɒ/ and /ɔ:/, /ʊ/ and /u:/ because basically the difference in representing them lies in the two dots. Furthermore, /w/ represents the consonant sound of 'w' as is found in 'will', so /aw/ representing the vowel sound in 'now' can be confusing. On the other hand, using the symbols /aʊ/ instead of /aw/ will easily remind learners that this sound is a diphthong and they should start quickly with the /a/ sound then move all the way to /ʊ/.

When I was learning English at the undergraduate level, I was taught about place of articulation, manner of articulation, and voicing. I remember confessing to my best friend that I could not distinguish between a voiced and a voiceless sound. I graduated and started teaching English but I tried to avoid mentioning voicing in my classes because I myself could not tell the difference between being voiced and voiceless. Then one fine day, I thought about voicing again and just at that moment I knew I could feel a voiced sound. So that's it – my self-discovery happened so unexpectedly and without effort. From then on, when it comes to the pronunciation of plural nouns or third person singular verbs in the present tense, I would explain voicing and tell my students to feel the difference between /s/ and /z/. But whether they get it or not, only they themselves know that. Anyway, I do hope those who still haven't got it will understand it one day like I did.

I believe I can pronounce the glottalized /t/ as in 'mountain' but I don't understand the explanation of the glottal stop in the case of 'Uh-oh'.

It is true that Vietnamese sound system does not have /θ/ and /ð/; however, I can produce the sounds correctly (although I cannot say it is exactly native-like). If I can do so, it means other Vietnamese learners can do the same if they have proper practice. But I still have difficulties distinguishing between long and short vowels such as /ɪ/ and /i:/, or /ʊ/ and /u:/. I would appreciate it if you could help me with this problem.

Appendix 7: Nga's Writing Sample

University of Arkansas

Term paper:

**Diet, Inflammatory Bowel Disease, and
potential treatments**



Food microbiology

FDSC 4122

Abstract

Inflammatory bowel disease (IBD) is indicated as an immune system disorder in the intestine. The treatments of IBD still require extensive medical treatment and surgery. The objective of this review is to clarify the correlation of diet and IBD as well as gut human microbiome changes in IBD. From these perspectives, innovative potential treatments for IBD will be introduced. This review verified that the effect of diet on IBD was clearly reflected by the increasing number of IBD incidences in countries that adapt a high fat-sugar and low fiber content diets. Firmicutes appears to consistently reduce in IBD patients. Potential approaches (probiotics, turmeric, honey) which is based on the knowledge of diet and dysbiosis in IBD can be promising treatments for the disease although it is necessary to have more clinical studies before these treatment can be utilized for human.

Key words: diet, dysbiosis, inflammatory bowel disease, inflammatory bowel disease treatments, Firmicutes.

Introduction

Inflammatory bowel disease (IBD) indicates condition in which the immune system abnormally responds to food, bacteria and other materials in the intestine and attacks the cells of the intestine causing chronic inflammation (1). The treatments for Crohn's disease (CD) and ulcerative colitis (UC), two main types of IBD, still require extensive medical treatment and surgery (2). Therefore, studying factors affecting IBD and new approaches to cure IBD has caught the attention of many scientists. Genetic factors are not the sole reason that results in IBD. Genome-wide studies estimated that only 25% of IBD-associated genotype could develop into the disease phenotype. This suggests that environmental factors play a significant role in developing IBD in individuals having IBD-associated genotype (3). Dietary patterns, one of environmental factors, was reported to have an important impact on IBD by affecting the gut microbiome (4) and genetic predisposition of the disease (5). By understanding the association between diet and IBD as well as the imbalance happening in IBD patients, new approaches for curing IBD can be obtained. The aim of this review is to provide an insight into the correlation of diet and IBD, knowledge on dysbiosis- the imbalance of gut microbiome ecology- in IBD, and new potential treatments for the disease.

Dietary pattern affects the incidence of IBD

Even though IBD is prevalent in Northern Europe and North American (6), both developed and developing countries have witnessed the dramatic increase of this disease in recent years (3). This may suggest that the shift of diet composition in non- Western countries from high fiber to high-sugar and fat-content food increases the risk of getting IBD in those countries. An outstanding case of speedy changes in dietary pattern is Japan. From 1945, after the end of

World War II, a large proportion of Japanese population underwent westernization which was likely to result in a noticeable shift in diet composition from dietary fiber toward high-sugar content food. It is noteworthy that the IBD incidences in Japan have concurrently increased 100 times in the past 30 years (7). This is a clear evidence of an association between diet and IBD.

There are various pathways for diet to influence on intestinal inflammation. It can affect immune system, gut microbiome and gastrointestinal permeability (4). Diet and bacterial metabolites have been reported to play a key role in manipulating gut and immune homeostasis and inflammation. Specifically, the fewer "healthy foodstuffs" (dietary fiber, fish, and elements of the Mediterranean diet) are consumed in daily meal, the less dietary-related metabolites are produced. The special thing about these metabolites is that they have engagement with "metabolite-sensing" G-protein-coupled receptors (GPR43, GPR41, GPR109A, GPR120, and GPR35) which have expression on immune cells and gut epithelial cells, as well as regulate a direct anti-inflammatory effect (8). By affecting the anti-inflammatory activity, the shortage of healthy food can obviously increase the risk of getting IBD.

Not only does dietary habit affect the immune system, it also affects the gut microbiome ecology. A study on colon cancer risk in native Africans and African Americans, having the same age and sex, revealed that different diet resulted in different microbial composition. *Prevotella* (enotype 2) and butyrate-producing bacteria are more prevalent in native African than American African (9). This result is in accordance with previous studies which also observed the predominance of *Prevotella* in rural African. *Prevotella* is reported to effectively ferment dietary fiber which, in turn, increases the concentration of short-chain fatty acid (4). In African Americans group, the predominant bacteria groups is *Bacteroides* and it is noticeable that the microbial gene responsible for producing secondary bile acid were more plentiful. All

these results suggested that a fiber rich diet of native Africans lowered the colon cancer risk by influencing the microbiota to produce health-promoting metabolites like butyrate, and increasing short-chain fatty acid whereas the Western diet increases the risk of cancer when having predominant bacteria groups which produce potentially carcinogen like secondary bile acid (9). Although this research is related to colon cancer, it is likely that diet can affect microbiota in IBD with the same mechanism.

Different dietary composition have a crucial impact on gut microbiome and immune activity so changes in dietary habit can indicate the increase or decrease of IBD incidence. Therefore, it is necessary to consider diet factors in studying IBD treatment.

Gut microbiota in Inflammatory Bowel Disease

Microbiota are the heterogenous community of microorganisms that have colonized in human body since his birth (10). The gut microbiota and human body work together using various bi-directional instructive mechanisms to maintain intestinal homeostasis. The gut microbiota is influenced by epithelial and immune cell-derived mucosal signals and in turn, affect the mucosal immune system by their by-products (11). If this symbiotic relationship does not function correctly, the response to pathogens and maintenance of harmless antigen will be disturbed. Moreover, the imbalance in microbiota is postulated to be the cause of autoimmune and inflammatory disorders (12). Therefore, dysbiosis, an absence of some gut microbiota composition, can be the main cause of intestinal immune disease like IBD (7).

A study using 16S rRNA-based pyrosequencing identified mucosal-associated microbiota in healthy individuals. The study confirmed that Firmicutes, Bacteroidetes and Proteobacteria is predominant in healthy human (13). The fecal microbiota in CD and UC is different from that of

infectious colitis (IC) and healthy subjects (HS). Researchers compared the microbiota in fecal samples of four different groups by using fluorescent in situ hybridization (Fish) and flow cytometry. The study reported the "phylogenetic gap" in both CD and UC patients compared to HS and IC patients. Although the absence of dominant bacterial group-Firmicutes, was known in CD before, this is the first time this "Phylogenetic" gap is observed in UC patients. This may suggest that the reduction of those main groups of bacteria is specific for IBD. The dysbiosis showed the reduction of Firmicutes in both CD and UC samples, which was not observed in IC and HS. More specifically, in UC patients, *C. coccoides* group was reduced and *C. leptum* groups were reduced in CD patients (14). This research only focused on fecal microbiota so the question is that whether dysbiosis will be different when studying other type of samples rather than fecal samples.

It appears that with different types of samples and methods, Firmicutes is still the dominant group that missing in IBD patient. Another study also analyzed the microbial community dysbiosis in IBD but with a different approach. Researchers used rRNA sequences to analyze the microbiota in gastrointestinal (GI) tissues from CD, UC patients and non-IBD. It is believed that the surgical samples will give better access to wall- associated microbiota which is more accurate than fecal microbe. The results showed that there are abnormal GI microbiotas in CD and UC samples. Interestingly, although the study used different sample types and methods, one of two groups of bacteria absent in microbiota, Firmicutes, is similar to the previous study (2). This suggests that Firmicutes may be a universal microbial composition in the dysbiosis in IBD.

Another aspect of dysbiosis is microbial pathways disturbance. In fact, besides the imbalance in microbial population, dysbiosis in IBD is also known to be associated with significant malfunction in microbial metabolic pathways that tend to have effects on the IBD patients. In a

study, researchers utilized 16S gene pyrosequencing and shotgun metagenomics method to analyze DNA extracted from fecal samples and biopsies of 121 CD patients, 75 UC patients and 27 healthy controls. The aim of the study was to identify not only microbial composition but also microbial function of gut human microbiome in IBD. The results revealed that in IBD patients, the microbial function experienced more changes than microbial composition. The difference in genera was 2% while there was 12% of microbial pathways different. Among these, oxidative stress pathways, carbohydrate metabolism and amino acid biosynthesis dramatically changed in IBD patients. Specifically, the abundance of metabolism and biosynthesis genes of almost all amino acids (especially, histidine and lysine) reduced. Interestingly, *Firmicutes*, along with Enterobacteriaceae, was again identified as a group of bacteria of which the abundance changed in IBD. Also in the study, it is reported that human gut microbiome in IBD is not only influenced by the disease itself but also by the applied treatments (mesalamine treatments for UC and immunosuppressants for CD), type of samples (stool or biopsy) and patients characteristics (age, smoking) (15).

Potential treatments for IBD

Previous studies offered an understanding of the mechanisms of probiotic activity in IBD which verified the effectiveness of using probiotics in curing the disease. The combination of 4 strains *Lactobacillus* provided a compelling effect in the management of IBD which lent support to the usage of probiotic approach in treatment of IBD (16). Recent studies have elucidated bacterial populations that are absent in the gut microbiota of IBD patients. These knowledge can be utilized in researching new probiotic treatments for the disease. The role of *Firmicutes* in protecting patients from the recurrence of IBD is an interesting aspect to study. In fact, *Faecalibacterium prausnitzii*, a major of *Firmicutes*, was proven to be anti-inflammatory in-

vitro as well as in vivo. In the first part of the study, researchers identified the composition of mucosa-associated microbiota of CD patients at the time of surgical resection and 6 months later to compare the proportion of *F.prausnitzii*. Using Fish analysis, researchers reported that the reduction of *F. prausnitzii* on resected ileal Crohn mucosa had a relation with endoscopic recurrence at 6 months. It means that *F. prausnitzii* had a certain role in preventing inflammation. The second part of the study, *F. prausnitzii*'s anti-inflammatory effects is examined in cellular models (in vitro) and in colitis mice (in vivo). The results showed that *F. prausnitzii* had an anti-inflammatory effect in vitro and decreased the mortality rate in colitis mice . This study offers a promising method for treating CD by using *F. prausnitzii* as a probiotic (5). However, more studies are required in order to understand the optimal treatment and dosage of this probiotic.

Another potential approach to cope with IBD is utilizing dietary components. A study examined *in vitro* effect of turmeric extract on two gene relating to IBD, solute carrier protein 22 A4 (SLC22A4) and interleukin-10 (IL-10) by using HEK293 cells. The results showed that turmeric could decrease abnormal epithelial cell transport and enhance the activity of cytokine gene promoter which plays a role in anti-inflammation (17). Even though more studies need to be carried out to clarify the effect of turmeric extract *in vivo*, this result proposed a very promising possibility of using turmeric in IBD treatment. Moreover, Manuka honey is another potential dietary component in curing IBD. In the article, the effect of different doses of Manuka Honey in experimentally induced inflammatory bowel disease (IBD) in rats, scientists established the correlation between oxidant/antioxidant imbalance and the cause of IBD. This correlation explained why in their study, Manuka honey, an antioxidant agent, was evaluated its impacts on induced IBD in rats. Adult pathogen-free young male Wistar rats (n= 30) were divided into 5

groups (n = 6) in which 4 groups were induced colitis by using 20 mg TNBS (2,4,6-trinitrobenzenesulfonic acid) dissolved in 0.25 mL ethanol and 1 control group treated by 35% ethanol; five groups include group I (ethanol as vehicle - control group), group II (20 mg TNBS in 35% ethanol), group III (360 mg/kg body weight sulfasalazine- positive control), group IV (5g/kg body weight Manuka honey) and group V (10g/kg body weight Manuka honey). After 14 days of colitis induction, colonic mucosa of all groups was utilized to evaluate the changes in morphological analysis, histological analysis as well as various antioxidant parameters (Myeloperoxidase activity, lipid peroxidation, reduced glutathione, superoxide dismutase (SOD), catalase, glutathione peroxidase). In morphological analysis, both different doses of Manuka honey expressed remarkable effectiveness in ameliorating inflammatory condition in TNBS colitis induced rats compared to the control group. Histological analysis indicated no cryptitis in Manuka honey group and there were no difference in histological score for both doses of Manuka honey. While the low dose of Manuka honey was more effective in restoring Myeloperoxidase activity (MPO) and Lipid peroxidation, high dosage Manuka honey showed striking effects in increasing SOD activity. Treatment with both different doses of Manuka honey improved antioxidant parameters to the control level except in catalase activity; although catalase activity increased in honey treatment compared to the TNBS group, it was significantly lower than the control group. The improvements in morphological inflammatory and antioxidant parameters in TNBS induced colitis rats as treating with oral Manuka honey (5g/kg and 10g/kg body weight) confirms that Manuka is efficient in treating TNBS-induced colitis rat model. (18). The study provided a compelling evidence that Manuka honey can effectively improve the inflammatory condition in IBD induced rat.

Based the knowledge on dysbiosis and association between diet and IBD, scientists can possibly reach for new approaches in curing IBD. However, most studies on novel IBD treatments are only carried out *in vitro* or on animal model, so there still remains a need for clinical studies of these new potential treatments in order to identify their effect on human body and the optimal dosage for implicating to treatments for human.

Conclusion

In summary, diet plays an important role in affecting the microbiota of IBD patients. Shifting dietary habit can lead to the changes in microbiota which may result in IBD. Dysbiosis is consistently observed in IBD not only in microbial composition but also microbiobiofunction. It is possible that if we can ameliorate the dysbiosis, IBD may be cured. Therefore, understanding the abnormal microbiota as well as factors affecting it in IBD patients can be major progress in curing IBD. Recent studies help to clarify the composition of microbiota in IBD patients, which can lead to better understanding in dysbiosis in these diseases. In fact, the discovery of *F. prausnitzii*'s anti-inflammatory effects as well as positive effect of dietary components such as turmeric and honey are a really good start for future research in using new approach in the treatment of IBD. However, clinical studies are necessary to confirm if these are effective treatments for IBD.

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Appendix 8: Hong's Writing Sample

**N-NITROSODIMETHYLAMINE FORMATION AND REMOVAL
IN DRINKING WATER SYSTEMS**

(CHEG 5133)

November 23, 2015

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Acronyms and Abbreviation used in the text

EPA	United State Environmental Protection Agency
Kow	Octanol/water partition coefficient
NDMA	N-nitrosodimethylamine
UDMH	Unsymmetrical dimethylhydrazine
WHO	World Health Organization

I. Introduction

N-Nitrosodimethylamine (NDMA) is a strong potent carcinogens for most living creatures. It is reported that feeding NDMA to rats could induce liver cancer. In fact, NDMA is not direct carcinogen, there are some enzymatic oxidative reactions take place and convert it into a precursor of the ultimate carcinogen (Fig. 1)¹. The International Agency for Research on Cancer (WHO, 1987) classified NDMA as a “probable human carcinogen”. Their cancer potencies are much higher than those of the trihalomethandes. The daily tolerable limit for intake was identified to be 4.0 – 9.3 ng/kg.day². WHO proposed the value of 100 ng/L in water, about 2.9 ng/kg.day intake³.

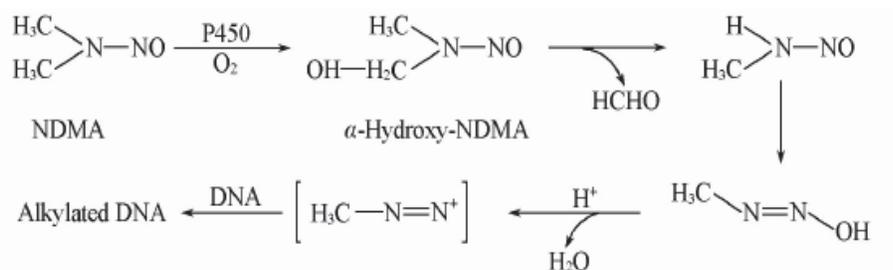


Figure 1- Carcinogenic mechanism of NDMA

At first, human exposure to NDMA was focus on food, consumer products and polluted air. The attention for NDMA in drinking water system arose after the detection of elevated concentration of NDMA in the water supply in Ohsweken, Ohio, Canada⁴. After that, the discovery of high concentration of NDMA in groundwater (near a rocket engine testing facility in Sacramento County, California that used UDMH-based rocket fuel) as high as 400,000 ng/L on site and 20,000 ng/L caught the attention of governments and researchers⁵. A statewide survey at drinking water facilities also indicated that NDMA occurrence was not limited to region proximal to facilities that used UDMH-based fuels, but also associated with chlorine or chloramines disinfection of water and wastewater.

Although being listed as a priority toxic pollutant in the Code of Federal Regulations, there is no federal maximum contaminant level has been established for NDMA in drinking water. Only California and Massachusetts have established their own regulatory limit for NDMA in drinking water, 10 ng/L.

I.I. Chemical and Physical properties

NDMA is the simplest compound in strong carcinogenic aliphatic Nitrosamines family. Its formula is $C_2H_6N_2O$ and the chemical structure is demonstrate in Fig. 2. It has molecular weight about 74.08 g/mol and its vapor pressure at 25°C is 1080 Pa. Due to its structure, NDMA is fairly hydrophilic with log Kow = 0.27⁶, and is miscible with water.

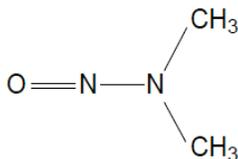


Figure 2- Structure of NDMA

I.II. Analytical methods and analytical achievability

Because of its potent carcinogenicity, NDMA needed to be detected at ppt level (nanoram per liter). The procedure to analyze NDMA is normally started with a liquid or solid extraction to concentrate the NDMA concentration in the samples then use gas or liquid chromatograph and mass spectrometer to separate and quantification NDMA in the samples.

EPA already published the methods to detect NDMA in both drinking water and wasterwater. EPA Method 521 is applied for drinking water, uses solid phase extraction (SPE) with methylene chloride as an eluent, fused silica capillary gas chromatography column for separation, and tandem mass spectrometer as a detector. This method is meant to detect not only NDMA but also 6 others nitrosamines compounds: N-nitrosomethylethylamine (NMEA), N-nitrosodiethylamine (NDEA), N-nitrosodi-n-propylamine (NDPA), N-nitrosodi-n-butylamine (NDBA), N-nitrosopyollidine (NPYR) and N-nitrosopiperidine (NPIP).

Analyte	DL (ng/L)	LCMRL (ng/L)
NDMA	0.28	1.6
NMEA	0.28	1.5
NDEA	0.26	2.1
NPYR	0.35	1.4
NDPA	0.32	1.2
NPIP	0.66	1.4
NDBA	0.36	1.4

Figure 3- Detection Limit (DL) and Lowest Concentration Minimum Reporting Level (LCMRL) according to EPA Method 521

Method 607 covers the detection of NDMA along with two others nitrosamines compounds NDPA and N-nitrosodiphenylamine (NDFA) in municipal and industrial wastewater. The samples are extracted with methylene chloride, further treatment with diluted hydrochloric acid in order to remove free amines. Gas chromatography and nitrogen-phosphorous detector are used to separate and quantify these targeted compounds. The detection limit for NDMA reported to be 0.15 µg/L

There are also many others methods such as EPA 1625, EPA SW-846 Method 8070 and 8270. Mitch et. la also developed method in order to quantify NDMA precursors in waste or wastewater⁷.

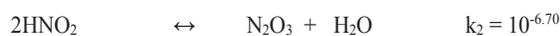
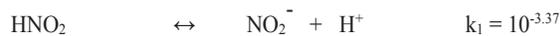
II. Reaction pathway

There are many mechanisms have been suggested to explain the occurrence of NDMA in drinking water and their impacts are listed in Figure 4⁸.

Mechanism	Features	Importance
Chloramination	<ul style="list-style-type: none"> Dichloramine as the active reagent Formation over days Yields ~2% for most secondary/tertiary amines but >50% for amines with β-aromatic groups Bromide catalysis for high bromide concentrations (>500 $\mu\text{g/L}$) 	High
Ozonation	<ul style="list-style-type: none"> Rapid formation (<1 h) Bromide catalysis important for 15 $\mu\text{g/L}$ bromide Importance restricted to source waters impaired by hydrazines/sulfamides 	Limited
Chlorine-nitrite	<ul style="list-style-type: none"> Formation of the nitrosating and nitrating species, N_2O_4 Rapid reaction (<1 h) but yields 2 orders of magnitude lower than for chloramination Low importance due to low concentrations of nitrosamine precursors, low yields and limited co-occurrence of chlorine and high nitrite concentrations 	Limited
Breakpoint chlorination	<ul style="list-style-type: none"> Formation of nitrosating species from chloramine decay reactions at the breakpoint Rapid enhancement of nitrosamine formation Importance limited to poorly-controlled breakpoint chlorination scenarios where no significant free chlorine residual is achieved (mixing of chlorinated and chloraminated waters in consecutive systems?) 	Low
Activated carbon	<ul style="list-style-type: none"> Formation of nitrosating species from nitrogen gas on activated carbon surfaces Restricted to secondary amine precursors Low importance due to low concentrations of secondary amine precursors 	Low
Photolysis	<ul style="list-style-type: none"> Sunlight photolysis of nitrite or UV photolysis of secondary chloramines Low importance due to low concentrations of nitrite and secondary amines, low yields (<0.3%) and photolysis of nitrosamine products 	Low

Figure 4- NDMA formation mechanism and its importance

In food, normally NDMA and related nitrosamines can be formed by nitrosation of secondary amines by nitrite. Toxicologists studied nitrosamine formation in the stomach have proposed by the following sequence of reactions to explain the kinetics of NDMA formation⁹:



Consequently, the formation of NDMA depends strongly on pH and the maximum rate occurs near the range of 3.4:

$$\frac{d[\text{NDMA}]}{dt} = k[(\text{CH}_3)_2\text{NH}][\text{HNO}_2]^2 \quad \text{with } k = 1.5 \times 10^{-5} \text{ M}^{-2}\text{s}^{-1}$$

However, this hypothesis does not explain for the formation of NDMA in water and wastewater treatment plants. For instance, there would be around 10^{-21} g/L of NDMA formed after 24h with

concentration of nitrite and DMA about 100 μM at neutral pH. Moreover, at pH = 7 under normal operation conditions of water and wastewater treatment plants, nitrite is easily oxidized by hypochlorite to form nitrate with half-life less than 1s^{10} . Therefore, it would be unlikely for nitrous acid to be able to produce dinitrogen trioxide.

Mitch¹¹ proposed a different way to explain the formation of NDMA in water and wastewater treatment plants using chlorination in disinfection process. This explanation involves the formation and oxidation of an intermediate 1,1-dimethylhydrazine, well-known as unsymmetrical dimethylhydrazine (UDMH). UDMH is a main product of the reaction between monochloramine and dimethylamine at pH greater than 10. It was used as a component in rocket fuel. At neutral pH, with the presence of oxidants, UDMH is converted into many products such as dimethylcyanamide (DMC), formaldehyde monomethylhydrazone (FMMH), formaldehyde dimethylhydrazone (FDMH), dimethylformamide (DMF) and NDMA. The pathways are illustrated in Figure 5 and 6¹¹. The yields of NDMA are relative low (~5%) in all experiments. The reaction takes very long time to occur, normally period of days. Choi and Valentine determined the rate constant for these two steps as $k_1 = 6.4 \text{ M}^{-1}\text{s}^{-1}$ and $k_2 = 0.3 \text{ M}^{-1}\text{s}^{-1}$ obtained by fitting the observation NDMA concentration formed by DMA and NH_2Cl at neutral pH; however UDMH concentration was not measured¹².

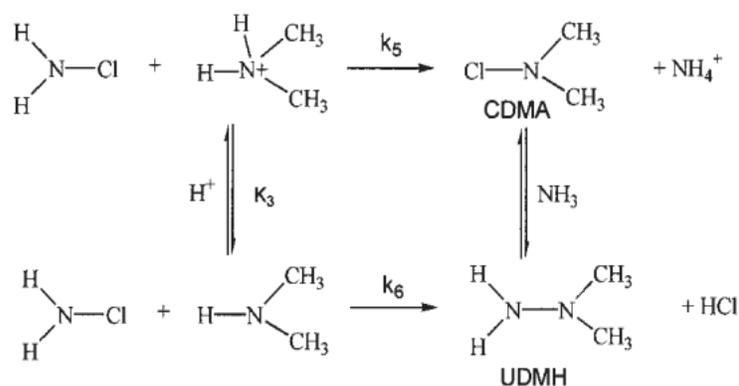


Figure 5- UDMH intermediate formation from DMA and monochloramine

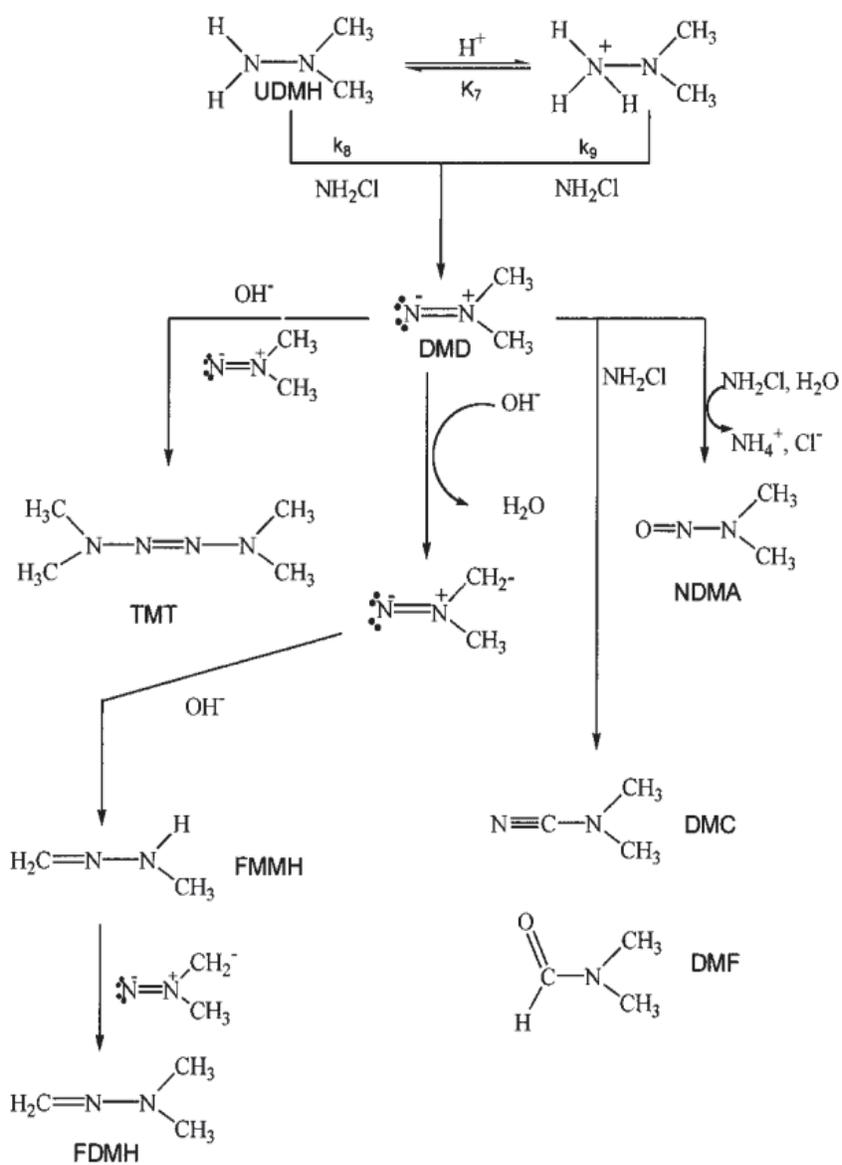


Figure 6- Proposed reaction mechanism for NDMA formation via UDMH as an intermediate

With further investigation, Schreiber and Mitch¹³ found out there are at least two factors that did not fit the proposed pathway involving monochloramine. First, the amount of NDMA formed by reaction between monochloramine and DMA is 100 times higher than that of monochloramine and UDMH with equivalent concentration, even though UDMH was believed to be a key intermediate. Secondly, the formation of UDMA by monochloramine and DMA was experimentally reported¹⁴ to have a rate constant value of 0.081 M⁻¹s⁻¹, which was 100 times lower than the value predicted by Choi and Valentine. The reaction model suggested by Choi and Valentine also did not take into account the effect of pH. Therefore, a new reaction pathway has been proposed.

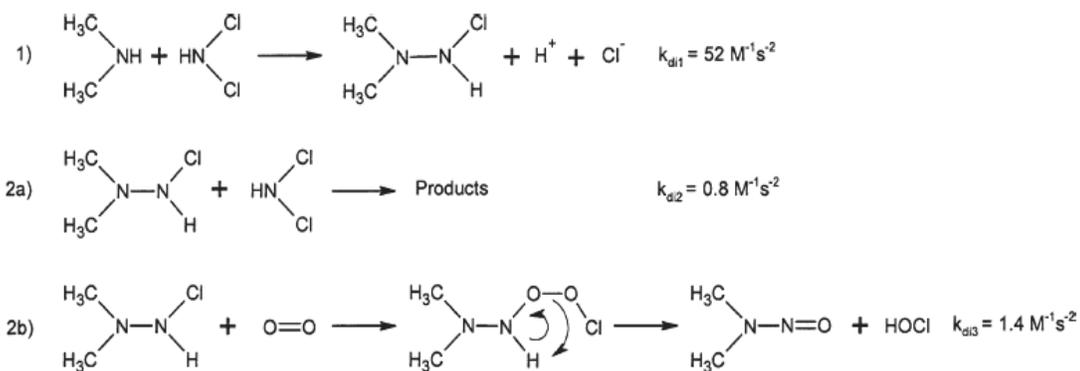


Figure 7- The mechanism for NDMA formation involving dichloramine and dissolved oxygen

All the elementary rate constants were based on experimental observed data. This pathway demonstrates that dichloramine instead of monochloramine played an important role in NDMA formation. The intermediate formed is chlorinated unsymmetrical dialkylhydrazine - UDMH-Cl. This intermediate is later oxidized by dissolved oxygen, instead of monochloramine as previously proposed mechanism, in water to form NDMA along with a variety of other products.

III. NDMA precursors

Chloramination is the major cause for NDMA formation in drinking water system, and amines are believed to be the dominant source of precursors during chloramination. Amide, the other major compound of organic nitrogen precursors, react much slower with chloramines than amine, due to the electron withdrawing effect of the carbonyl group on the nitrogen. However, the slow formation of secondary amines from certain amide can produce high concentration of NDMA in periods of 7 days¹⁵.

Reaction between primary amines and chloramines can produce primary nitrosamines. However these compounds decompose nearly instantaneously into a carboncation and nitrogen gas. Most secondary amines can make stable secondary nitrosamines, NDMA formation from DMA gain most of the attention in the field.

Tertiary amines can also serve as NDMA precursor. After contact with chloramines, tertiary amines can decay and result in an aldehyde and a secondary amines which as mentioned above can produce stable secondary nitrosamines. It is significant to note that those compounds with an aromatic group in the β -position to the nitrogen can form NDMA at very high concentration during chloramination. These substance are commonly found in pharmaceuticals. For instance, ranitidine which is the active ingredient in actacid Zantac can yield NDMA up to 60 – 90%¹⁶. It is suggest that these compounds can react with chloramine to produce NDMA without being decay to form secondary amines intermediate, however, the pathway still remains unclear.

Due to the positive charge in the nitrogen, it is harder for quaternary amines to react with chloramine than secondary amines. The average yields is around 0.2%. The reaction pathway is likely involve the decay of quaternary amines to release secondary amines by radicals¹⁷. These amines are main components in personal care products such as shampoos, cosmetics and materials in drinking water treatment, for example anion exchange resins and cationic polymers in coagulation process.

IV. Removal of NDMA and its precursors

There are two fundamentally different approaches in order to remove NDMA proposed for drinking water treatment. The first one attempted to remove NDMA precursor, so that the formation of NDMA will be minimized, while the other aimed to remove NDMA after it had been already formed.

Treatment	Features	Importance
Polymer optimization	<ul style="list-style-type: none"> Reduction in polyDADMAC dosage can reduce, but not eliminate NDMA formation. 	High
Precursor pre-oxidation	<ul style="list-style-type: none"> Involves risk tradeoffs because increasing pre-oxidant exposure promotes the formation of DBPs associated with each pre-oxidant. Ozone most effective, followed by chlorine UV treatment only partially effective at advanced oxidation process fluence Chlorine dioxide relatively ineffective 	High
Alternative polymer	<ul style="list-style-type: none"> Nearly all cationic polymers currently in use will contribute to nitrosamine formation because they are amine-based. Epi-DMA polymers are more potent precursors than polyDADMAC. Polyacrylamide has much less precursors than polyDADMAC. 	High
Activated carbon	<ul style="list-style-type: none"> Activated carbon is more efficient at removing NDMA precursors than TOC in limited studies. 	High
Riverbank filtration	<ul style="list-style-type: none"> The ability to remove precursors for other nitrosamines is limited to one study in China. Limited evidence shows that riverbank filtration can remove NDMA precursors. 	Moderate
Modify chloramination protocol	<ul style="list-style-type: none"> Minimizes dichloramine, the active inorganic chloramine for promoting nitrosamine formation Involves a hydraulic mixing phenomenon. Needs more pilot- or full-scale testing to characterize importance. 	Moderate
Biofiltration	<ul style="list-style-type: none"> Biofiltration may remove NDMA precursors, but can also increase NDMA formation by transforming some precursors into more potent forms. 	Low/Moderate
UV treatment	<ul style="list-style-type: none"> Full-scale applications ongoing for hazardous waste treatment and wastewater recycling applications Destroys nitrosamines, but only modest destruction in nitrosamine precursors (see pre-oxidation). Nitrosamine formation would continue from remaining precursors within chloraminated distribution system. 	Low
Anion exchange	<ul style="list-style-type: none"> Anion exchange resins can increase nitrosamines. The ability of anion exchange resins to remove nitrosamine precursors is unclear. 	Low
Coagulation/softening	<ul style="list-style-type: none"> Neither process significantly removes NDMA precursors. 	Low

Figure 8- Treatments for NDMA and its precursors⁸

IV.I. Remove NDMA precursors

As mentioned earlier, the formation of NDMA in drinking water systems involves the reaction between unchlorinated organic nitrogen compounds and dichloramine. Therefore, the removal or deactivation of nitrogen-containing compounds or minimized the dichloramine dosage would reduce NDMA formation. In the case of the system that use cationic coagulation polymers, such as polyDADMAC, reducing the polymer dosage can decrease the formation of NDMA¹⁸. For wastewater-impacted source water, which usually has high concentration of nitrogen – containing compounds, these compounds can be removed or deactivated

by using ozone¹⁹ or free chlorine²⁰. As the mechanism of NDMA formation requires an initial nucleophilic attack between dichloramine and the lone electron pair of nitrogen, the treatment with strong oxidant would couple the lone pair, therefore preventing any further formation. Recently, it has been found that changing the method of adding chlorine and ammonia can reduce the concentration of NDMA formed during chloraminating²¹. Due to the fact that chloramine reaction take much shorter time than normally reagent mixing time, by adding chlorine downstream of ammonia, it will come to the point that the chlorine to ammonia ratio exceed Cl₂:N = 5:1 by weight. Dichloramine is likely to form under this condition. In another hand, if chlorine flow is opposite to ammonia flow, the condition is reversed and monochloramine is favorable to form.

IV.II. Treatment for NDMA

UV treatment: is the most common technique to remove NDMA. NDMA strongly absorbs light with wavelength around 230 nm with $\epsilon = 7000 \text{ M}^{-1}\text{cm}^{-1}$ and 300 nm with $\epsilon = 100 \text{ M}^{-1}\text{cm}^{-1}$. Those bands corresponding to the $\pi - \pi^*$ and $n - \pi^*$ transitions respectively. These adsorption usually leads to the breaking N–N bond and produce dimethylamine and nitroso radical. For this process, dimethylamine and nitrite are the primary products. However, there are also a small amount of formate, formaldehyde and nitrate are yield, 0.13 at pH = 7²². However, the UV dosage required is about 1,000mJ/cm² which is 10 times higher than those employed for virus removal. Consequently, the cost for operation UV treatment for NDMA is more expensive than that for disinfection.

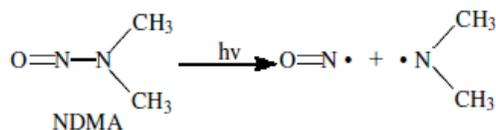


Figure 9- Photodecomposition of NDMA

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