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UMI
Using Task-Based E-Mail Activities in Developing Academic Writing Skills in English as a Second Language

by

Yili Li

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A Dissertation Submitted to the Faculty of the

GRADUATE INTERDISCIPLINARY PROGRAM IN SECOND LANGUAGE ACQUISITION AND TEACHING

In Partial Fulfillment of the Requirements
For the Degree of

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THE UNIVERSITY OF ARIZONA

1998
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Yili Li entitled Using Task-Based E-mail Activities in Developing Academic Writing Skills in English as a Second Language and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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I dedicate this work to my mother

who always believes that I can succeed.

I also dedicate this work to my husband

who is always there for me even when he is far away.
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ABSTRACT

This study investigated the efficacy of using e-mail in the form of a class mailing list to help ESL students practice and develop academic writing skills beyond the spatial and time limits of a writing classroom. In this study, e-mail writing tasks of different purposes, audiences and task structures were integrated into a process-oriented freshman ESL writing class. The subjects of this study were 22 ESL students in a freshman composition course. In an ex post facto design (Hatch & Lazaraton, 1991), this study involved within-subject repeated measures of data collected from different e-mail writing tasks over the course of a semester. Data analysis included 1) computerized text analysis focusing on the linguistic and textual features of written discourses at the levels of syntactic complexity, lexical richness, textual cohesion and grammatical accuracy; 2) holistic and analytical assessments by ESL raters focusing on the overall rhetorical features and quality of writing.

The results indicated that there were syntactic, lexical, textual and grammatical differences in ESL students' writing performance on e-mail writing tasks of different rhetorical purposes, and there was also variation between e-mail tasks involving an interactive audience and those involving an non-interactive audience, and between structured versus non-structured e-mail tasks. In particular, in e-mail tasks in which an interactive audience was present, students tended to produce texts that were linguistically more complex. Besides, students wrote with a higher level of syntactic and lexical complexity in the non-structured e-mail tasks than in the structured ones, indicating more
sophisticated use of language when the student were given more freedom and control of the learning activities. The results also showed obvious tradeoff effects between linguistic complexity and accuracy, i.e. while students produced texts that were linguistically more complex, there was less attention to grammatical accuracy. Furthermore, the results suggested that motivation, attitude, and anxiety had some significant contributions to the variation in ESL students' writing performance while they composed in an electronic mode.
Chapter 1

Introduction

Background of the Study

Pedagogical Trends towards Computer Use in L2 Writing Instruction

To date, with the wide spread of computer-assisted language learning (CALL) in L2/FL instruction, computer-assisted writing instruction has found its way into L2 classrooms (Dunkel, 1991; Garrett, 1991; Pennington & Brock, 1992). As Biber (1992) notes: "Of all the areas in which computers have been used to teach language skills, writing has received the most attention and research" (p. 271). Indeed, with the rapid evolution of modern information and communication technologies, computer technology has permeated L2 writing instruction in many aspects.

The early use of computers in L2 writing classrooms was largely for word processing. At a time when the field of L2 writing underwent a paradigm shift from the traditional product-oriented approach to the process-oriented approach which emphasizes multiple revisions, the computer has demonstrated great capacity for assisting the writing process for L2 students. The features of word processing have been shown to facilitate L2 learners' composing process by enabling them to make easier and faster revisions (Brock, 1990; Dunkel, 1991; Phinney, 1989).
In recent years, the advancement of modern technology has brought about more innovative use of computers for L2/FL learning and teaching. Although the word processor is still the primary tool for computer-aided writing, computer-mediated communication realized through different kinds of computer networks has been introduced into L2/FL instruction. By now, the popular networking tools used in L2/FL teaching include e-mail, synchronous and asynchronous computer conferencing and the World Wide Web (The definitions of these terms will be presented later in this chapter). The application of such telematic tools have caused fundamental changes in the dynamics of L2/FL classrooms, which are most obvious in terms of classroom communication and interaction among students themselves, and between teachers and students (Johnson, 1991; Leppanen & Kalaja, 1995; Sollito, 1997; Liaw, 1997; Warschauer, 1995b, 1996c). Consequently, changes have occurred in the learning environment. Computer-mediated communication has led to more social, interactive, collaborative, communicative, and student-centered classrooms. Besides, computer networking enriches and expands the opportunity to learn and use the target language naturally and with a communicative purpose. The changes that have taken place with instructional innovation in L2/FL teaching are congruent with the pedagogical trends towards process-oriented communicative writing in L2 writing pedagogy.
Theoretical Rationales for Computer-Mediated Communication in L2 Writing

In light of the principles described in theories of second language acquisition, there are several strong rationales for applying computer-mediated communication to L2 writing instruction. First, computer-mediated communication helps develop a learning environment that promotes interactive language learning and provides opportunities for authentic use of the target language for second language learners (Chun, 1994). This distinctive aspect of computer-mediated communication is congruent with the discourse-based second language acquisition theories which emphasize the role communicative interaction plays in second language learning (Gass & Varonis, 1985; Long & Porter, 1985; Pica, 1987; Pica, Young, & Doughty, 1987). The capacity of the computer network to link students from different schools, areas and even different parts of the world together enriches and expands the opportunities for L2 students to interact with peers, teachers, as well as native speakers of the target language. Through written communicative interaction, L2 learners engage in negotiation of meaning to improve their comprehension of linguistic input, which is considered a necessary condition for second language acquisition (Krashen, 1985). It is evident that the interactive learning environment of computer networking is facilitative of second language learning.

Second, computer-mediated communication encourages collaborative writing in the L2 classroom, which is based on the assumption that writing is basically a social activity that is constructed through interaction with others (Strasma & Foster, 1992). The social view of writing maintains that writing should be approached with an emphasis on the
social aspect of the writing process. Collaborative writing activities in the L2 classroom enhance second language writing development through increasing engagement, confidence and responsibility on the part of the L2 learners (Strasma & Foster, 1992). Since computer networking can easily bring students together beyond the constraints of time and space, L2 students have extended opportunities to work together, challenge each other, and give feedback to each other's writing in an ultimate attempt to develop their L2 writing abilities.

Third, computer-mediated communication fosters student empowerment, i.e. students' increased control of the content and process of their own learning (Warschauer et al, 1994). This sense of control and mastery, which is termed "learner autonomy" by second language educators, is viewed as especially important for language learning (Wenden, 1991). The interactive learning environment of computer-mediated communication in language classrooms decentralizes the teacher's authority and increases student-student interaction in the written form. As a result, the classroom dynamics becomes more social, communicative and student-centered. As students assume more responsibilities for language learning, they can learn more effectively (Wenden, 1991).

Fourth, computer-mediated communication attests to the importance of social and affective factors in second language learning by promoting student motivation and interest in second language writing, and providing students a less threatening means to communicate (Beauvois, 1995; Beauvois, & Eledge, 1996; Warschauer, 1996c). On-line writing provides an authentic writing situation in which students write to a real audience
for an authentic purpose, which can greatly stimulate students’ interest in writing to communicate with each other (Hoffman, 1996). The positive learning environment created within the context of computer-mediated communication also reduces students’ anxiety about communicating in a second language and improves their affective state for second language learning.

Given the asserted benefits of computer-mediated communication for second language learning, which are congruent with both current L2/FL pedagogues and established theories of second language acquisition, there are strong theoretical support and pedagogical reasons for using computer-mediated communication in the L2 classroom to promote L2 written development.

**Why Use E-mail for Teaching English as a Second Language**

As an asynchronous form of computer-mediated communication (see the definition in the subsequent section of this chapter), e-mail has been persuasively used by L2/FL teachers as an instructional tool and a means of communication. Since the present dissertation reports on a classroom-based study concerning integrating e-mail into ESL writing instruction, a discussion of the theoretical and pedagogical rationales for using e-mail for teaching writing in English as a second language are in order here.

First, e-mail provides an easy and convenient means of communication among teachers and students with fast feedback, thus facilitating the process of communication between the teacher and students, which is crucial in second language teaching and
learning. Besides, communication via e-mail creates an authentic situation for written communication, in which students interact with each other, sharing ideas and exchanging information and feedback to improve their own writing.

Second, e-mail creates an authentic purpose and audience for writing, which are elements often lacking in the writing assignments in traditional writing classes, but are of great importance for second language students in learning to develop rhetorical awareness for academic writing in English as a second language.

Third, a related advantage of the communicative nature of e-mail writing lies in its capacity to facilitate process writing by enabling students to engage in on-line collaborative writing activities such as planning, drafting, revising and editing. Thus, e-mail enhances the social process of writing, which is beneficial for developing writing abilities in a second language.

Fourth, e-mail enriches and extends the opportunities for learning and writing practice beyond the time and space restraints of the traditional writing classrooms by allowing students more time to write at their own pace to a real audience for authentic communicative purposes. Besides, e-mail enables students to maintain constant contact with the teacher and receive immediate feedback from the teacher outside the classroom, thus expanding teacher-student interaction beyond the time and space limits of traditional classroom instruction.

Lastly, compared with synchronous computer-conferencing, which requires more special networking facilities than the more generally used e-mail system, e-mail is easier
and more convenient for teachers and students to get access to and use outside the classroom. Furthermore, the asynchronous nature of e-mail communication makes it possible for second language learners to take time to process linguistic input and produce more elaborated and complex language than electronic discussions taking place during synchronous computer conferencing sessions. The convenient access to the e-mail system also makes it easier for teachers to integrate e-mail activities into a semester-long course and make such activities part of the curriculum.

Considering the apparent advantages of e-mail as a medium of communication and instruction as well as a writing tool for second language students, the present study is designed to explore the integration of e-mail into an ESL writing class for the goal of helping students develop academic writing skills in English as a second language.

**Purpose of the Study**

The purpose of this classroom-based study was to explore the use of e-mail in the form of a class mailing list to help ESL students practice and develop academic writing skills beyond the spatial and time limits of a writing classroom. In this study, e-mail writing tasks of different purposes, task structures and audiences were designed and integrated into a process-oriented freshman ESL writing class. Analysis of students' writing performance on the e-mail tasks was conducted to examine how the variables of writing purpose, audience and task structure might affect the writing performance of ESL students.
composing in an electronic mode, and to what extent such performance was related to some social and affective factors pertinent to second language learning. Thus, this study aimed at examining second language writing development in the computer-mediated learning environment in light of the principles of theories of second language acquisition. A secondary purpose of this dissertation was to explore the potentials and limitations of using computerized text analysis programs for analyzing L2 written data. This study was also intended to provide pedagogical implications for the application of computer technology in second language instruction, particularly in terms of designing effective writing tasks in a computer-mediated learning environment for the enhancement of L2 writing development.

The subjects of this study were 22 ESL students in a freshman composition course. In an ex post facto design (Hatch & Lazaraton, 1991), this study involved within-subject repeated measures of data collected from different e-mail writing tasks over the course of a semester. The data of this study consisted of writing samples collected via the e-mail system, pre- and post-activity surveys, and classroom observations. Both quantitative and qualitative methods were employed to analyze the data from this study.

Significance of the Study

The present study was designed to contribute to the research literature in L2 writing, focusing primarily on the effects of writing purpose, audience and task on students' writing performance. While previous investigations into the characteristics of
L2 writing examined variation mainly in terms of syntactic complexity and lexical use, the present study aims at measuring L2 writing in terms of both linguistic and rhetorical features, taking into account both complexity and accuracy of ESL students' written language production.

Since the present research is situated in the context of computer-mediated communication, it is also intended to contribute to the field of computer-assisted language instruction (CALL), particularly in the area of computers and composition. Although computers have been increasingly used in composition instruction, most studies reporting on the use of computers in L2 writing instruction have focused mainly on the effects of word processing while research on computer-mediated communication in L2 writing classrooms is scarce. The findings of this study will contribute to a better understanding of the effect of computer-mediated communication on L2 writing development. In particular, it is intended to explore the effectiveness of integrating e-mail as a popular form of computer-mediated communication into the curriculum of an ESL writing course.

The present study is grounded on an interdisciplinary base of theoretical frameworks from several related disciplines, drawing upon theories and research from the fields of rhetoric and composition studies, L2 writing research, CALL research, and second language acquisition theories. Therefore, it is hoped this study will demonstrate the strengths of an interdisciplinary inquiry in understanding the processes of second language learning with particular focus on the development of L2 writing abilities.
Lastly, the present study is based on a semester-long classroom-based research project which involves integration of technology into the L2 curriculum, it is hoped that the findings of this study will have implications for applying computer technology in second language instruction, particularly in the area of integrating computer-mediated communication into the L2 writing curriculum.

Researchers and practitioners in second language education have recognized that technology and language learning are bonded in a symbiotic relationship from which both eventually benefit. The new partnership between learning and technology is in fact redefining language learning and changing the fundamental notion about how best to create suitable environments for language acquisition in academic settings (Barson & Deski, 1996). This dissertation is an attempt to add to our understanding of this symbiotic relationship of technology and language learning.

Definitions of Important Terms

As mentioned in the previous section, the advancement of modern technologies has provided new medium and tools for L2/FL instruction. Since this dissertation investigates the innovative use of computer technology in teaching English as a second language, some technical terms are used throughout the subsequent chapters. In order to help the reader make sense of the discussions to follow, the definitions of the most important terms used in this dissertation are in order here.
Computer-mediated communication (CMC)

In a general sense, computer-mediated communication (CMC) is defined as "communication that takes place between human beings via the instrumentality of computers" (Herring, 1996, p. 1). In other words, in computer-mediated communication, the computer serves as the medium through which humans interact with each other electronically. When applied to L2/FL teaching and learning, computer-mediated communication is primarily text-based, which means participants interact by means of the written word, e.g., by typing a message on the keyboard of one computer which is read by others on their computer screens. Computer-mediated communication can take place in different manners, e.g. locally or globally, synchronously or asynchronously. So far, computer conferencing and e-mail are two most popular forms of computer-mediated communication for L2/FL teachers (Warschauer et al, 1994).

Computer conferencing

Computer conferencing is a form of computer-mediated communication that involves communication among a group of people through networked computers. There are two kinds of computer conferencing, synchronous and asynchronous. Synchronous computer conferencing takes place with all the participants logging on to the computer network simultaneously. Messages are sent instantly between one person and a group of people who are all on-line together. In educational settings, this often takes place in a classroom or laboratory with networked computers. It can also occur at a distance by
taking advantage of special telecommunication resources (Warschauer et al, 1994).

Asynchronous computer conferencing involves delayed-time interaction and is different from synchronous computer conferencing which occurs simultaneously. In asynchronous computer conferencing, participants do not have to log on to the networked computers at the same time. A message can be sent from one person to many people in two types of asynchronous computer conferencing: 1) discussion list, where one message can simultaneously be sent to all subscribers to the list, 2) bulletin boards, where a message is posted in a central place to be accessed and read by many people (Warschauer et al, 1994). In the present study, electronic mail (e-mail) in the form of a class discussion list was used as an instructional as well as a writing tool for the ESL students to practice academic writing skills beyond the time and space limits of the L2 writing classroom. Thus a description of the special features of e-mail as well as its communicative use is provided next.

**Electronic mail (E-mail)**

Electronic mail (e-mail) is a way of sending a message from one computer to one or more other computers around the world. As a communication tool, e-mail has several distinctive features: 1) It is a high-speed method of transferring information that allows rapid exchanges. 2) It allows easy data management because all the communications and documents arrive via computer and can easily be stored, altered, printed, or forwarded. 3) It allows one message to be sent to many people around the world very inexpensively. 4)
Since the recipient does not have to be on-line, but can read the messages at any time later, e-mail communication is considered asynchronous.

E-mail was first started in the late 1960s by the U.S. military in preparation for nuclear war time communication. It was spread to the university communities in the 1970s, but was used in a limited way by those involved with research related to national defense research. By the 1980s, e-mail was used more widely by academics for professional collaboration. The early 1990s witnessed an explosion of the use of e-mail along with other computer networking tools for a wide range of professional, academic and personal purposes. While only a few thousand people were using e-mail in 1980, it is estimated that more than 25 million people around the world were using it in the mid-1990s (Warschauer, 1995c).

Because of its communicative nature, e-mail has become one of the most popular forms of computer-mediated communication that have been introduced into L2/FL teaching. Taking advantages of e-mail technology, language teachers around the world have used e-mail in many innovative ways to enhance language learning. For example, e-mail keypal projects involving students from different countries can link language learners around the world together for cross-cultural exchanges and provide opportunities for L2 learners to interact with native speakers across long distances (Kern, 1996; Tella, 1992; Vilmir, 1995). E-mail can also be used in a single-class setting as a communication and writing tool for L2 learners to engage in collaborative writing in the forms of class mailing list, bulletin boards, and newsgroups (Warschauer, 1995b). It can also allow
students to engage in one-to-one exchanges and provide feedback to each other's writing (Liaw, 1997; Sotillo, 1997). Since students can use e-mail to write and communicate at any time and do the writing at their own pace, e-mail helps them overcome the constraints of time and space in practicing their writing skills in a second language.

Computer-assisted writing instruction

In a broad sense, computer-assisted writing instruction refers to the teaching of writing that is facilitated by the use of computers. The earlier use of computers for writing was primarily with the word processor. Compared with the traditional mode of writing with pen and paper, word processing shows great promise for assisting students' writing process by providing them the useful tools to make easier and faster revisions (Phinney, 1989; Phinney & Khouri, 1993). Another popular computer tool for writing instruction is the text analyzers, which can be used to help students identify grammatical and stylistic problems in their written texts and therefore facilitate their revision process (Brock, 1993; Pennington, 1993; Pennington & Brock, 1992;). The most recent use of computers for writing instruction involves computer-mediated communication in its various forms (Hoffman, 1996; Phinney, 1996), among which, the most popular ones include e-mail, synchronous and asynchronous computer conferencing, and the World Wide Web.
Collaborative writing

Collaborative writing is based on the assumption that writing is basically a social activity that is constructed through interaction with others (Strasma & Foster, 1992). Applying computer-mediated communication to L2 writing instruction allows student writers to interact and collaborate with each other on-line in completing particular writing tasks. In the L2/FL writing classrooms, students' collaborative writing activities include exploring topics for writing, sharing ideas, exchanging information, giving feedback to each other's writing, and completing a writing task together.

Academic writing in a second language

Academic writing in a second language is defined, for the purpose of the present study, as the kinds of written discourse that are commonly required of L2 learners in academic contexts, i.e. at the universities. In basic writing courses, the most common genres of writing include narrative, descriptive, expository and persuasive essays (Cohen, 1994). Writing that is required in the academic disciplines is more diverse and discipline-based. Academic writing can be seen as rhetorical in the sense that it is defined and specified by the topic, purpose, and audience of a particular task that is situated in a particular academic context. Academic writing in a second language requires that the L2 writers be aware and understand the audience in academia and write to fulfill the audience's expectations within the cultural contexts of the target language. Thus, audience awareness is a crucial concern in academic writing in a second language.
Concordancing

Concordancing refers to the use of computer programs called concordancers to access a corpus of text for lexical analysis. A concordancer can search for words, phrases, and categories of words, and display the results in various formats, e.g. alphabetically or by frequency. By showing the immediate contexts in which a particular word appears, the concordance illustrates the patterns in which the given word or phrase is typically used (Flowerdew, 1996). A concordancer can also produce statistics of the lexical items in a given text, which is useful for researchers to do textual analysis. Concordancing has a variety of applications. Its earliest use was in the field of lexicography and dictionary making. Concordancing has also been used in the field of stylistics and literary research as well as in linguistic research. In the recent years, concordancing has been introduced into language learning and teaching, serving as a resource tool for material and curriculum development (Flowerdew, 1996; Stevens, 1995).

Computerized Text Analyzer

Computerized text analyzers, also called grammar checkers, employ the special attributes of the computer and some sophisticated programming routines to analyze written texts and then provide the writer suggestions of how that text can be altered and improved (Brock, 1990). The major functions of a text analyzer include flagging problematic usage in terms of grammar, style and mechanics with suggestions for change and improvement. It also provides the user with descriptive statistics such as the number of words, number
and length of sentences, and number and length of paragraphs. Text analyzers have been widely used as computerized writing aids in composition classrooms. The major text analyzers used for ESL writing include Writer's Workbench, Critique, Correct Grammar, RightWriter, Complete Writer's Toolkit, and Grammatik IV (Pennington, 1993). In recent years, the most popular word processing programs such as Microsoft Word and Word Perfect have integrated the grammar checker into the word processor, thus making it a more convenient computerized writing aid for L2 learners.

Structure of the Dissertation

This dissertation consists of 5 chapters. Chapter 1 describes the background of the study, states the purpose of the present investigation, discusses the significance of the study, defines key concepts pertaining to the subsequent discussions, and outlines the dissertation. Chapter 2 reviews the theoretical and empirical literature which has bearing on the application of computer technology to L2 writing instruction in order to lay the groundwork for the analysis and discussion of the research findings in this study. The literature review in this chapter covers several relevant bodies of research literature: L2 writing theories, research and pedagogy, computers and L2 writing, computer-mediated communication and L2 writing, the use of e-mail in L2 writing instruction, and CALL research and theories of second language acquisition. Chapter 3 discusses the principles and procedures of the methodology employed in the present study. It states the research
questions and hypotheses, provides the definitions of the variables being investigated, describes the measurements of these variables and the subjects involved in the study, and discusses the procedures of data collection from various sources as well as the methods used for the statistical and qualitative analyses. It also contains a detailed explanation of the computer text analysis programs utilized for text analysis of the written data. Chapter 4 reports the results of the analyses conducted according to the procedures described in the preceding chapter. The reports are presented in an order following the 6 major research questions. Tables and figures are provided where appropriate to help visualize and substantiate the presentation. Chapter 5 discusses the findings with reference to previous studies on second language writing and the application of computer technology to second language writing instruction. It also reviews the limitations of the study, discusses pedagogical implications for computer-mediated second language writing instruction, and provides recommendations for future research.
Chapter 2

Literature Review

Introduction

This chapter will review the theoretical and empirical literature which has bearing on the application of computer technology to L2 writing instruction. The review will lay the groundwork for the analysis and discussion of the research findings from this study. The chapter begins with a brief overview of L2 writing instruction and a discussion of theoretical issues of L2 writing in terms of research and pedagogy, which is followed by a review of research on computers and L2 writing. Then the general application of computer-mediated communication in L2 writing is discussed, followed by a presentation of research on using e-mail for L2 writing instruction. Lastly, the chapter reviews CALL research in terms of the principles of second language acquisition and focuses on a discussion of the impact of social and affective variables on L2 learning in the computer-mediated environment. The chapter closes with a conclusion of the literature review and a call for research.
L2 Writing Theories, Research and Pedagogy

An Overview of L2 Writing Instruction

In the past two decades, there have been profound changes in our understanding of the theory and practice of L2 writing. Various theoretical frameworks have emerged drawing upon works in other related disciplines, e.g. applied linguistics, cognitive psychology, sociolinguistics, rhetoric, text linguistics, and educational ethnography. These theories have begun to change L2 writing instruction and caused fundamental pedagogical shifts in the field. Raimes (1991) provided a succinct historical overview of the trends of developments in L2 writing research and practice over the past three decades. The following diagram illustrates the pattern of development along with the shift of focus in the field of L2 writing instruction. As pointed out by Raimes (1991), each of these approaches has a distinctive focus, yet the emergence of a new approach does not actually lead to the ending of an old one. The dates given only mark the approximate time when each focus first appeared consistently in the literature, but no final dates are given because all the approaches are still in practice in varying degrees.
From what is shown in Figure 2.1, we can see the emergence of new approaches with distinctive shifts of instructional focus on L2 writing over the past three decades. The mid 1960s saw a predominant focus on the form of writing with emphasis on the accuracy of grammatical form as well as the appropriate rhetorical form of composition. The preoccupation of grammatical and linguistic form in the 1960s led to the use of a lot of drill practices in the writing classroom, e.g. sentence drills such as fill-ins, substitutions, transformations and completions. The concern for rhetorical form in the early 1970s was
influenced by the theory of contrastive rhetoric firstly advanced by Kaplan (1966). Research
in the area of contrastive rhetoric found that L2 students' composition in English was
influenced by L1 rhetorical and linguistic conventions, therefore, it was seen as necessary to
provide students with models for the construction of texts in English that would meet the
expectations of the native speaker. This led to compensatory exercises in writing courses to
help students construct effective and logical texts by imitating prescribed paragraph and
essay form. The typical exercises included recognizing and constructing topic sentences,
outlining the organization of an essay, completing paragraphs, reordering paragraphs, etc.

Starting from the mid 1970s, a new approach emerged with a shift of focus from the
form, which is the product of composition, to the writer and the process of writing.
Consequently, in the L2 writing classrooms, we have observed a major pedagogical shift
from the traditional product-oriented approach to one which emphasizes the process of
writing. The attention to the writer has led to a new range of classroom activities
characterized by pre-writing, journals, multiple-drafts, peer collaboration, feedback and
revisions.

In the mid 1980s, we saw a new trend towards attending to the content for writing as
well as the interests and needs of the audience. Both content-based instruction and English
for academic purposes are academically oriented approaches which aim at helping L2
students achieve success in academic studies. The focus of content-based instruction is on
acquiring content area knowledge via a second language and developing academic language
skills in the process (Wesche, 1993). In a content-based course, writing skills are taught in
combination with reading and other basic language skills and students write from sources to develop writing skills needed in various academic tasks. In this way, writing is connected to the study of a specific academic subject matter and is viewed as a means of promoting understanding of the content of study. The goal of English for Academic Purposes is to "initiate students into the academic discourse community" by helping them to develop academic language skills (Spack, 1988, p. 47). The instructional focus of English for Academic Purposes is on the structure and conventions of typical types of writing across discipline. Consequently, writing practice focuses on the forms of writing that are common to many academic assignments, e.g. summary, reader response, synthesis, critique, research papers (Jordan, 1997).

Another approach to writing that has emerged out of L1 writing instruction and is gaining gradual recognition by L2 writing researchers is the sociopolitical approach, though this particular approach was not included in Raimes' (1991) review. The sociopolitical approach is based on the social constructionist view, which considers writing as primarily a social act that takes place within and for a specific community embedded within a particular social and political context. Furthermore, the language, focus and form of a text are shaped by the particular community for which it is written. Given the social dimension of writing, learning to write involves developing critical thinking and social critiquing skills. The writer is viewed as an active agent of problem-posing (versus problem-solving in the process approach) and social transformation (versus knowledge construction in the process approach). The role of the teacher is to empower students to find their own voice in writing.
In terms of the students' need to write within and for the academic community, social constructionists maintain that academic conventions should not be preset and can be changed to adapt to the many cultures students represent (Johns, 1990). However, as an emerging view, the sociopolitical approach has not been widely adapted into the classroom practice of L2 writing instruction.

It should be noted further that the approaches discussed above are still widely used in varying degrees, and they are by no means sequential. As Raimes (1991) rightly comments,

In all, our path through the woods of writing instruction is less clearly defined now in 1991 than it was in 1966. Then there was one approach, form-dominated, clearly defined, and relatively easy to follow in the classroom. Now teachers have to consider a variety of approaches, their underlying assumptions, and the practices that each philosophy generates (p. 412).

Given that the research of this study was conducted in an ESL writing classroom where the process approach was adopted, and the objective of the course was to help ESL students develop academic writing skills, the following section of this chapter will provide a further discussion of the theoretical rationale and practice of the process approach as well as some important issues relevant to L2 writing in academic contexts.
The Process Approach to L2 Writing Instruction

Theoretical assumptions

The process approach has drawn upon the theory of cognitive psychology which emphasizes the study of the mental processes writers experience to communicate ideas. The theory of cognitive psychology entails three major underlying assumptions about the learner and learning: a) the inner working of the mind can be studied, b) complex skills are made up of interacting components working together in complex processes, and c) learners are creative hypothesis generators (Gardner, 1985). From the cognitive perspective, the learner is seen as an active and creative agent in knowledge construction, and writing is viewed as a learning process in which the learner acquires and develops a set of skills and strategies to explore ideas and discover meanings. The writing process is considered as a complex, creative and recursive process of meaning discovery and problem-solving. In the course of the writing process, writers generate, express, modify and reformulate their ideas while engaging in a series of activities involving planning, drafting, revising and editing (Flower and Hayes, 1977, 1980, 1981; Zamel, 1983).

Research on the composing processes

Based on the cognitive view of writing, researchers advocating the process approach came to believe that in order to teach students to write, one must also understand what goes on during the internal act of writing. Thus, there has been a substantial body of literature on the composing processes of both L1 and L2 writers. In L1 literature, a great deal of
research has been done to study the composing processes and strategies of successful and unsuccessful writers. The assumption was that the composing characteristics and strategies associated with successful writers could provide models of teaching to help students become better writers (Hillocks, 1986).

In general, L2 writing research has been greatly influenced by L1 research in the processes of writing and has adopted the research designs of L1 studies. Krapels (1990) has provided a comprehensive summary of research findings from a number of studies on L2 writing processes as compared with L1 composing processes. In general, there is evidence to suggest that L1 and L2 writing share some basic similarities, for example, inexperienced L2 writers used generally ineffective processes similar to those used by inexperienced L1 writers, and experienced L2 writers used processes similar to those of experienced L1 writers. However, important differences have also been found to exist between L1 and L2 composing processes. Silva (1993) reviewed a number of studies on L1 and L2 writing processes and found salient differences between L1 and L2 composing in terms of planning, transcribing (producing written text), and reviewing (revising). To sum up, previous studies have found that L2 writers did less planning at the global and local levels and had more difficulty with generating and organizing materials. Their drafting seemed to be more laborious, less fluent, less productive and require more time, probably due to a limited repertoire of L2 vocabulary. L2 writers also tended to review, reread and reflect on their written texts less, revise more, but with more difficulty. To account for such differences, Leki (1992) suggested understanding the characteristics of L2 writers with regard to their
linguistic and cultural backgrounds and how such L1 backgrounds may influence their composing processes in L2.

Classroom practice

Research in L2 writing processes has provided important insights for the L2 writing classroom. From the process perspective, learning to write entails developing an effective composing process; therefore, the focus is on the writing process, and form becomes secondary. The teacher's role is to help students develop effective strategies and skills for going through the composing process. Translated into the classroom context, the process approach stresses creating a positive, encouraging and collaborative learning environment in which students can take time to explore their composing processes. Some typical activities in a process-oriented writing class include pre-writing, invention, journal writing, writing multiple drafts, peer reviews, teacher-student writing conferences, group workshops, and revision (Silva, 1990). All of these classroom activities reflect the principles and theoretical rationales of the process approach which underscores that writing is a continuous, recursive process. Thus, instructional practice in a process-oriented classroom attends to what writers do back and forth in the composing process at various stages, i.e. invention, planning, drafting, revising, editing. Process-oriented instruction aims at helping student writers understand their own composing process and build their repertoires of strategies for composing.
Second Language Writing in Academic Contexts

Goals and instructional focus

As illustrated in Figure 2.1, another current trend of development in L2 writing instruction concerns L2 writing in academic contexts, and hence the emergence of English for Academic Purposes. Proponents of this approach claim that each discipline is a "discourse community" with certain norms, expectations, structures and conventions. The primary aim of this approach is to help students to "initiate into the academic discourse community" by understanding the principles, conventions and constraints of academic discourse (Johns, 1988; Horowitz, 1986; Spack 1988). Thus the instructional focus is on academic discourse genres and the range and nature of academic writing tasks. In an EAP writing class, the role of the teacher is to create a learning environment with writing tasks that simulate the real academic writing tasks. e.g. summary, personal response, synthesis, critique, research paper, and to help students develop practical reading, writing and study skills needed for academic success. Writing is an important component of the basic language skills, yet in academic contexts, writing also serves as a means for students to demonstrate their understanding of subject matters and a mode of promoting "independent thinking, research and learning" (Shih, 1986). Therefore, L2 writing for academic purposes has characteristics that are pertinent to the rhetorical situation of the academic discourse community.
Rhetorical issues in academic writing

Rhetoric has traditionally been defined as the art of persuasion, yet in a broader sense, rhetoric includes the various strategies a writer uses to accomplish his/her purpose with an audience (Ferganchick-Neufang, 1994). Effective written communication requires careful consideration of a number of rhetorical issues related to writer, text, topic and audience. Academic writing is rhetorical in the sense that it is defined and specified by the topic, purpose and audience of a particular task that is situated in a particular academic context. Successful completion of such a task thus demands a good understanding of all the elements that contribute to define the writing task and the interrelationship between such elements. Of particular concern is the issue of purpose and audience. The purpose of writing defines what and how one wants to write. In academic writing, the purpose also leads to writing in a particular mode of discourse that is consistent with the purpose. In terms of rhetorical genre, the most common types of writing that are required in composition courses at the university include narrative writing—to relate a series of events; descriptive writing—to offer a sensory impression of an object or feeling; expository writing—to explain or inform; persuasive writing—to convince (Cohen, 1994). Related to the purpose of writing is the audience for whom the purposed is directed. The audience also plays an important role in deciding what and how one writes. For academic writing in a second language, audience is a particularly crucial concern because L2 writers need to understand the characteristics of the audience in academia and write to fulfill the audience’s expectations. In light of such
rhetorical considerations, it is necessary to specify the purpose and audience in designing and assessing academic writing tasks (Hamp-Lyons, 1993).

In L1 literature, there has been evidence for the effect of purpose and audience on writing performance in terms of quantity and quality. Studies have found that variation in writing performance is related to varying rhetorical purposes which elicit different modes of writing. For example, expository and argumentative writing were found to be more demanding and difficult than narrative and descriptive writing, and there was evidence of a higher level of syntactic complexity associated with expository and argumentative writing (Perren, 1977). Research in L2 writing has also yielded evidence to support the claim that writing performance is related to writing tasks of different purposes. For example, Koda (1993) found significant variation in vocabulary delivery between narrative and descriptive writing tasks in Japanese as a second language. With regard to audience, there has been evidence in L1 literature suggesting that the specification of different target audience may have significant effects on the quality of writing in terms of syntactic complexity (e.g. Crowhurst & Piche, 1979; Rubin & Piche, 1979; Smith & Swan, 1978). In L2 writing instruction, attention to audience is also an important concern, yet no empirical investigation has been conducted so far to examine the effect of different types of audience on the writing performance of L2 writers. This is thus an area of L2 writing that has to be investigated.
Summary

A review of the development of L2 writing instruction reveals that after more than two decades' research and practice, we have come to a better understanding of the nature of L2 writing, the characteristics of L2 writers and the processes of L2 composing. Informed by theories and research findings from other related disciplines, various theoretical frameworks have emerged and contributed to the fundamental pedagogical shifts in L2 writing over the past two decades. The various emerging approaches to L2 writing reflect the rigorous development of the field in terms of theory, research and practice. Today, a new area of writing research which also stands to benefit from research is computer-assisted writing instruction, with computers being used as a research tool and an instructional resource (Pennington & Steven, 1992). The next section of this chapter focuses on the application of computer technology in the L2 writing classroom and the impact of this new medium on L2 writing research and practice.

Computers and L2 Writing

An Overview of CALL and L2 Writing

To date, with the spread of computer-aided language learning (CALL) in L2/FL instruction, computer-aided writing instruction has found its way into L2 classrooms with increasing popularity (Dunkel, 1991; Garrett, 1991; Pennington & Brock, 1992). With the pedagogical shift from the traditional product-oriented approach to the process-oriented
approach in L2 writing instruction, L2 teachers have begun to recognize the usefulness of applying computer technology to aid the process of writing for the ultimate goal of enhancing L2 writing. Besides, researchers have paid attention to the influence of computerized writing aids on the way writing is taught and the process student writers follow in computer-based writing instruction (Brock, 1990; Scott & New, 1994). It is also noted that the computer has changed the dynamics of L2/FL classroom and made it more interactive and student-centered (Ariew & Frommer, 1987; Johnson, 1991; Odenthal, 1992). A review of the literature reveals various aspects in which computer technology has been applied as instructional tools and writing aids for L2 writing. There is evidence showing that computer technology can help enhance L2 writing development in different ways with varying degree of success. To further examine the evidence of this enhancement, the following section of this chapter discusses the most prevalent aspects of computer use in L2 writing instruction.

Computer as a Writing tool: Word Processing

Attitudes towards writing with computer

Word processing is undoubtedly the most widely used computerized writing aid in composition classrooms. Earlier research on computers and the teaching of writing has focused primarily on the use of word processing and its effect on the quantity and quality of student writing as well as the way students feel about writing. Studies find teachers and students report generally positive attitudes towards writing on the computer, and these
general attitudes toward using the computer for writing are reported to have encouraged
students to write more often and more freely (Dunkel, 1991; Neu & Scarcella, 1991;
Phinney, 1989).

Among the difficulties students encounter in L2 writing, overcoming writer's block
in order to get started is crucial. There are studies which have explored the ways in which
the computer can be used to decrease student apprehension about writing (e.g. Phinney,
1991; Phinney & Mathis, 1990). Phinney (1991) reports on a study designed to examine the
perceived changes in the writing apprehension behavior of ESL students who were writing
on the computer as compared with students in a traditional writing class. The results show
that using a computer to write reduced writing apprehension, improved attitudes, helped
students deal with deadlines, and enhanced their perception of their ability to deal with
complex materials.

Effect of computer on revision

As noted by Brock (1990), much of the research on word processing has examined
its effect on the revision behaviors and strategies of student writers. While results are
somewhat mixed, a number of studies have found that the scope and amount of revision
ESL writers perform on a piece of writing increase when using word processing as
discovered several effects that seem applicable to a process-oriented approach to L2 writing
instruction: L2 writers who used word processing spent more time writing and revising
than those who used more traditional modes of composing; besides, attitudes towards
writing among students using word processing improved over time more than those using
pen and paper. Phinney also claims that L2 writers using word processing are more likely to
develop a piece of writing in stages over time and several drafts than those using traditional
means of composing. This is due to the fact that when using word processing, students can
easily move or delete portions of text or carry out any number of revisions more easily and
readily than with pen and paper. This capacity of word processing makes it serve as an
useful aid to facilitate the act of revision, which is an important component of the writing
process. Thus, it has been claimed that word processing has the potential of enhancing
process-oriented writing instruction.

**The writing process with computers**

Computers have also been used to aid investigation into the L2 writing process.
Phinney & Khouri (1993) report on a case study of four advanced ESL students using a
computer to write and revise a paper on an assigned topic. Two of the subjects were
experienced in computer use while the other two were novice computer users. The students'
composing and revising process on the computer were observed, recorded and analyzed.
The results indicated that experience with the computer was a stronger factor than writing
proficiency in determining computer writing strategies, e.g. the two inexperienced computer
users spent less time revising, made more surface changes, and used the computer functions
less than the experienced computer users. Another study using the computer as a means of
analyzing the writing process is reported by Scott & New (1994), which used a computer program for writing in French to examine college students composing in French as a foreign language. The computer provided a log indicating what the student did on the computer. The results indicated that students employed certain predictable strategies during the writing process with some identified as being more effective than the others. The information obtained from the computer-aided analysis thus allowed the researchers, the teachers and the students to better understand the writing process.

Critique

While it is important to examine students' perceptions about their writing experience with computer and their writing processes using the computer, it is also vital to investigate how computer-aided writing actually affects the quality of student writing. However, there is little evidence so far for the effect of computers on the quality of L2 writing at different linguistic and rhetorical levels. One reason may be the lack of well-established instrument for assessing writing with the computer as compared with writing with pen and paper. It is argued that in order to fully investigate the effectiveness of using computer to enhance L2 writing development, there is the necessity of examining the characteristics of writing done on the computer and how computers can help improve the quality of L2 writing.
Computerized Writing Aids: Text Analyzer

Definition of text analyzer

Another computer-based writing aid that has been widely used in the L2 writing classroom is the text analyzer. Computerized text analysis employs the special attributes of the computer and some sophisticated programming routines to analyze written texts and then provide the writer suggestions as to how the text can be altered and improved (Brock, 1990). As summarized by Pennington (1993), the functions of text analysis software include analyzing the distribution and the frequency of certain items in a piece of writing, flagging errors, and providing advice for improvement. The analysis can be done in terms of grammar, punctuation, word choice, sentence length and variety, as well as descriptive counts of the number of words, sentences and paragraphs of a text.

The role of text analyzer in L2 writing

It is noted that computerized text analyzer is "one of the most popular and controversial computer-based writing aids available to ESL composition teachers" (Brock, 1993, p. 19). A number of recent studies have been conducted to examine whether text analyzers can be useful aids for L2/FL writing (Brock, 1990; 1993; Liou, 1991, 1992, 1993, Liou et al, 1994; Pennington, 1993; Pennington & Brock, 1992). The major text analysis programs that have been examined include Writer's Workbench, Critique, Correct Grammar, RightWriter, Complete Writer's Toolkit, and Grammatik IV. Previous studies on the use of text analyzers for L2 writing have reported mixed results.
On the whole, students show positive attitudes towards the use of such programs, but little evidence is found regarding the effect of such programs on the quality of student writing. For example, Pennington and Brock (1992) compared the writing quality of two small groups of students with one applying tutor-facilitated process-oriented revision and the other, the feedback of Critique alone. They found that the Critique group performed worse in producing more shorter sentences, shorter drafts, and fewer revisions. Liou (1993) conducted a quasi-experimental study to examine the effect of Grammatik and Complete Writer's Toolkit on ESL students' revision and found no group difference in writing quality between the students who used the programs and those did not use them, though the programs may help detect some errors in student writing.

Problems and limitations of text analyzers

The inherent problems of text analyzers have been pointed out by researchers and teachers alike (Brock, 1993; Liou, 1993). There are two main points of criticism: (a) the programs sometimes offer incorrect advice that is misleading to students; (b) they cannot address deeper, content-level problems in student writing such as underdeveloped ideas or faulty logic at the discourse level. Also, there is the concern that students may tend to depend on the programs, and the use of such programs encourage a product-oriented approach to writing, which is not in tune with the current process-oriented approach in L2 writing.
Therefore, researchers have warned against the potential drawbacks of employing text analyzers as writing aids for ESL students (Pennington, 1993). Attempts have been made to customize text analyzers to suit the needs of ESL students, but still, researchers remind us of the limitations of using text analyzers in L2 writing instruction (Brock, 1990, 1993) and claim that they are best used as "editing tools" for non-initial drafts in which surface-level problems are the primary focus (Pennington & Brock, 1992).

Summary

A review of the literature reveals various beneficial aspects of using computer technology as instructional tools and writing aids for L2 writing. In general, computer-aided writing instruction has been found to have a positive effect on the attitudes towards writing and the writing performance of L2 students (Neu, & Scarcella, 1991; Odenthal, 1992; Phinney & Mathis, 1990). A number of studies have been conducted to investigate the application of various aspects of computer technology in L2 writing. Earlier research in CALL and L2 writing tend to focus on the effect of word processing (Phinney, 1989; Phinney, 1991; Phinney & Mathis, 1990), and the use of computer-aided writing tools such as text analyzers and grammar checkers for L2 writing (Brock, 1990; 1993; Liou, 1991, 1992, 1993, Liou et al, 1994; Pennington, 1993; Pennington & Brock, 1992). The results of these studies have provided evidence showing that computer technology can help enhance L2 writing in different ways with varying degrees of success. However, research on the use of text analyzers for L2 writing instruction indicates both cost and gains involved in
adapting text analysis for the L2 writing classroom (Block, 1990), and some claim that the effect of such computerized text analysis programs may be limited because they serve well mostly in the mechanical aspects of writing such as grammar, spelling and punctuation (Pennington, 1993).

In recent years, the field of computer-assisted writing has expanded with the rapid development of computer technology and the application of computer networks in the L2 classroom. Consequently, the focus of the research has moved away from using the word processor or text analyzer as a tool to changing writing behaviors and pedagogues brought about by the electronic medium and the interaction between teachers, learners and technology. The following section reviews the body of literature on the application of computer networking to L2 writing instruction.

Computer-Mediated Communication and L2 Writing

Overview

In recent years, a major development in computer-assisted language learning (CALL) has been the expanded use of the computer as a medium of communication. This in turn has led to the introduction of computer networks into the L2 classroom and the application of computer-mediated communication to learning and teaching. Herring (1996) defines computer-mediated communication (CMC) as “communication that takes place between humans via the instrumentality of computers” (p. 1). When applied to the language
classroom, CMC involves the innovative use of computer network-based conferencing in both synchronous and asynchronous situations.

The innovative use of computer network-based conferencing has provided students and teachers "much easier network links" to communicate with each other via the written form within classes, across classes, or across campuses (Kemp, 1993, p. 174). It has been argued that computer conferencing can be used as "an adjunct to class", especially for students in writing classes (Spitzer, 1989). As an innovative instructional tool, computer conferencing provides students a real audience and an authentic purpose for writing, which are elements often lacking in the writing assignments in traditional writing classes. As noted by Esling (1991), this sense of a real audience "produces a more realistic association of events and discourse" for writing than the traditional writing exercises (p. 124). Moreover, computer-mediated communication, when applied in the L2 classroom, promotes students' motivation and interest in L2 writing, encourages sharing and collaboration, and increases peer interaction among the students (Itzzes, 1997; Meunier, 1997). The classroom thus becomes more social, communicative, collaborative and student-centered, which results in more active social interaction for language use and learning (Johnson, 1991; Colomb & Simutis, 1996).
Extended Learning through Electronic Communication

A most obvious advantages of the innovative use of computer networking for L2 learning lies in its capacity to link students from different schools, areas and even different parts of the world together. This provides L2 students extended opportunities to interact with peers, teachers, as well as native speakers of the target language. Hoffman (1996) refers to computer networks as “spinning webs of communicative relationships among language learners and teachers” which can broaden international communication among language learners and teachers by providing them “a channel of communication free from the restrictions of time and distance” (p. 55). Warschauer (1995b) provides a comprehensive overview of various on-line projects and activities involving the innovative use of computer networks by language teachers around the world, which demonstrates the power of “virtual connections” for language learning and teaching.

Several recent studies have reported collaborative projects accomplished by L2 learners across distance via computer networks. Sayers (1989) studied a networking project involving bilingual sister classes in Connecticut and California. The students from the two classes in different schools worked together on publishing a classroom newspaper through a computer writing network. An interesting finding of this study is that through the interclass negotiation process realized via the computer network, students arrived at a common set of criteria for judging effective writing, which they would use to decide what kinds of writing to publish in their joint publication.
Sanaoui and Lapkin (1992) report a research project in which Anglophone students of French in Toronto were linked with native French-speaking peers at a school in Montreal via the use of computer networking. This collaborative project emphasized the students' development of communicative competence in the second language, particularly in terms of writing skills developed through writing about topics of cultural relevance and interests to the students. The study shows that as these two groups of students wrote to each other on various cultural topics of interest to them, their French writing skills improved through extensive communication in the written form. The emphasis on the development of communicative written abilities reveal that writing was a means to multiple ends as it played several roles in the context of the collaborative project: writing was a means by which students brought together the subject matters the students had learned or in the process of learning; through writing, students demonstrated what they had learned about the subject matter; as a means of communication, writing helped students generate more written production about issues related to the subject matter; and finally, written communication on cultural issues with the L2 culture group was a means by which students experienced the L2 culture.

**Computer Conferencing as an Innovative tool for Writing Instruction**

Exchanging authentic messages synchronously with a real audience provides a strong motivation for L2 writing (Johnson, 1991; Ittzes, 1997). Most studies on computer conferencing reveal that students report positive attitudes towards and great enthusiasm for
this new medium of communication; student participation increases as compared with the traditional teacher-fronted and teacher-centered classrooms, and students gain autonomy, responsibility and freedom to interact with each other while engaging in meaningful communication (Warschauer, 1995a, 1996b; Warschauer, Turbee & Roberts, 1994). As a result, the role of the teacher has changed to one of a "co-worker/co-learner" and a "consultant", and the structure of the computer-based classroom has changed to more student-centered with more communicative interaction among students themselves (Chun, 1994; Johnson, 1991; Kern, 1995; Kelm, 1992; Leppanen & Kalaja, 1995; Paramskas, 1993).

Kelm (1992) reports the result of using InterChange, a local area networking program developed by the Daedalus Group at the University of Texas at Austin, in foreign language classrooms. In this exploratory study, InterChange was used in a fourth semester Portuguese course attended by native speakers of English. A total of fifteen students participated in the semester long project in which they attended an one-hour InterChange session each week apart from the regular class hours. During the computer conferencing session, the students used the target language to discuss various topics related to class reading materials. They could read comments at their own pace, type their responses at their leisure, and wait to send messages only when they were completely satisfied with what they had written. The results show that students were actively engaged in the exchanges, and their participation drastically increased as their anxiety about writing in their L2 was reduced. Even the shy and quiet students, stimulated by the interactive atmosphere, joined
in the discussions and became active participants. As a result, students increased their use of interlanguage communication while focusing their on-line discussions on meaning rather than form. The findings of this study support the claim that computer networking increases classroom equality by encouraging equal participation from students (Warschauer, Turbee & Roberts, 1994), and the claim that network communication can be face-saving because it relieves learners of the inhibitions associated with face-to-face communication, and allows them to express themselves more freely as they develop their proficiency (Hoffman, 1996).

Similar findings are reported by Kern (1995) who compared the quantity and characteristics of the discourse produced by two groups of second-semester French students during an InterChange session and during an oral discussion on the same topic. This study found that students had over twice as many turns, produced two to four times more sentences, and used a much greater variety of discourse functions when working in InterChange than they did in their oral discussion. As a result, the structure of classroom interaction shifted from teacher-centered to student-centered. Students were actively engaged in making comments and responding to each other's comments, thus creating a highly collaborative learning environment. Moreover, a large majority of the students demonstrated positive attitudes towards participating in computer conferencing and found it motivating. There was also some indication that the computer-mediated communication environment in InterChange reduced communication anxiety among the students. The findings of this study further support the claim that computer networking has potential in
promoting collaborative language learning and fostering social interaction in the language classroom, which results in student empowerment (Warschauer, Turbee & Roberts, 1994).

Another comparative study on the effects of computer conferencing using the InterChange program and face-to-face oral discussion was conducted by Warschauer (1996b) in an ESL writing class. This study uses a counterbalanced repeated measures procedure to test the claims that electronic discussion enables more equal participation and produces lexically and syntactically more complex language than face-to-face discussion. The subjects in the study were 16 students enrolled in an advanced ESL composition class. These students took turns to participate in both an electronic and a face-to-face discussion. The students' performance in both tasks was analyzed in terms of amount of participation and language complexity at the lexical and syntactic level. Students' attitudes towards these two modes of discussion were also examined with a questionnaire survey. Corroborating with previous studies (e.g. Kern, 1995), the results of this study show a tendency towards more equal participation in the computer mode. Furthermore, the study found that students used more complex language at syntactic and lexical levels in electronic discussion than in face-to-face discussion, which led the researcher to claim: "... the formality and complexity of language in electronic discussion suggests that it might be an excellent medium for pre-writing work since it could serve as a bridge from spoken interaction to written composition" (Warschauer, 1996b, p. 21).

While the several studies that have been reviewed above are cross-sectional in terms of research design, Chun (1994) reports a longitudinal study of first and second year
German students participating in electronic discussions in the InterChange computer program. Chun’s study focuses on the effective use of networking to increase beginning foreign language learners’ communicative language proficiency at sociolinguistic, discourse and strategic levels. The data of this study was collected over the course of two consecutive semesters from beginning German students who participated in regular computer networking sessions using InterChange. Based on computer-generated transcripts of the electronic discussions, the researcher examined the quantity and quality of the language used during the networking sessions. The findings demonstrate that students discussing on the computer network perform a number of different interactional speech acts, e.g. asking questions, giving feedback to others, requesting clarification, managing the discourse through turn-taking and practicing a range of social formulas such as greetings and farewells in the target language. One of the most striking features of the interaction pattern observed is that the students tended to interact directly with each other rather than interacting mainly with the teacher. This feature is distinctively different from the traditional classroom discourse where the teacher dominates the discussion by asking questions to students who, in turn, supply the answers. Therefore, the class discussions on the computer network were characterized by an active involvement of students in terms of topic initiation, construction, expansion and discourse management. Consequently, the teacher’s role was decentralized. An interesting finding that came out of the analysis of the transcripts of the networking sessions is in the linguistic characteristics of the language used, which has allowed the researcher to conclude: “The types of sentences being written
by students on the computer require not only comprehension of the preceding discourse but also coherent thought and use of cohesive linguistic references and expression. These skills, which are important components of writing proficiency, are enhanced by CACD (computer-assisted class discussion)” (Chun, 1994, p. 28-29).

Summary

The studies reviewed above make it clear that while computer networks have been widely used for L2 writing instruction, computer-mediated communication performed on computer networks allows L2 teachers and learners to explore communication more fully in support of language learning. The results of studies on computer-mediated communication in the L2 classroom have revealed beneficial influences of this new kind of medium on L2 learning and development. However, empirical investigation in this area is inadequate. Moreover, some limitations are observed among the reported studies, which are worthy of note here.

First of all, in terms of research design, most of the studies are cross-sectional in that data was collected in one time spot or over a short period of treatment time, e.g. one or two computer conferencing sessions (e.g. Kern, 1995; Warschauer, 1996b), with the exception of only a few longitudinal studies which traced students’ developmental changes in performance over time (e.g. Chun, 1994). This limitation in research design has been critiqued by Dunkel (1991) in a metanalysis study of the effectiveness research on computer-assisted instruction (CAI) and computer-assisted language learning (CALL). It is
argued that in order to fully investigate the impact of computer networking on L2 learning, there is the need to look into students’ learning processes and evaluate the learning outcomes over a reasonably long period of time. Another limitation of the previous research on CMC in the L2 classroom lies in the relatively small sample size used. The data of most studies was generated by a small number of students, which to a great extent, limits the generalizability of the research findings, thus making it difficult for the researchers to use inferential statistical procedures to make generalizations from the sample to the larger population (Shavelson, 1988). Consequently, most of these studies are descriptive, exploratory and interpretative in nature (e.g. Chun, 1994; Kelm, 1992; Kern, 1995). Although Warschauer’s (1996b) used a controlled experimental design to conduct hypothesis testing with some inferential statistical procedures, the small sample size he used (i.e. with a total sample size of 16, which was divided into 4 groups with only 4 subjects in one cell) made the results of his statistical tests questionable.

Another criticism of the research design of the previous studies on CMC and L2 learning concerns the nature of the inquiry. As reviewed in the above section, several studies are comparative in research design, i.e. comparing L2 learners’ performance on computer conferencing sessions and face-to-face oral discussions (e.g. Kern, 1995; Warschauer, 1996b). What has been brought to be questioned here is the validity of such a comparison between two distinctively different modes of communication, with one carried out through the electronic medium while the other in the traditional human face-to-face manner. Commenting on the future avenues for CALL research, Dunkel (1991) suggests
that research attention should move away from asking questions such as "whether or not
computer makes a difference" to a closer examination of questions such as "how does
computer make a difference in L2 learning, and in what aspects and what ways?" In
particular, Dunkel (1991) calls for conducting more rigorous research to examine the
specific conditions under which use of computer materials results in L2 learning, and
situating research on the effectiveness of computers within the broader context of L2
learning and teaching as well as the interplay between both. With regard to the effect of
computer-mediated communication on L2 learning, researchers in the field have also
realized the need to further exploit "the strength of network communication to enhance
language learning, not merely to replicate other media and forms of instruction" (Hoffinan,

Among the various forms of telecommunication, electronic mail (e-mail) has been
used most popularly in language teaching and learning (Levy, 1997). The discussion that
follows will focus on the advantages of e-mail, its application in the L2 classroom as well
as research on its effects on L2 learning.
The Use of E-mail in L2 Writing Instruction

Overview

As a form of non-real-time computer conferencing, electronic mail has been increasingly used in L2 writing classrooms. In a comprehensive, updated review of CALL literature, Levy (1997) states: "Of these CmC [Computer-Mediated Communication] systems, electronic mail has so far been the most pervasive in language teaching and learning" (p. 97). Given the limited classroom time for L2 writing instruction, e-mail system provides students the means to extend their writing practice outside the classroom, and at the same time, engage in written communication with an authentic purpose and a real audience (Allen, 1995; Barson, Frommer & Schwartz, 1993; Kern, 1996; Kroonerberg, 1994/1995; Liaw, 1997; Shetzer, 1997; Sotillo, 1997; Wang, 1993; Warschauer, 1995c). Taking advantage of the e-mail technology, language teachers around the world have implemented various e-mail projects involving students of different languages and cultures (See Warschauer 1995b for a comprehensive, up-to-date synthesis). Such e-mail projects have provided students advantages such as motivation, collaboration, social interaction, cross-cultural exchanges, and authentic target language use.

It should be noted that e-mail writing does not have to always involve students across great distance such as different countries. There are reports of teachers making creative use of e-mail to connect students in a single class setting. For example, e-mail was
used as a writing tool for L2 learners to engage in "dialogue journals" with their teachers (Wang, 1993). In the forms of class mailing lists, bulletin boards, class newsgroups, e-mail can also be used as a means for on-line out of class discussion and collaborative writing (See Warschauer, 1995b for an updated synthesis).

E-mail Penpals and Cross-Cultural Exchanges

Levy (1997) reviews: “Of the reported types of e-mail interaction, pen pal projects are one of the most frequent” (p. 97). Most reported e-mail penpal or “keypal” projects involve cross cultural exchanges between students in different countries, L2 learners corresponding among themselves or with native speakers. Warschauer (1995c) notes that writing to pen pals electronically has many of the same advantages that traditional pen pal writing can have: using the target language for an authentic purpose, making new friends, and learning about a new culture. Writing via e-mail provides several additional advantages: it is fast, convenient, and either free or very inexpensive. A browse in the internet finds an impressive host of well set-up e-mail discussion lists that have been established especially for international students for the purposes of cross-cultural exchanges on various topics. Warschauer (1995c) provides a survey of these lists:

- CHAT-SL: Student General Discussion List (lower level)
- DISCUSS-SL: Student General Discussion List (higher level)
- BUSINESS-SL: Student Discussion List About Business and Economics
<table>
<thead>
<tr>
<th>Discussion List</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGL-SL</td>
<td>Student Discussion List About Using and Learning English</td>
</tr>
<tr>
<td>EVENT-SL</td>
<td>Student Discussion List About Current Events</td>
</tr>
<tr>
<td>MOVIE-SL</td>
<td>Student Discussion List About the Cinema</td>
</tr>
<tr>
<td>MUSIC-SL</td>
<td>Student Discussion List About Music</td>
</tr>
<tr>
<td>SCITECH-SL</td>
<td>Student Discussion List About Science, Technology, and Computers</td>
</tr>
<tr>
<td>SPORT-SL</td>
<td>Student Discussion List About Sports</td>
</tr>
</tbody>
</table>

The number of ESL students engaged in cross-cultural exchanges through these international student discussion list is inestimable and the benefits for these students are even more far-reaching. Among the reported international e-mail keypal projects, the Individual Writing Exchange project organized by Ruth Vilmi from the Language Center of Helsinki University of Technology is worthy of noted here (Vilmi, 1995). This project was started in 1993 and involved ESL/EFL and native English-speaking students and their teachers from twelve countries. This project still on-going project is based on a three-week cycle in which students submit essays on various topics to an international forum, then comment on essays about their chosen topic written by peers from other countries, and finally share their perceptions of what make for effective communication. These shared perceptions are formed into a criteria for effective writing which students can then use to revise their own essays or create more effective essays during subsequent cycles.

As language teachers and learners around the world are excited by the opportunity provided by computer networks for authentic conversations with native speakers or non
It is important to caution that in order to ensure positive learning effects, efforts must be made not only to link learners together, but also to enhance language learning for learners engaged in cross-cultural exchanges. Hoffman (1996) comments: “Merely putting language learners in contact with one another is no guarantee that learning will occur” (p. 69). Warschauer (1995c) points out two major problems with pen pal exchanges: a) lack of response and b) lack of purpose. Warschauer suggests: “Experience has proven that international e-mail exchanges can become lackluster if they are not somewhat integrated into the curriculum of the course” (p. 49).

A few studies have investigated the implementation of international e-mail exchange projects, among which those conducted by Telia (1992 cited in Warschauer, 1995c) deserve mentioning here. Telia carried out a 2-semester investigation of e-mail exchanges between four Finish high school classes and their partner classes in England. Students in the two countries exchanged e-mails several times a month on a wide variety of personal and social issues. Using an ethnographic approach that combines observations, interviews, and analysis of e-mail messages, Telia carefully examined all aspects of the cultural changes and the students’ affective reactions to the exchange process. The study found a number of beneficial aspects of the e-mail exchanges: there was a shift from teacher-centered, large-group teaching towards a more individualized and learner-centered learning environment; the focus of teaching and learning shifted from form to content, which was made of primarily of students’ own writings; consequently, the quality of writing
improved as writing changed from teacher assigned, only to be marked and graded, to real-purpose writing with genuine audiences around the world.

Kern (1996) reports a content-based e-mail exchange project aimed at promoting learning of language, history and culture through written dialogue between students in an elementary French class at the University of California at Berkeley and a history class in a French high school. The main topic of the exchange was family histories and how they interact with history. Kern claims that the project had important language learning benefits. He concludes: “While ostensibly an exercise in communicative language use, this e-mail exchange has been at least as significant in exchanging students’ cultural and historical awareness as well as their overall motivation in learning French” (Kern, 1996, p. 118).

Another important conclusion Kern draws is related to the role of the teacher in language instruction using computer-mediated communication. He states: “E-mail is not, however, a panacea. The degree to which computer-mediated communication promotes language and content learning, cultural awareness, and critical reflection depends fundamentally on the teachers who coordinate its use”. This argument has been supported by other researchers in the field (Levy, 1997; Pennington, 1996).

Research on Using E-mail for L2 Writing Instruction

Although there has been increasing use of e-mail technology by L2 teachers, empirical investigation into the effectiveness of e-mail as an instructional as well as a writing tool is scarce. Among the few empirical endeavors, Sotillo (1997) reports a study on
using the e-mail system for native speakers to provide corrective feedback to ESL students on their writing. In the course of a semester, a class of English-speaking freshmen was instructed to form a collaborative partnership with another class of ESL students enrolled in a composition course. These two groups of students were engaged in a series of collaborative writing activities via e-mail while the native-speakers acted as peer reviewers for the ESL students' compositions. The study finds that the ESL students benefited from different types of corrective feedback from the native speakers, and the successful learners were able to incorporate more than 70% of the native speakers' corrective feedback into their revised written work. Grounded in sociocultural theory, this study also examines the extent to which native and nonnative speakers are able to co-construct the zone of proximal development in a computer-mediated context. An interesting finding of this study reveals that L2 learners' participation in the e-mail exchanges with native speakers was related, to a great extent, to their cognitive regulatory stages. Only those who demonstrated a clear understanding of the goals of collaborative writing and were capable of independent problem solving (identified as successful learners in the author's term), were found to benefit the most from corrective feedback of native speakers. This finding indicates the importance of taking into account individual learner differences in investigating L2 learning in the computer-mediated learning environment.

Leppanen and Kalaja (1995) report on a quasi-experimental study in which students' peer feedback to their written work given via e-mail outside the class was compared with a tutor's feedback given with pen on paper. The results show that students gave each other a
great deal of feedback of different kinds and demonstrated a great sense of responsibility. In a collaborative manner, the students generated more comments on each other's writing than the tutor could provide. Moreover, the group dynamics changed drastically compared with traditional classroom discussions which are characterized by three-part exchanges consisting of the teacher's initiation, a student's response, and the teacher's feedback. Instead, the students engaged in the electronic discussions asked questions, argued, initiated new topics, expressed opinion, commented on each other's messages, etc. The authors conclude that the e-mail system is "a flexible means of exchanging ideas and commenting in the written form, and consequently, of transforming writing into a social and interactive activity" (p. 35). It should be noted that Leppanen and Kalaja also express concerns about an observed shift of power in computer conferencing. They point out that the increased student freedom and responsibility can have both positive and negative effects: "Greater freedom means that students also have more power in controlling what, how, when, and where to learn than they would normally have in an 'ordinary' language classroom. On the other hand, students may end up having too much control, and the teacher too little" (p. 32). Leppanen and Kalaja have made a very important point about the teacher's role in computer-mediated communication in the L2/FL classroom. As the classroom shifts from teacher-centered to student-centered, students gain more dominance in the classroom and more control of learning activities on the computer. Then what kind of teacher control is necessary and facilitative? In what way, and to what extent can teacher control work most effectively? In order to make computer conferencing a meaningful pedagogical tool for
L2/FL writing, we need to consider its various pedagogical functions as well as the role of the teacher. As pointed out by Ariew (1987), the computer alone can not carry the burden of teaching all language skills given its inherent limitations. Dunkel (1991) also warns us against "falling into the trap of fixation on the 'medium' (the computer) alone" (p. 20), since the central components of the educational situation are the people, the classroom culture, and the contents of learning. Therefore, the teacher's role remains a crucial one in a classroom with new technological aids.

In an English as a foreign language setting, Liaw (1997) investigated the efficacy of integrating e-mail writing into EFL classrooms to facilitate authentic target language communication between L2 students. This project involved two classes of EFL students in Taiwan. The students in one class were paired up to exchange e-mail messages with the students in the other class. Rather than letting students sent random e-mail messages to each other, the e-mail activities in this semester long project were built into the syllabus as writing assignment for the course. Findings from end-of-the-semester surveys and interviews revealed positive responses from students in terms of the beneficial experience of writing via e-mail. Motivation, computer skills and social interaction were promoted by such e-mail activities in the course of a semester. Students' sustained discussions of various topics also helped improve their communicative skills in the written form. Interestingly, the study found that the students would prefer to have some teacher intervention in the e-mail activities. For example, they preferred that the teacher assign them topics for discussion so their e-mail exchanges would be focused, and they requested some good e-mail writing
samples from the teacher so they understood what should be the right pattern to follow in conducting e-mail exchanges. This finding has raised an important issue of the role of the teacher in the computer-mediated instructional context, which has been of great concern to CALL advocates and researchers (Kern, 1996; Levy, 1997; Pennington, 1996).

Barson et al (1993) report another study on using e-mail in the foreign language classroom with immediate French classes at three universities. Students engaged in collaborative projects via e-mail to accomplish a semester-long task, in most cases, the publication of a student newspaper or magazine. A distinctive feature of the e-mail projects reported in this study is that they are task-based, and goal-oriented. The researchers assert that such an approach is characterized by a "student-shaped curriculum" in which students are involved in purposeful activities generated by a central task. The e-mail system thus provided students a convenient channel of communication for making collaborative contacts to accomplish the task. A functional analysis of the e-mail messages generated by students in the process of accomplishing the semester-long task reveals that a wide range of speech acts were performed by the students in a foreign language, indicating efforts made in the process of negotiation of meaning with the acquisition of certain discourse strategies. The researchers conclude by advocating task-based learning through distance communication as an innovative approach to language teaching and learning.

The last study to be reviewed here is a dissertation research conducted by Wang (1993) at the University of Oregon, which investigated the effectiveness of dialogue journal writing between ESL students and their instructor via e-mail. The research project was
conducted over a period of nine weeks with ESL students in an intermediate level reading and writing class. The class was randomly divided into two groups, each using a different medium to write dialogue journals to their instructor: while the treatment group wrote via e-mail, the control group used paper and pen. The results of this comparative study show that the students writing via e-mail wrote more per writing session than those using paper and pen. Besides, e-mail captured and maintained the interest of the students and the instructor in writing to each other. As a result of on-going dialoguing between the students and the instructor, the students practiced and developed their writing abilities. The analysis of the language functions shows that the students in the e-mail group produced a greater number of language functions per writing session than did the students in the paper-and-pen group. The researcher attributed such difference in the amount of language production between the two groups to the fast and convenient feature of communication via the electronic medium. The findings of Wang's (1993) research provide evidence to show that e-mail can be used as a valuable tool to facilitate the writing process. The analysis of students' attitudes and affective reactions towards e-mail writing as well as their experience and skills with the computer is revealing because it indicates the importance of taking into account social and learner variables in investigating the effectiveness of language teaching and learning in the computer-mediated environment.
Summary

The above review shows that the use of e-mail as a communication and an instructional tool has been pervasive in L2/FL learning. This has been demonstrated by the numerous e-mail projects carried out by language teachers and learners around the world. E-mail has offered language learners a fast and convenient channel of communication for cross-cultural exchanges, which can foster their linguistic and cultural awareness of the target language and culture, directly or indirectly enhance their L2 development, especially in terms of L2 writing skills (Kern, 1996; Vilmi, 1995; Warschauer, 1995a). In a single class setting, e-mail has been used as an innovative instructional and writing tool for interactive learning and collaborative writing among L2 students (Sotillo, 1997; Leppanen & Kalaja, 1995; Liaw, 1997; Wang, 1993). However, despite the wide application of e-mail for L2 teaching and learning, systematic and empirical investigation into the impact of this new medium of communication and instruction on L2 learning and teaching is scarce. The few reported studies on the use of e-mail for L2 instruction have focused on the communicative and motivating aspects of this new technology when applied to the L2/FL classroom, yet no empirical attempts have been made to systematically examine the quality and characteristics of students' written production as well as the students' writing process while composing in the electronic mode. Moreover, little attention has been paid to relating L2 learning in the computer-mediated context to social and affective variables such as motivation, attitude and anxiety which have been found to be crucial for second language
acquisition. Thus, the following section of this chapter attempts to examine the relationship between SLA theories and CALL research.

**SLA and CALL**

CALL research has evolved along with the development of computer technology as well as our further understanding of the second language learning process. The connection between CALL research and SLA theories has been stressed by CALL advocates. Doughty (1988) asserts that models of second language acquisition theories should form the basis of CALL research and development. Garrett (1991) argues for relating theories and research in second language learning process to the design and implementation of technology-based materials. Levy (1997) suggests using theories of second language learning as points of departure for developing CALL programs. All of these claims point to the necessity of framing the investigation into computer-assisted language learning in terms of theoretical and empirical understandings of the second language acquisition process. Of particular concern with regard to the purpose of the present study is the influence of some underlying social and affective factors on second language learning. Thus, the following section will discuss findings from SLA research focusing on some social and affective factors such as motivation, attitude, and anxiety as well as the role such factors play in L2 learning in the computer-mediated environment.
Motivation

Motivation is viewed as a key factor in L2 learning and motivation in L2 learning constitutes one of the most fully researched areas. The most extensive and earliest research into the role of motivation in second language acquisition has been conducted by Gardner and Lambert (1972) who drew a basic distinction between two types of motivation, i.e. integrative and instrumental. Integrative motivation is defined as a learner's intention to identify with the culture of the target language. Instrumental motivation occurs when the learner's goals for learning the L2 is practical, e.g. to pass an examination, to find a job. Gardner and Lambert (1972) propose that integrative motivation is more likely to be associated with L2 achievement than instrumental motivation, yet these two types of motivation are not mutually exclusive because second language acquisition rarely involves just an integrative or just an instrumental motivation. However, more recent studies aimed at re-examining the relationship of motivation to language learning have shown that the traditional framework for explaining the nature of language learning motivation is inadequate and needs expansion and refinement (Brown, 1994; Crookes & Schmidt, 1991; Dornyei, 1994; Gardner & Tremblay, 1994a, Gardner & Tremblay, 1994b; Oxford & Shearin, 1994). Brown (1994) proposes that there are three types of motivation: 1) global motivation, which accounts for the learner's general orientation to the goal of language learning; 2) situational motivation, which varies according to the situation in which language learning takes place, and 3) task motivation, which is related to performing particular learning tasks. Brown's (1994) model has provided a more precise theoretical
framework for the study of motivation which takes into account the contextual factors of
language learning.

In a computer-mediated learning environment, it has been found that motivation
plays a crucial role for learning as it does in the traditional language learning situations. One
of the main alleged benefits of computer-mediated communication is that it enhances
student motivation, which has been supported by the findings of a number of studies (e.g.
Barson et al., 1993; Beauvois, 1995; Ittzes, 1997; Kelm, 1992; Kern, 1995; Leppanen &
Kalaja, 1995; Meunier, 1997; Vihni, 1995; Wang, 1993; Warschauer, 1996b). While many
have attested to the motivational benefits of using computers for L2 learning, and
particularly for written communication, few empirical studies of this issue have been
conducted.

Warschauer (1996b) made the first empirical attempt to analyze the motivational
aspects of using computers for writing and communication through a survey of 167
university students in twelve ESL and EFL academic writing classes in the United States,
Hong Kong and Taiwan. The primary purpose of this study was to investigate aspects of
using the computer for writing and communication which L2/FL students find motivating
and the differences existing among the motivating aspects for students of different
backgrounds. The results of a factor analysis yield three factors: communication,
empowerment and learning, which Warschauer claims as defying the view of language
learning motivation as being either integrative or instrumental. Identified as the strongest
factor, communication is associated with feeling part of a community, developing thoughts
and ideas, learning about different people and cultures, and students' learning from each other. The second factor, empowerment, is more related to affective variables such as enhancing personal power, overcoming isolation, and making it less threatening to contact people. The third factor, learning, indicates that students think that computers can help them learn better and more independently. While using computers, the students feel they have more control of their learning and more opportunities to practice English. Thus, the researcher concludes that using computer for writing and communication enhances learning opportunities for the L2/FL learners. The survey also found that students of all categories showed positive attitudes toward using computers for writing and communication in the language classroom. The researcher attributes this finding to the individualized aspects of using computer-mediated communication. He concludes: “By allowing students to communicate with whom they want, when they want, and about whatever topic they want, computers may offer something for everyone” (p. 40).

Attitudes

Another affective factor that has a crucial impact on second language acquisition process is learner attitude, which may be manifested in different ways. Ellis (1994) sums up: “Learners manifest different attitudes towards (1) the target language, (2) target language speakers, (3) the target-language culture, (4) the social value of learning the L2, (5) particular use of the target language, and (6) themselves as members of their own culture” (p. 198). Learner attitudes have an impact on language learning because they may
lead them to make efforts to learn the second language or not to do so. In general, positive attitudes towards the second language, its speakers, and its culture are more likely to enhance language learning whereas negative attitudes may impede learning (Brown, 1994).

Studies in computer-assisted language learning have found that L2/FL learners generally have positive attitudes towards the use of computers for language learning. It has been shown that the use of computers increases students' interest in language learning, promote interactions among the learners, and provides a non-threatening environment for learners to engage in communication using the target language (Beauvois, 1995; Kern, 1995; Meunier, 1997; Warschauer, 1996c). A recent study conducted by Beauvois (1995) empirically investigated student attitudes towards learning a foreign language on a real-time electronic network. Using pre- and post-study surveys and interviews, Beauvois analyzed various aspects of student attitudes towards learning on the computer networks. The study yields several positive results: students felt the computer network reduced their stress in communicating through a second language; they found the experience of learning on the computer networks valuable and enjoyable; they were uniformly positive regarding the networking sessions. Such findings indicate the motivating effects of computer networks and computer-mediated communication that takes place on such networks.

Anxiety

As an important affective factor in second language acquisition, anxiety has received considerable attention in SLA research (Horwitz, Horwitz & Young, 1986;
Horwitz & Young, 1991; MacIntyre & Gardner, 1991). Horwitz & Young (1991) report a collection of studies on anxiety in language classroom settings. These studies indicate that learners frequently experience "language anxiety" associated with attempts to learn a second language and communicate in it. However, studies on the effect of anxiety on learning have yielded mixed results. Some research found that language learning anxiety had a negative effect on learning as manifested in a negative correlation between foreign language classroom anxiety and FL achievement (Horwitz et al., 1986). The findings of other studies suggest that a low level of anxiety can enhance linguistic production because of the learner's increased attention to the language learning task (Young, 1986).

Thus, it is necessary to note the distinction between two types of anxiety proposed by Gardner (1985), i.e. "facilitating" and "debilitating" anxiety. While the former motivates the learner to "fight" the new learning task, fostering them to make extra efforts to overcome their feelings of anxiety, the latter causes the learner to "flee" the learning task in order to avoid the source of anxiety (p. 33). Given the mixed findings of previous anxiety studies, MacIntyre and Gardner (1991) propose a model to account for the role anxiety plays in language learning which takes into account the learners' stage of development and situation-specific learning experiences. Ellis (1994) sums up: "There is sufficient evidence to show that anxiety is an important factor in L2 acquisition. Anxiety (its presence or absence) is best seen not as a necessary condition of successful L2 learning, but rather as a factor that contributes in different degrees in different learners" (p. 483).
Research in computers and L2 writing instruction has yielded evidence to show that using a computer to write reduce writing apprehension and help L2 writers overcome the writer's block (Phinney, 1991). Studies in computer-mediated communication and L2 learning have also found that computer networking provides a less threatening environment than face-to-face discussion for students to communicate in the target language, thus minimizing language anxiety (Beauvois, 1995; Kern, 1995; Meunier, 1997; Warschauer, 1996b). In addition, it was found that the informal atmosphere of electronic exchanges reduced students' communication anxiety (Kern, 1995). Moreover, research shows that students' computer skills and experience with computers account for anxiety for L2 learning in the computer-mediated environment (Warschauer, 1996c).

**Conclusion**

The literature review in this chapter has revealed various beneficial aspects of using computer technology as instructional tools and writing aids for L2 writing. In general, computer-aided writing instruction has been found to have a positive effect on the attitudes towards writing and the writing performance of L2 students (Neu, & Scarcella, 1991; Odenthal, 1992; Phinney & Mathis, 1990). Moreover, computer-mediated communication, when applied in the L2 classroom, promotes students' motivation and interest in L2 writing, encourages sharing and collaboration, and increases peer interaction among the students.
(Ittzes, 1997; Meunier, 1997; Warschauer, 1996b). It is also noted that the computer has changed the dynamics of the L2 writing classroom and made it more social, communicative, collaborative and student-centered (Beauvois, 1995; Bump, 1990; Ittzes, 1997; Johnson, 1991; Odenthal, 1992; Warschauer, 1995a; 1996; Warschauer, Turbee, & Roberts, 1994).

A number of studies have been conducted to investigate the application of various aspects of computer technology in L2 writing. Earlier research in CALL and L2 writing tend to focus on the effect of word processing (Phinney, 1989; Phinney, 1991; Phinney & Mathis, 1990), and the use of computer-aided writing tools such as text analyzers and grammar checkers for L2 writing (Brock, 1990; 1993; Liou, 1991, 1992, 1993, Liou et al, 1994; Pennington, 1993; Pennington & Brock, 1992). More recent studies have examined the introduction of computer-mediated communication into the L2 classroom in the form of both real time and non-real time computer network-based conferencing (Beauvois, 1992; Bump, 1990; Chun, 1994; Ittzes, 1997; Kelm, 1992; Kern, 1995; Leppanen & Kalaja, 1995; Sanaoui & Lapkin, 1992; Sullivan, 1993; Warschauer, 1996b).

However, as has already been pointed out, although the potential benefits of e-mail and other forms of computer-mediated communication seem apparent to L2 teaching and learning, research to date on computer-mediated communication in the L2 classroom has been scarce, and most reported studies consist of innovators reporting on the outcomes of their own teaching (See Warschauer, 1995b for a comprehensive overview). Among the few empirical studies, research attention has been focused on the motivating and communicative
aspects of computer-mediated communication and its benefits for promoting communication through the use of the target language. Most of these studies have measured students' amount of participation in computer-mediated communication tasks and the development of communicative skills, yet no empirical attempt has been made to examine the quality of writing students produced in an electronic medium, and how different types of writing tasks in terms of purpose, structure and audience may affect students' writing performance in the computer-mediated context. As recognized by researchers and practitioners in the field, one of the most urgently important questions in CALL research today is to investigate what kind of learning tasks can be most effective in the CALL context. To investigate this question, it is important to design task-oriented CALL activities and integrate such activities into the L2 curriculum. Furthermore, it has been noted that computer-mediated communication in the L2 classroom has presented a number of linguistic and social issues needed to be investigated (Herring, 1996). Besides, social and affective variables evidenced to affect second language acquisition processes should also be examined in the computer-mediated learning context in light of principles of second language acquisition (Kelm, 1996). Thus arises the research conception of the present study. The next chapter will describe the procedures used to establish the research design of the present study.
Chapter 3

Methods and Procedures

Introduction

This chapter will describe the principles and procedures of the methodology employed in the present study. The chapter will first state the research questions and hypotheses related to each of the research questions, provide definitions for the variables to be investigated, and discuss procedures used to measure the variables. Then the participants of the study are described, followed by a detailed discussion of the procedures used for data collection and the methods used for the quantitative and qualitative analyses. The chapter will close with a detailed explanation of the computer text analysis programs used for text analysis of the written data in this study.

Research Questions and Hypotheses

As reviewed in the previous chapter, computers have been used increasingly in classrooms to aid second language learning and teaching, yet insufficient empirical research has been done to investigate the effectiveness of second language learning in the computer-mediated learning environment. It has been generally agreed that one of the
most urgently important questions for CALL research today is: What kind of learning tasks can be most effective in the CALL context (Thomas, 1997)? It is noted that in order to investigate the effectiveness of CALL activities, it is important to design task-based CALL activities and integrate such activities into the L2 curriculum (Warschauer, 1996c). Besides, it has been established that social, affective and cognitive variables that affect second language acquisition processes need to be examined in the computer-mediated learning environment in light of principles of second language acquisition (Kelm, 1992; Herring, 1996). It is against such theoretical, pedagogical and research backgrounds that the present dissertation was conceived.

The following section presents the major research questions to be investigated in this study. The definitions of the dependent and independent variables included in the research design will be provided in the subsequent section of this chapter.

**Research Question #1:** Does writing performance vary across e-mail tasks with different rhetorical purposes?

**H₀:** There is no difference in writing performance among e-mail tasks with different rhetorical purposes.

In this research design, four classroom-based e-mail writing tasks were designed, each involving student writing of a particular genre and for a particular rhetorical purpose, i.e. narrative, informative, persuasive and expressive. The details of the nature
and characteristics of these tasks as well as their place in the course curriculum will be discussed in the subsequent section of this chapter.

Research Question #1 entails four sub-questions which are combined to assess students' writing performance in terms of syntactic, lexical, textual and grammatical levels:

1) Do students perform with different levels of syntactic complexity in e-mail tasks with different rhetorical purposes?

This sub-question can be addressed through two kinds of syntactic measurement which assess the complexity level of sentences. Hence two more follow-up questions:

a) Is there a difference in average sentence length in e-mail tasks with different rhetorical purposes?

b) Is there a difference in the ratio of subordinated structures over the combination of subordinated and coordinated structures in e-mail tasks with different rhetorical purposes?

2) Do students perform with different levels of lexical complexity in e-mail tasks with different rhetorical purposes?

This sub-question can be addressed through two kinds of lexical measurement which assess the richness of lexical use. Hence two more follow-up questions:

a) Is there a difference in lexical diversity in e-mail tasks with different rhetorical purposes?
b) Is there a difference in lexical density in e-mail tasks with different rhetorical purposes?

3) Do students perform with different levels of textual cohesion in e-mail tasks with different rhetorical purposes?

This sub-question can be addressed through two kinds of textual measurement which examine cohesion at both the sentence and the discourse level. Hence two more follow-up questions:

a) Is there a difference in the ratio of cohesive conjunctions used at the sentence level in e-mail tasks with different rhetorical purposes?

b) Is there a difference in the ratio of transitional expressions used at the paragraph level in e-mail tasks with different rhetorical purposes?

4) Do students perform with different levels of grammatical accuracy in e-mail tasks with different rhetorical purposes?

This sub-question can be addressed through two kinds of grammatical measurement which assess the level of grammatical accuracy. Hence two more follow-up questions:

a) Is there a difference in the ratio of grammatical errors in e-mail tasks with different rhetorical purposes?

b) Is there a difference in the ratio of different types of grammatical errors in e-mail tasks with different rhetorical purposes?
**Research Question #2:** Is there a difference in writing performance in e-mail tasks involving an interactive versus a non-interactive audience?

\[ H_0: \text{There is no difference in writing performance in e-mail tasks involving an interactive versus a non-interactive audience.} \]

To further investigate how students' writing performance on e-mail might vary in terms of audience and interaction between the student writers and the assumed reader, the four tasks described above were grouped into two categories according to the nature of the interaction between the student writer and the audience, who were the class members. Task 2 and Task 3 fell into the first category, which was termed tasks with an interactive audience. Task 1 and Task 4 fell into the second category, which was termed tasks with a non-interactive audience. The details of the assignments and interaction characteristics of these two types of tasks will be discussed in the subsequent section of this chapter.

Similar to the procedures in Research Question #2, the dependent variables used to measure syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy, as described in Research Question #1 above, will be used again in the analyses conducted to answer Research Question #3.
Research Question #3: Is there a difference in writing performance in structured versus non-structured e-mail tasks?

H0: There is no difference in writing performance in structured versus non-structured e-mail tasks.

In order to investigate the effect of task structure on students' writing performance, the same four e-mail tasks were regrouped into two other categories according to the way the task was structured and assigned to students. Task 1 and Task 3 fell into the first category, which was termed structured tasks. Task 2 and Task 4 fell into the second category, which was termed non-structured tasks. The details of the assignments and structure characteristics of these two types of tasks will be discussed in the subsequent section of this chapter. The dependent variables used to measure syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy, as described in Research Question #1 above, will be used again in the analyses conducted to answer Research Question #2.
**Research Question #4:** To what extent do motivation, attitude, anxiety, and computer literacy account for the variation in the writing performance of ESL students composing in an electronic mode?

**H_0:** Motivation, attitude, anxiety and computer literacy do not contribute significantly to the variation in the writing performance of ESL students composing in an electronic mode.

The definitions and measurements of the independent variables of motivation, attitude, anxiety and computer literacy will be discussed in the subsequent section of this chapter. Similar to the procedures in Research Question #2, the dependent variables used to measure syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy, as described in Research Question #1 above, will be used again in the analyses conducted to answer Research Question #4.

**Research Question #5:** What are the potential and possible limitations of using computerized text analysis programs for data analysis in L2 research?

This research question is addressed by 1) comparing the results of textual analysis performed by the computer and holistic/analytic evaluation conducted by ESL raters, and 2) exploring the advantages and disadvantages of the computer programs used to conduct the textual analysis. The first part of this question is investigated by means of statistical analyses performed on the computerized scores and the scores assigned by the raters. The following sub-questions arise:
1) Is there a significant correlation between the computer scores on linguistic and textual features and the correspondent analytical scales assigned by the ESL raters?

H₀: There is no significant correlation between the computer scores on linguistic and textural features and the correspondent analytical scales assigned by the ESL raters.

2) Is there a significant correlation between the computer scores on linguistic and textual features and the holistic and combined scores assigned by the ESL raters?

H₀: There is no significant correlation between the computer scores on linguistic and textural features and the holistic and combined scores assigned by the ESL raters.

The details of the ESL raters’ evaluation in terms of holistic and analytical scoring will be discussed in the subsequent section in this chapter.

The second part of Research Question #5 regarding the advantages and problems of using computer programs to conduct textual analysis will be examined qualitatively, taking into account the strengths and weaknesses of the programs utilized for the present study as well as the problems the researcher encountered while performing data analysis with these programs.

Research Question #6: What are students' attitudes and reactions to the e-mail activities?

Research Question #6 is to be investigated qualitatively based on a triangulation of sources of information including the teacher-researcher's teaching-research log, classroom observations, teacher-student conferences, student questionnaire survey, student self-reflections and course evaluation.
Definitions and Measurements of Variables

The following section operationally defines the variables to be investigated, provides justifications for the components of the research design, and discusses the measurements for the variables to be studied.

Independent Variables

Writing tasks of different rhetorical purposes

Writing is an intellectual act of multifaceted processing which involves a composite of strategic elements, hierarchical procedure levels and processing adjustments (Flower & Hayes, 1980; Scardamalia & Bereiter, 1982). The composing process thus requires writers to adapt their writing to the rhetorical/linguistic requirements of the task as specified by its particular purpose. In L1 composition literature, it has been long established that different purposes elicit different levels of writing quality and different linguistic features (Oliver, 1995; Perron, 1977; Prater, & Padia, 1983; San Jose, 1972). Recent research on FL/L2 writing has also yielded evidence to support the claim that both the quantity and the quality of writing are associated with writing tasks of different purposes (Foster & Skehan, 1996; Koda, 1993). However, no empirical attempt has been made so far to investigate whether the same claim applies to ESL writers in the context of computer-mediated learning environment. To test the hypothesis that ESL students’ writing performance varies across e-mail tasks of different purposes, four task-based e-
mail assignments were designed, each having a different rhetorical specification and requiring students to write for a different purpose in a different genre of academic discourse (Swales, 1990). The following describes these four tasks in detail:

- **Task 1:** sharing a personal story—narrative
- **Task 2:** exchanging cultural information—informative
- **Task 3:** making an argument—persuasive
- **Task 4:** expressing personal opinions—expressive

**Description:**

The four tasks selected for data analysis were part of the informal writing assignments students were required to do over the semester in English 106, an ESL freshman composition course in which the present study was conducted (See Appendix A). Such writing assignments were designed to help students practice various writing skills related to academic discourse on a regular basis, and in doing so, they also had the chance to explore their own writing processes by generating and exploring ideas for their formal academic essays, which constituted the major writing projects in the course. Each of the four tasks was related to a major essay students wrote in the course. Task 1 was related to Essay 1—a personal narrative essay in which students narrated a significant personal experience and showed the reader how that experience affected them. Task 2 was related to Essay 2—a cultural comparison/contrast essay in which students compared or/and contrasted on a self-chosen topic between their own culture and another country. Task 3 was related to Essay 3—a persuasive essay in which students took their own stand
on a particular issue and developed an argument of their own. Task 4 was related to the final exam—an in-class timed essay based on questions derived from an assigned article. Students were asked to express their personal opinions on the author’s viewpoints and react to the article.

By doing the informal writings, students had the chance to practice using different writing techniques for different purposes. For example, for Task 1, students practiced using narration and description to share a personal experience with classmates via e-mail. Likewise, they needed to further develop their narrative and descriptive skills in the first formal essay, a personal narrative essay. In Task 3, students practiced playing the role of proponent and opponent by proposing arguments and counterarguments to each other. In the corresponding formal essay, a persuasive essay, they needed to incorporate the opposition side's counterarguments to develop their own arguments. Designed in this way, each of the informal writing tasks helped students prepare for their writing of the final formal essay, providing them the opportunity to do a lot of planning and pre-writing, which is an essential and integral phase of the complex, recursive writing process (Flower and Hayes, 1981; Krapels, 1990; Raimes, 1987; Silva, 1993; Zamel, 1982).

All four tasks selected for data analysis were performed by students outside class via e-mail on the class mailing list, which was created in the first week of the semester. Each class member, including the teacher-researcher, got a copy of each passage posted in the class mailing list so the writings were circulated electronically among the students. Each task was completed within a week's time, and students were able to take time to do
it within that week at their own pace. There were general guidelines or specific questions for each task depending on the way it was designed, but no length requirement. It turned out that all the students were able to complete each of the assigned tasks as required. No single student did miss any of the assignments. Therefore, a complete data set was collected for analysis in the present study.

**Writing tasks of different audience**

The notion of audience is central to composition. Researchers in composition believe that all writing is context-based and socially constructed (Bizzell, 1992; Swales, 1990). In light of such a viewpoint, both L1 and L2 composition instruction has emphasized the importance for student writers to know for whom they are writing and that they should be able to articulate their ideas according to the needs of the audience (Park, 1982, 1986; Ramanathan & Kaplan, 1996). Attention to audience is thus a distinct feature of the process approach (Raimes, 1991). The process-oriented approach to L2 writing instruction also places high value on the interaction among student writers in ways such as collaborative writing, peer reviews and writing conferences. In these interactive learning activities, student writers become readers of their peers' writings and offer collective feedback to each other. It is believed that such interactive learning strategies can transform a classroom into a positive writing environment where students help each other to learn to write more effectively (Strasma & Foster, 1992). Taking into account the importance of audience and interaction for L2 writing, the researcher
proposed the hypothesis that ESL students’ writing performance differs between tasks involving an interactive audience and tasks involving a non-interactive audience. Detailed explanations of such a distinction follows:

Description:

The four e-mail tasks described previously were grouped into two categories according to the nature of the interaction between the student writer and the audience, who were the class members. Task 2 and Task 3 fell into the first category, which involved interactive feedback from the peer audience and exchanges between the student writer and the peer audience. Task 1 and Task 4 fell into the second category, which did not involve interactive feedback from the peer audience and there were no exchanges between the student writer and the peer audience.

Writing tasks of different task structure

Task implementation, which involves the manipulation of task conditions, is recognized as an important factor related to learning outcomes in recent proposals for task-based approaches to L2 instruction (Foster & Skehan, 1996; Long, 1989; Long & Crookes, 1991; Skehan, 1996). Language learning tasks are categorized in different ways according to different task design features and subsequent task conditions, e.g. convergent versus divergent tasks based on the outcome option, i.e. one solution only or more than one, open and closed tasks in terms of the extent to which tasks lead to more negotiation of meaning between the learners (Long, 1989), planned versus unplanned
tasks from the perspective of information processing (Crookes, 1989; Ellis, 1987; Foster & Skehan, 1996). Studies have found evidence of variation in learning performance under different task conditions (Crookes, 1989; Ellis, 1987; Foster & Skehan, 1996). In the present study, a distinction is made between structured and unstructured tasks according to the degree of specification in the task assignment. The explanation of such a distinction is provided below:

**Description:**

The same four e-mail tasks were regrouped into two other categories according to the way the task was structured and assigned to the students. Task 1 and Task 3 fell into the first category, which was termed structured tasks. In these tasks, specific questions were given to the students who wrote in response to such questions rather than on self-selected topics of their own. For example, in Task 1, the students were asked to write about their first experiences in the US. They were given specific questions such as: "What happened? Where and when did it happen? Who was involved? What surprised you? What caused that surprise? How did you feel about this experience? What did you learn from this experience?" (See Appendix A for the Assignment Sheet of this Task) In response to the assignment for Task 1, students had to keep all these questions in mind and supply details related to these questions in their narrative. Task 2 and Task 4 fell into the second category, which was termed non-structured tasks. In these tasks, general guidelines were provided to the students conveying the instructor's expectations, but the students had the choice of topic selection and freedom to express their ideas on their
chosen topic. The structured and the nonstructured tasks thus allowed students different degree of freedom in responding to the writing prompts (See Appendix A for the Assignment Sheets of these four tasks).

Table 3.1
Structure and Audience Characteristics of the Four E-mail Tasks

<table>
<thead>
<tr>
<th>Interactive Audience</th>
<th>Non-interactive Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured</td>
<td></td>
</tr>
<tr>
<td>Task 3—Persuasive</td>
<td>Task 1—Narrative</td>
</tr>
<tr>
<td>Non-structured</td>
<td></td>
</tr>
<tr>
<td>Task 2—Informative</td>
<td>Task 4—Expressive</td>
</tr>
</tbody>
</table>

Motivation, Attitude, Anxiety and Computer Literacy

Theoretical and empirical studies have demonstrated that the processes of second language acquisition are affected by a multitude of internal and external factors which can be personal, social, affective, cognitive or cultural in nature (Brown, 1987; Ellis, 1994). Among these various factors, motivation, attitude and anxiety have been well studied with ample evidence showing their influences on the learning processes (Dornyei, 1994; Doughty, 1987; Ehrman & Oxford, 1995; Gardner, 1985; Green, 1993; Horwitz & Young, 1990). However, in the context of computer-mediated learning environment, insufficient empirical investigation has been conducted to examine the impact of motivation, attitude and anxiety on learning outcomes. Hence arises the hypothesis to test
the extent to which these social and affective variables may affect ESL students' writing performance in an electronic mode. Since the learners used computers to perform the writing tasks, an assessment of their knowledge of and skills on computers is in order.

In the present study, learners' motivation, attitude, anxiety and computer literacy were measured through self-reported pre-activity and post-activity questionnaires (See Appendix B and C). Motivation was measured through questionnaire items which assessed students' motivation for using computers to learn English in general (situational motivation), and for the e-mail activities in particular (task motivation). Attitude was measured through questionnaire items which assessed students' attitudes towards computers and e-mail writing in general, and the e-mail activities in particular. Anxiety was measured through questionnaire items which assessed students' comfort level with computers in general, and with on-line writing via e-mail in particular. Computer literacy was assessed through students' self-reported computer knowledge, computer experience and computer skills, the composite of which was operationally defined as computer literacy for the measurement purpose of the present study. Computer knowledge included familiarity with word processing, e-mail and the World Wide Web, which are three most salient aspects of computer use for academic purposes. Students' self-reported computer experience and computer skills were also assessed in terms of these three areas.
Dependent Variables

Students' writing performance on e-mail tasks constituted the dependent variables in the present research design. Writing performance was operationally defined as the linguistic and textual features shown in ESL students' written discourse as well as the overall rhetorical effect of a piece of writing. Writing performance was thus assessed through two kinds of measurement: 1) objective measurement performed by the computerized text analysis programs, focusing on discrete linguistic features including syntactic complexity, lexical complexity, textual cohesion, and grammatical accuracy; 2) subjective assessment conducted by two raters specialized in ESL writing, using a combination of holistic and analytical scoring procedures to evaluate the overall rhetorical features and quality of a piece of writing. The following section provides the details of these two kinds of measurement:

Objective Measurement Performed by the Computer

Syntactic complexity

1) average sentence length—average number of words per sentence

2) ratio of subordinated structures—subordination/subordination + coordination

Syntactic complexity has been commonly used by researchers as an indicator of the students' writing performance (Hunt, 1965; Polio, 1997). In the present study, two indexes were used to measure syntactic complexity: 1) average sentence length, which
was measured by calculating the average number of words per sentence; 2) the ratio of subordinated structures, which was measured by calculating the ratio of the number of subordinated structures over the combination of subordinated structures and coordinated structures in a piece of writing. Such calculations were done by a computer program which will be discussed in greater detail in the subsequent section of this chapter.

Lexical complexity

1) lexical diversity—number of different words including content and function words/total number of words

2) lexical density—lexical items (content words)/total number of words

Lexical richness reflects the overall quality of a piece of writing (Engineer, 1993; Laugher & Nation, 1995). Two measurements were used to assess lexical complexity in the present study: 1) lexical diversity, which was calculated by dividing the number of different words including both content and function words by the total number of words in a piece of writing; 2) lexical density, which was calculated by having the number of lexical items excluding function words divided by the total number of words in a piece of writing (Laufer & Nation, 1995). Such analyses were performed by a computer program to be discussed in greater detail in the subsequent section of this chapter.
**Textual cohesion**

1) the ratio of cohesive conjunction at the sentence level--number of cohesive conjunction at the sentence level/total number of sentences

2) ratio of transitional expressions at the paragraph level--number of transitional expressions at the paragraph level/total number of paragraphs

The quality of a piece of writing is reflected not only in its linguistic features such as syntactic complexity and lexical richness, but also in textual cohesion, which is broadly defined as the semantic relations in a text which make the text cohesive.

Cohesion concerns the intersentence relationships of extended discourse in the text, which are realized by the writer's choice of linguistic and semantic elements (Halliday & Hasan, 1976). According to Halliday and Hasan, a text is a semantic unit, the parts of which are linked together by explicit cohesive ties. In Halliday and Hasan's terms, a cohesive tie is "a semantic relation between an element in a text and some other element that is crucial to the interpretation of it" (p. 8). It is this network of semantic relationships that links together sentences or paragraphs, creating the cohesive quality of connected discourse. Composition studies of cohesion have found some evidence indicating a positive correlation between the use of cohesive devices and the overall quality of writing (Hartnett, 1980; Witte & Faigley, 1981). In these studies, it was found that composition rated highly using holistic assessment contain more cohesion than those rated lower.

Similar findings were reported in research on ESL composition (Lieber, 1980). In light of such findings from cohesion studies, the researcher proposed to examine the use of
cohesive devices between both sentences and paragraphs for an induced account of textual cohesion in ESL students' writing performance on the e-mail tasks.

In the present study, textual cohesion was evaluated in two ways. First, the number of cohesive conjunctions at the sentence level was calculated using the ratio of the number of conjunctions over the total number of sentences in a piece of writing. Due to the difference in length among the writing samples, the ratio was used to eliminate the possible biases caused by unequal length among the texts analyzed. To further examine cohesion at the discourse level, the number of transitional expressions that occurred at the beginning of paragraphs were calculated, using the number of transitional expression divided by the total number of paragraphs in a piece of writing to obtain a ratio so as to deal with the problem of unequal text length. Halliday and Hasan's (1976) taxonomy of cohesive conjunctions was adapted in the cohesion analysis in the present study, the details of this analysis, which was performed by a computer text analysis program, will be discussed in the subsequent section of this chapter.

**Grammatical accuracy**

1) ratio of the number of grammatical errors—the number of grammatical errors/total number of sentences

2) ratio of types of grammatical errors—number of types of grammatical errors/total number of sentences
In L2 writing assessment, linguistic accuracy is often of central concern because it is believed to be a viable index of the learner's interlanguage development which indicates the learners' level of L2 language proficiency as measured against norms of the target language system (Fischer, 1984; Hamp-Lyons & Henning, 1991; Ishikawa, 1995; Polio, 1997). Among the various methods used to measure linguistic accuracy, counting the number of grammatical errors with or without classification of error types was reportedly employed by L2 researchers (Polio, 1997).

In order to further assess the quality of writing performance in the present study, the writing samples were analyzed in terms of their grammatical accuracy. There were two ways to tap into grammatical accuracy: 1) The number of grammatical errors was counted and divided by the total number of sentences in a piece of writing so as to obtain a ratio for grammatical errors. 2) Similarly, another ratio was obtained by calculating the types of grammatical errors divided by the total number of sentences. The total number of sentences rather than the total number of words was used to do the calculation because it was assumed that grammatical errors tended to relate to syntactic structure, so the number of sentences instead of the number of words seemed to be a more appropriate base for the ratio calculation. These two indexes served together to indicate the accuracy of a piece of writing in terms of adhering to the general rules of the English grammar. Such grammatical analyses were performed using a computer text analyzer which will be described in greater detail in the subsequent section of this chapter.
Subjective Measurement Conducted by ESL Raters

As described above, the computerized text analyses focused mainly on the linguistic features in a discrete manner. To supplement such objective, discrete-point measurement, another kind of evaluation was done by human raters to assess the overall rhetorical features and quality of the written samples. Two experienced ESL composition instructors were invited to perform this task. Both have obtained master's degrees in TESL and have taught composition courses at the institute where the current study was carried out. They both possessed a good understanding of the assessment criteria and were familiar with the evaluation procedures used for ESL compositions.

The raters evaluated each piece of writing with a grading chart which addressed the overall rhetorical features and quality of a piece of writing. They used a combination of holistic and analytical assessment procedures. Each piece of writing was given a holistic single score with accompanying analytical subscores on a five-point scale (1 indicating failing and 5 indicating excellent) for seven areas: 1) statement of main ideas, 2) clarity of purpose, 3) audience awareness, 4) flow of ideas, 5) sentence structure, 6) vocabulary, 7) grammar (See Appendix D for a detailed description of the scoring.)
Subjects

Twenty-two students enrolled in English 106, a freshman composition course for ESL students at the University of Arizona in the fall semester of 1997 participated in this study. Undergraduate students enrolled at the University of Arizona are required to take a sequence of composition courses, and upon passing the composition courses, they must take a writing proficiency exam called the Upper Division Writing Proficiency Exam (UDWPE) and pass this exam in order to be awarded a bachelor's degree. The sequence of composition courses at this university consists of English 101 (first semester), 102 (second semester), 109 (honor class). All students are required to take a placement exam in writing before the semester starts to decide which course they should take. The placement exam requires students to write an essay responding to a writing prompt within 30 minutes. The exam is scored on a 4-point scale with 1 indicating the lowest and 4 the highest. The score of the placement exam along with the SAT (or TOEFL for international students) score is used to inform placement decisions. Students who score a solid 3 as evaluated by two raters are placed in English 101 while those who score a solid 4 are placed in English 109 (honor class). Those who score below 2 or earn a marginal 2 are placed in English 100 for an additional semester's class in basic writing before they enroll in the regular sequence of English 101. Students who speak English as a second language are sheltered in courses equivalent to those offered to native speakers, but are attended by ESL students only. The ESL sequence of composition courses offered at the
University of Arizona consists of English 106 (parallel to English 100), English 107 (parallel to English 101), and English 108 (parallel to English 102).

The subjects of the present study were twenty-two students enrolled in English 106 at the University of Arizona in the fall semester of 1997. Table 3.2 presents some basic demographic characteristics of this group of subjects.

Table 3.2

Demographic Characteristics of the Subjects

<table>
<thead>
<tr>
<th>Gender</th>
<th>Females (9), Males (13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age</td>
<td>21.26 years</td>
</tr>
<tr>
<td>Native languages</td>
<td>Spanish (4); Japanese (4); Indonesian (4); Chinese (3); Arabic (3); Greek (2); Korean (1); Malaysian (1); Hebrew (1)</td>
</tr>
<tr>
<td>Academic majors</td>
<td>Engineering/Computer science (9); Business /Accounting /Finance (8); Natural sciences (2); Humanities (2); Education (1)</td>
</tr>
<tr>
<td>Years of English study</td>
<td>Minimum (3 years); Maximum (10 years); Average (6.68 years)</td>
</tr>
<tr>
<td>Length of residence in the US</td>
<td>within a month’s time (14); half a year (2); 1 year (2); 2 years (2); 4 years (1); 6 years (1)</td>
</tr>
<tr>
<td>Year at the University</td>
<td>freshman (19); sophomore (2), junior (1)</td>
</tr>
</tbody>
</table>
As shown in Table 1, among the subjects, nine were females and thirteen were males. Their average age was 21.26 years old. They came from eleven first language backgrounds, i.e. Spanish (4), Indonesian (4), Japanese (4), Arabic (3), Chinese (3), Greek (2), Malaysian (1), Korean (1), Hebrew (1). They were enrolled in varied academic programs at the university including computer science, engineering, natural sciences, business, accounting, finance, humanities, education. The majority of them were either engineering/computer science majors (9), or business/accounting/finance majors (8). All of them had experienced formal instruction in English, and their years of English study ranged from three years minimum to ten years maximum, with an average of six and half years. The majority of the subjects came to the US shortly before the semester began, and fourteen of them had lived in the US for no more than a month’s time. So they had very limited experience in the United States and little exposure to the academic environment at an American university at the outset of the present study. With the exception of three, all of the subjects were in their freshman year at the university.
Table 3.3

The Subjects' Self-Assessed Abilities in English Writing and Typing

<table>
<thead>
<tr>
<th>Self-assessment</th>
<th>Writing Ability in English</th>
<th>Typing Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poor</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>2. Fair</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>3. Good</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>4. Very Good</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5. Excellent</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3.3 indicates that most of the subjects ranked their writing ability in English as Fair (11) and their typing ability as Good (9). The majority of them ranked their ability in these two areas within the range of Fair-Good. A few of the subjects thought their writing ability in English was poor (5) and a few thought the same about their typing ability (4). None of the subjects ranked their ability in either English writing or typing as Excellent.

The subjects also reported their self-perceptions of their knowledge of computers in terms of how often they used word processing, e-mail and world wide web. Table 3 below presents their self-report on their knowledge of computers.
Table 3.4

Subjects’ Self-Report of Knowledge of Computers

<table>
<thead>
<tr>
<th>Self-Report</th>
<th>Word Processing</th>
<th>E-mail</th>
<th>World Wide Web</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Never</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Little</td>
<td>14</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>3. A lot</td>
<td>8</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 3.4 indicates that the majority of this group of learners reported having some experience in computers in terms of word processing (14), e-mail (12) and the World Wide Web (12). All of them had experience in word processing. Only two of the learners, one from Cyprus, another from Saudi Arabia, had never used e-mail at all. The same two learners had never accessed the World Wide Web either. Another learner who had never used the World Wide Web was from Cyprus. About one third of the subjects reported having had a lot of experience with computers in terms of word processing (8), e-mail (8), and the World Wide Web (7). Besides, about one third of them (8) had also subscribed to another class mailing list, MIS 111 which was a required course for their major. It seems that with just a few exceptions, this group of ESL learners had a certain level of computer literacy which accounted for their knowledge and experience with computers in terms of word processing, e-mail and the World Wide Web.
Since an intact group of students was elected instead of random sampling of subjects, this study adopted the *ex post facto* design, which is used when the requirements of experimental design is not satisfied for one to make causal claims. In particular, this design allows the researcher to examine the type and strength of the relationship between independent and dependent variables without considering what went before. According to Hatch and Lazaraton (1991), this design type allows us to discover "what is going on" rather than "what caused this". It is appropriate to be used for a study using a single group of students without experimental treatment and a control group. Thus this design is justified in the present study, which involved within-subject repeated measures of data taken from the same data source, e.g. the same subjects on different tasks over the course of a semester.

The purpose of the present research was explained by the teacher-researcher to the students on the first day of class, and students were invited to participate in the research project on a volunteer basis. It was explained to the students that the tasks to be used for data collection would be part of the required assignments for the course, yet they had the freedom to decide whether they wanted to be included in the research project or not. If they did not want to be included, their written works would be taken out of the database. All students expressed willingness to participate in the research study, and they were asked to sign a written consent form.
Instructional Context

A process-oriented approach to writing instruction was implemented in the composition courses at the institution where the present study was conducted. The objective of English 106 was to help ESL students develop academic writing skills needed for success in their discipline studies at the university (Ekstrom & Kelley, 1993). In particular, it introduced ESL students to some of the basic skills of critical thinking, reading and effective writing for academic purposes (See Appendix E for the course syllabus).

In this course, students were engaged in a variety of classroom activities related to the process of composing, from planning, drafting to revising (Flower & Hayes, 1981; Drapels, 1990; Silva, 1993; Zamel, 1982). For example, they practiced using planning strategies such as freewriting, brainstorming, mapping and clustering to find topics and generate ideas for their essays. They were asked to write journals to respond to various reading assignments and explore topics for the essays they were required to write in the course. Students wrote multiple drafts, received feedback on their first drafts and went through a revision process before they turned in their final papers. The course emphasized the social aspect of writing (Bizzell, 1987; Bruffee, 1986) and students were encouraged to share their ideas and writings in different ways, e.g. in-class discussions, group workshop, journal exchanges, presentations, and sharing of writings in the class mailing list.
Data Collection

The data of this study were collected from several sources:

Writing samples

This study used the natural written language data produced by a class of ESL students over an academic semester. The students were required to write weekly informal pieces and communicate their writings with their classmates via e-mail on the class mailing list. Each class member got a copy of each message sent to the class mailing list. The instructor, who was the researcher of the present study, also got a copy of each message sent to the mailing list. A separate folder called Eng106 was created on the researcher’s e-mail account on the UNIX operating system to save all the messages coming from the class mailing list. Four subfolders were created, named Task 1, Task 2, Task 3 and Task 4 respectively, for the researcher to save messages written to fulfil the requirement of each task. All the messages from the students were automatically sent to the researcher’s e-mail account, and then saved into the four subfolders according to task assignment. The WS-FTP program was used to transfer the complete file of Eng106 into a word processor, Microsoft word 6.0 in plain text format. Then the researcher “cleaned up” each message by removing the e-mail headers including the name of the sender, address, subject line, etc. Each subject was given an identification number and each message was numbered to ensure anonymity for the analysis and evaluation processes. The entire database consisted of a total of 132 pieces of writing collected over the course
of a semester from 4 e-mail tasks, among which two tasks required exchanges between the partners, thus making a total of 6 writing samples from each subject. The average length for each written text was about 450 words, and the entire database amounted to a total of 59,372 running words.

Pre- and post-activity questionnaires

The information on students' demographic data, motivation, attitude, anxiety and computer literacy was gathered through a pre- and a post-activity questionnaire. The pre-activity questionnaire was designed to gather information on students' demographic data and their level of computer literacy. It was administered to the students during the first week of class in an anonymous manner. This questionnaire consisted of 20 items requesting students to supply information regarding their age, gender, nationality, native language, major, TOEFL score, length of residence in the US, year at the university, time and place of English study, self-rating of writing ability in English, typing ability, knowledge of computers in terms of word processing, e-mail and World Wide Web, experience with mailing list, and e-mail assignments. The last question on the questionnaire was open-ended, asking the students to state their expectations and goals for the writing course they were taking (See Appendix B for a copy of the questionnaire). The responses to the question about knowledge of computers were coded to obtain a total score of computer literacy, the possible maximum of which is 35. This total score was used as an independent variable for the multiple regression analyses in the study. The
higher the total score a learner earned on this item, the higher the learner's level of computer literacy. It was assumed that the learner’s knowledge of computers and experience with computers would affect their writing performance on the e-mail tasks.

The post-activity questionnaire was administered to the students in the final week of the semester. It consisted of two major parts. The first part consisted of 15 Likert-type questions with a seven-point scale and the second part was in the format of either multiple choice or open-ended questions (See Appendix C for a copy of the questionnaire).

The first part of the post-activity questionnaire was designed to identify students' level of motivation, attitude and anxiety concerning computers and learning in general and participation in the e-mail activities in particular. Such information is important because there is evidence that motivation, attitude and anxiety are important social and affective variables that may affect the learning outcomes of L2 learners (Dornyei, 1994; Ehrman & Oxford, 1995; Gardner, 1985; Gardner & Lambert, 1972; Gardner & MacIntyre, 1991; Green, 1993; Horwitz, Horwitz & Cope, 1986; Horwitz and Young, 1991).

The 15 Likert-type questions used a seven-point scale. Each was phrased in the form of a statement. On the Likert-type questions, the number 1 represents “strongly disagree” while the number 7 represents “strongly agree”. The range of 1-7 was chosen to provide a more precise discrimination of the students’ responses to the questions (Hatch & Lazaraton, 1991). The 15 questions alternatively address students’ issues
related to students’ motivation, attitude and anxiety concerning computers and learning in general, and the e-mail activities in particular. Several items replicate themselves by stating the same question in both the affirmative and the negative manner to further confirm the student responses. For example, question #2 and #9 below are meant to elicit the same information regarding students’ affective state when writing on e-mail:

#4. I felt comfortable sharing my ideas with others on e-mail. 1 2 3 4 5 6 7

#8. I was not comfortable sharing my ideas with others on e-mail. 1 2 3 4 5 6 7

In fact, these two questions asked for the same information, yet students’ would actually respond to each with a different number. For example, if a student marked number 1 for question #4 (i.e. strongly disagree”), he/she would have also marked number 7 for question #9 (i.e. strongly agree). While coding the responses, question #8 was given the inverse numeric value because it was stated negatively. A similar procedure was adopted to code the questions which were negatively stated, i.e. Questions #6, #8, #12, #15. Besides, items #2 and #9 also deserved particular attention in coding.

#2. I was concerned about making mistakes while I wrote on e-mail.

#9. I was not worried about making mistakes while I wrote on e-mail.

Although stated in the affirmative manner, the statement in #2 in fact carries a negative connotation. A high score on this item, say the number 7 meaning “strongly agree”, would indicate a high level of anxiety. Conversely, although the statement in #9 was negatively stated, it actually carries a positive connotation. Therefore, a high score on
this item would indicate a low level of anxiety. As a result, in coding, #2 rather than #9 was given the reverse numeric value.

Among the 15 items, 5 questions were asked to assess motivation, another 5 to tap attitude, and the remaining 5 addressed anxiety. A total score out of a possible maximum of 35 points was calculated for each of these three variables, i.e. motivation, attitude and anxiety. The higher the score a subject earned for motivation, the more motivated this learner was towards learning and the e-mail activities. The same should be assumed about the subject’s level of attitude and anxiety regarding computer use and learning in general, and the e-mail activities in particular. That is, a higher total score for attitude indicates a more positive attitude towards computer use and learning as well as the e-mail activities. On the other hand, after reversing the numeric values of the negative statements, a higher anxiety score indicates a lower level of anxiety. In other words, the higher total score a learner had for anxiety, the lower his/her anxiety level. The total scores of motivation, attitude, and anxiety, along with the total score of computer literacy, were used as independent variables in the multiple regression analyses to find out to what extent such social, affective and cognitive variables account for the variation in writing performance on the e-mail tasks.

The second part of the post-activity questionnaire was presented in either multiple choice or as open-ended questions. The items in this part were designed to gather information on students’ ways of approaching the e-mail tasks as well as their affective reactions to the e-mail tasks. For example, the multiple choice questions asked students
how they usually wrote the e-mail assignment, e.g. whether they wrote directly on the computer, or wrote on paper first; whether they read over what they had written before sending it out, etc. The open-ended questions asked students to reflect upon their learning experience and comment on what they liked and disliked the most about the e-mail activities. The students' responses to these questions were used for a qualitative analysis of their affective reactions to the e-mail tasks to help further understand the relationship between learners' attitudes and their performance on the e-mail tasks. Meanwhile, such responses can provide further insights about the advantages as well as the problems and limitations of designing task-based e-mail activities to promote L2 writing for academic purposes.

Observations

Since the researcher was also the teacher in the writing class under investigation, she had an excellent opportunity for direct or indirect observations of the subjects involved. From the first day of class, the researcher kept a research log focusing on classroom activities and student behaviors related to the e-mail assignments studied. These included, for instance, the problems students might have when subscribing to the class mailing list—the very first thing they needed to deal with computer technology in the first week of the course, the problems they had gaining access to computers, the technological help they asked for regarding using e-mail, etc. The researcher also observed the students' classroom reactions to the e-mail assignments and what they
reported doing and not doing in the process of completing the assignments. Information gathered from such observations was used to support and validate the findings obtained from objective measurements of students' writing performance.

Data Analysis

Computerized Text Analysis

The data for this study was collected electronically. Similarly, data analysis was conducted electronically using a text analysis package, *Wordsmith Tools*, which was created by Mike Scott and distributed by Oxford University Press exclusively via the internet. In addition, the *Grammatik* program integrated in Corel WordPerfect 6.0 was used for the analysis of grammatical accuracy in the present study.

Basic features of the computer programs

*Wordsmith Tools* operates on IBM or IBM compatible machines with a minimum 80386 processor, VGA display or better, 4 MB RAM for Windows 3.1 or 8 MB if used with Windows 95. It accepts corpora in all ASCII and ANSI formats. It is an integrated package of programs designed to examine how words behave in texts. The package includes six tools, each for a specific text analysis task. In the present study, two major programs were used, i.e. *Wordlist* and *Concord*. The following section describes the basic features of each of these two programs.
**Wordlist.** This program generates word lists in alphabetical and frequency order so that one can compare texts lexically. It also provides statistics such as total number of words, number of different words, type/token ratio, length of words, number of sentences, length of sentences.

**Concord.** This is a concordancing program which allows one to search a collection of texts stored on computer and display all the instances of a chosen word or words in their contexts. Besides creating concordances, this program also finds collocates of the search word, identifies common phrases (clusters around the word) in the concordance, shows the most frequent words to left and right of the search word, and displays a graphical map showing where the word occurs in the corpus.

**Grammatik.** This is an integrated text analysis program or grammar checker in its most commonly used term. Its major functions include flagging problematic usage in terms of grammar, style and mechanics with suggestions for change and improvement. It also provides the user with descriptive statistics such as the number of words, number and length of sentences overall and per paragraph, and number and length of paragraphs. This program was chosen for the analysis of grammatical accuracy in the present study because it also offers the statistical counts of number and types of errors detected by the program.
Linguistic analyses using the computer programs

*Wordlist* and *Concord* were used for different kinds of text analysis in the present study.

1) *Wordlist* was used for the analysis of syntactic complexity in terms of average sentence length, and lexical complexity in terms of lexical diversity and lexical density. The statistic function of the program provides ready information on the average sentence length, which was used as an index of syntactic complexity. It should be noted here that T-unit, defined as an independent clause and all its dependent clauses (Hunt, 1965), has been frequently used in the analysis of written discourse by researchers, and the average length of T-unit serves as an index of syntactic complexity (Bardovi-Harlig, 1992). However, in the present study, average sentence length was used instead of T-unit due to the computer's inability to recognize T-unit boundaries. The Wordlist program searches and distinguishes sentences in accordance with its working definition of a sentence defined as "the full stop, question mark or exclamation mark (?.!) immediately followed by one or more word separators and then a capital letter A..Z or an accented capital letter, a number or a currency symbol" (Wordsmith, 1996).

In terms of lexical analysis, *Wordlist* defines a word as "a sequence of valid characters with a word separator at each end" (Wordsmith, 1996). Word separators specified by WordSmith Tools include spaces as well as certain standard codes used by most word processors, such as page eject codes, tabs, carrier return and line feed. The program gives the user the option to decide whether hyphens are to be considered as
separators. For example, if hyphens are not regarded as separators, "self-access" will be split into two words. In the present analysis, hyphens were defined as separators by the researcher. Numbers were also specified to be counted as words.

For lexical analysis, Wordlist provides statistics of type/token ratio. Token refers to the total number of words while type refers to the different words excluding the repeated ones. In English, the type/token ratio reflects the level of lexical diversity, which is calculated with the number of different words (non-repeated words including content and function words) divided by the total number of words. To provide a more precise measurement of lexical complexity, lexical density was also calculated. This required that the function words in the corpus needed to be excluded from the number of different words used to do the calculation. Wordlist contains a stop list function. When a list of words is created and used as a stop list, the words contained in this list will not be counted when the program calculates the type/token ratio. To determine lexical density, a list of function words in English was created and used as the stop list for the concordancing. The determination of this list was based on an existent list prepared originally by John and Muriel Higgins, which was posted on the internet. Modification and expansion were done on this list in accordance with the definitions and examples of function words in English as established in works of traditional English grammar (Curme, 1935; Fries, 1952; Stockwell et al, 1973; Winter, 1982). When the Wordlist program took into account the stop list of function words (See Appendix F for a list of function words used), the type/token ratio calculation excluded the function words and counted
only the content words, thus yielding the level of lexical density for the use of words in the texts. Both lexical diversity and lexical density serve as indexes of the richness and complexity of lexical use in written texts.

It should be noted that type/token ratio varies widely with the length of the text (Laufer & Nation, 1995). *Wordlist* uses a different strategy to compute the type/token ratio so as to address the problem caused by texts of unequal lengths. In *Wordlist*, there is a setting option for which the researcher could specify a certain \( n \) word limit for the program to compute the type/token ratio. For example, if \( n = 1000 \), the ratio is calculated for the first 1000 running words, then calculated afresh for the next 1000 words, and so on to the end of the text. Thus an average type/token ratio is computed based on consecutive 1000-word chunks of text. Since texts with less than \( n \) (whatever it specified) words get a type/token ratio of 0, a 50 word limit was set for calculating the type/token ratio in the present study to avoid obtaining zero values and to calculate the ratio for the smallest text interval.

2) The *Concord* program was used to search for the occurrences of subordinated and coordinated structures for the calculation of the ratio of subordination used in the measurement of syntactic complexity. For such a linguistic investigation, first, an understanding of the structure of the English language is in order. The following diagram schematizes the hierarchical structure of an English sentence:
As the diagram illustrates, sentences are classified into two most general categories: simple and complex. A simple sentence consists of only one clause, and the sentence and the clause are overlapping units. A complex sentence can be further broken down into two subcategories, i.e. coordination and subordination. Coordination involves "a linking of two more clauses on an equal structural level" (Dekeyser et al, 1979, p.9) while subordination is marked by a "hierarchical and recursive structure in terms of superordinate and subordinate clauses" (Dekeyser et al, 1979, p.10).

Sentences or parts of sentences are joined together by conjunctions, which are categorized into two general classes--coordinating and subordinating. A coordinating conjunction such as *and*, binds together two independent propositions, while a subordinating conjunction, for instance, *before*, joins a subordinate clause to the principal proposition, modifying it in some way. Therefore, coordinating and subordinating conjunctions are explicit markers of coordinated and subordinated...
structures respectively. It is assumed that subordination indicates a higher level of syntactic complexity, thus the ratio of subordinated structures to the sum of coordinated and subordinated structures serves as an index of syntactic complexity. The ratio of subordination has often been used by researchers to measure syntactic complexity in L2 writing (Polio, 1997).

In order to identify and distinguish types of syntactic structures, a list of coordinating conjunctions in English (See Appendix G) and another list of subordinating conjunctions in English (See Appendix H) were established (Curme, 1979; Dekeyser et al, 1979; Stockwell et al, 1973; Winter, 1982). These two lists were entered as “search word” files into the Concord program to make concordances of coordinated and subordinated clauses in the corpus of ESL students’ written samples collected from the e-mail tasks.

In the course of using the concordancer to search for coordinating and subordinating conjunctions to identify the number of coordinated and subordinated sentences for the purpose of calculating the ratio of subordinated structures in the corpus, the researcher encountered some problems, which are worthy of note here.

First, some conjunctions are used to link smaller units such as words and phrases instead of clauses and sentences so their occurrence in the text do not necessarily signal a particular type of syntactic structure. For example, the word and is problematic. And caused problems in the concordancing process because it has several different functions as illustrated in the following examples:
#1. They went to the cinema and had a nice evening together.

#2. Nothing was enjoyable and exciting.

#3. Penny and I were enrolled in the same math class.

Among the three sentences listed above, only the and in #1 should be counted as a marker for a coordinated sentence while the and in #2 and #3 serve as an additive conjunction to link words rather than clauses. More examples of some most problematic words for the concordancing are provided below. Notice that only those that occur in the sentences with an asterisk were counted as either coordinating or subordinating conjunctions for the concordance.

**That**

* It is important that you both register before the deadline.

* Nancy told me that Mike and Jeff won the door prizes at the school library.

That book will be returned next week.

Before that, I had no idea about the country I was going to stay for four years.

That was not the first time for me.

What do you think about that?

Are the people out there all that rich?

**After**

* After I arrived at the airport, I went to make a call to my friend.

Day after day, I waited for his news.

After hearing my story, my mom couldn’t help bursting into tears.
Before

* They came in before it started to rain.

I will be at my office today before 6 o’clock.

When the concordance was created, the researcher had to examine the identified lines and eliminate irrelevant lines such as those unmarked in the above examples.

The Concord program was also useful for the analysis of cohesive devices in the texts. For this purpose, first, a word list consisting of all the possible cohesive conjunctions serving as explicit links in connected written discourse was established based on Halliday and Hasan’s (1976) framework of cohesion in English, which contains five basic categories of cohesive conjunctions, i.e. additive, adversative, causal, temporal and continuatives (See Appendix I for a complete list). Then the Concord program was used to create concordances searching of the occurrences of such lexical items in the corpus. For an effective lexical search, the list of cohesive devices was saved as a text file and entered into the search word option of the program. Instead of looking for individual lexical items one after another in each concordance, Concord starts to search all the lexical items that are included in the word list and displays all the identified items at a time. Since students’ writing samples were saved separately with a filename given to each particular piece, each concordance contained the total number as well as types of cohesive conjunctions used in a particular piece of writing sample. It should be mentioned that similar problems due to the multiple meanings and functions of particular words in English also required the researcher to inspect the results of the concordances,
identifying and eliminating irrelevant items. For example, when used as a cohesive conjunction, *so* expresses causal relation as in the following sentence:

I had a headache, *so* I went to bed.

Yet *so* can also serve other functions as in the following sentences, none of which would be counted as a cohesive tie:

He didn’t expect to see *so* many people showing up at the bake sale.

However, I don’t think *so*.

*It so* happened that we had the same birthday.

*It cost only $7 or so.*

Bob likes to watch cartoon. *So* does his little sister.

When running the Concord program on the file of sample texts, all the occurrences of the word *so* were identified and highlighted, showing the context of each occurrence as well. When the concordance was created, the researcher went through the list, picked out instances where *so* doesn’t serve as a cohesive tie, and removed it from the concordance. Concord has a deletion function for unwanted lexical items as well as a *zip delete* function, which virtually takes the whole line with the wanted item out of the concordance. Once the concordance was inspected and irrelevant items eliminated, it was saved as a complete file. The remaining items in the concordance thus provide information about the number and types of cohesive conjunctions used in a piece of writing.
For the analysis of grammatical accuracy, *Grammatik* in WordPerfect 6.0 was used. Since *Grammatik* flags not just grammatical errors, but also usage related to style and mechanics, e.g. colloquialisms, capitalization, or number style, customization of its checking style and rules was required before the program was put into use for the analysis of grammatical accuracy. First, among the default options of checking styles, *student composition* was chosen because the texts to be analyzed were student writing samples. Then the rules used for checking were scrutinized and those not relevant to grammar checking were removed, leaving only rules that really apply to the grammatical categories of the English language. This customized checking style was then specified as the working checker for the purpose of the present analysis (See Appendix J for the grammatical rules included in this customized checker). However, to the researcher's surprise, it turned out that the statistics for error counts provides the total number and types of errors flagged while the program runs through the text, regardless of the checking style chosen. In this case, the customization does not make any difference. Therefore, the researcher chose to use its default style which includes all rules to check the texts, obtained the statistics for number and types of errors, examined the statistics, and removed manually those related more to style and mechanics rather than to grammar. The remaining statistics thus include only the number and types of grammatical errors. These figures were used to calculate the ratio of number and types of grammatical errors over the total number of sentences in a piece of writing. The ratio was used as an index of grammatical accuracy.
Statistical Analysis

Appropriate statistical tests were performed to test the hypotheses related to the major research questions raised in the present study. The following section provides detailed discussions of the different statistical tests performed to answer each of the major research questions.

Research Question #1, #2 and #3 were answered using one-way repeated measures ANOVA with suitable follow-up contrasts. These tests were run using the MANOVA procedure on SPSS for Unix.

Research Question #1: Does writing performance vary across e-mail tasks with different rhetorical purposes?

H₀. There is no difference in writing performance among e-mail tasks with different rhetorical purposes.

To test this hypothesis, eight one-way repeated measures ANOVA tests were performed separately on the eight dependent variables used to measure writing performance in terms of syntactic complexity, lexical richness, textual cohesion and grammatical accuracy. These overall omnibus ANOVAs test whether any of the four means of writing performance on the four different tasks differs from the rest for the eight dependent variables, i.e. syntactic complexity measured by average sentence length and the ratio of subordination over the combination of subordination and coordination, lexical complexity measured by lexical diversity and lexical density, textual cohesion measured
by the ratio of the number of conjunctive ties at the sentence level and the ratio of the
number of transitional expressions at the paragraph level, grammatical accuracy measured
by the ratio of the number and types of grammatical errors. Significant results were
followed up by pairwise contrast tests to determine which mean differed from which
among the four tasks. In order to protect inflation of the probability of Type I error by
repeated testing, the overall alpha level .05 was divided by the number of contrasts when
testing pairwise differences as suggested by Bonferroni (Neter, Wasserman, and Kutner,
1990). In this case, since there were eight pairwise contrasts, the alpha level was
determined by dividing 0.05 by 8, resulting in an alpha level of 0.0063.

**Research Question #2:** Is there a difference in writing performance in e-mail tasks
involving an interactive versus a non-interactive audience?

H₀: There is no difference in writing performance in e-mail tasks involving an interactive
versus a non-interactive audience.

To test this hypothesis, appropriate contrast tests following the overall ANOVAs
were performed by using the average means of the two tasks involving an interactive
audience (Task 2 and Task 3) vs. the average means of the two tasks involving a non-
interactive audience (Task 1 and Task 4) on the eight dependent variables measuring
writing performance. Since such a contrast test was run together with the pairwise
contrasts on the four e-mail tasks, the alpha level used for this test was the same as that
determined for Research Question #1 by using the Bonferroni procedure, i.e. 0.0063.
Research Question #3: Is there a difference in writing performance in structured versus non-structured e-mail tasks?

H₀: There is no difference in writing performance in structured versus non-structured e-mail tasks.

This hypothesis was tested using the same procedures as reported above for Research Question #2. In this case, however, the contrast test compared the average means of the structured tasks (Task 1 and Task 3) vs the average means of the non-structured tasks (Task 2 and Task 4).

Research Question #4: To what extent do motivation, attitude, anxiety, and computer literacy account for the variation in the writing performance of ESL students composing in an electronic mode?

H₀: Motivation, attitude, anxiety and computer literacy do not contribute significantly to the variation in the performance of ESL students composing in an electronic mode.

Multiple regression analysis on the eight dependent variables measuring writing performance was performed to test this hypothesis. The independent variables (predictors) were the cumulative scores for motivation, attitude, anxiety and computer literacy obtained from the pre-activity and post-activity questionnaires. Simultaneous, block regression analyses were used to estimate how the independent variables contributed to the variance in the dependent variables. This procedure of multiple regression analysis was performed by entering all the independent variables (motivation,
attitude, anxiety and computer literacy) into the multiple regression equation at the same
time and controlling for interrelations among independent variables by partialing out
shared variance and measuring the unique contribution of the block variables entered into
the regression. It thus allowed the researcher to examine to what extent motivation,
attitude, anxiety and computer literacy may account for the variance in writing
performance as measured on different linguistic and textual levels in both a combined and
a separate manner.

Research Question #5: What are the potentials and possible limitations of using
computerized text analysis programs for data analysis in L2 research?

The first part of this question was investigated through statistical analysis by
comparing the results of textual analysis performed by the computer and the
holistic/analytic evaluation conducted by the ESL raters. The following sub-questions
were raised:

1) Is there a significant correlation between the computer scores on linguistic and
textual features and the correspondent analytical scales assigned by the ESL raters?

   \[ H_0: \text{There is no significant correlation between the computer scores on linguistic and }
   \text{textual features and the correspondent analytical scales assigned by the ESL raters.} \]

2) Is there a significant correlation between the computer scores on linguistic and
textual features and the holistic and combined scores assigned by the ESL raters?
H$_0$: There is no significant correlation between the computer scores on linguistic and textual features and the holistic and combined scores assigned by the ESL raters.

In order to test these hypotheses, a series of Pearson product-moment correlational analyses were performed to test the null hypothesis of zero correlation between the two kinds of evaluation. First, the computer scores for the linguistic and textual features were correlated with the average scores of the two ESL raters' assessments in the corresponding categories, i.e. the scores of syntactic complexity (sentence length, subordination ratio) were correlated with the score of Sentence; the scores of lexical complexity (lexical diversity, lexical density) were correlated with the score of Vocabulary; the scores of textual cohesion (ratio of cohesive conjunctions at the sentence level, ratio of transitional expressions at the paragraph level) were correlated with the score of Flow; the scores of grammatical accuracy (ratio of number of grammatical errors, ratio of types of grammatical errors) were correlated with the category Grammar.

In order to validate the correlational analyses between the computerized scores and the ESL raters' scoring, a second correlational analysis was conducted using the computer scores and the ESL raters' holistic scores and the sum of the analytical scales. An average score for both the holistic and the sum of the analytical scales was obtained respectively by adding the two raters' scores divided by 2. Then each of the two averaged scores assigned by the ESL raters, i.e. the average holistic score and the average sum score of the analytical scales, was used to compare with the computerized scores.
Qualitative Analysis

The second part of Research Question #5 regarding the advantages and problems of using computer programs to conduct textual analysis was examined qualitatively, taking into account the strengths and weaknesses of the programs employed for the present study as well as the problems the researcher encountered while performing data analysis on these programs. Outputs from Wordsmith Tools along with research notes were referred to when exploring issues related to the computer programs' advantages and drawbacks. Research Questions #6 required qualitative investigation.

Research Question #6: What are students' attitudes and reactions to using e-mail to practice writing?

This question was investigated qualitatively based on a triangulation of sources of information involving qualitative data to be obtained through open-ended questions on the post-activity survey as well as the researcher's classroom observations and entries from the research log. Patterns of student responses to the post-activity survey were identified through frequency and percentage counts. Students' perceptions, affective reactions and problems related to the e-mail activities were identified and summarized through triangulation of the sources mentioned above.
Summary

This chapter has discussed the principles and procedures of the methodology employed in the present study. It has stated the research questions and hypothesis, provided the definitions of the variables being investigated, described the measurements of these variables and the subjects involved in the study, and discussed the procedures of data collection from various sources as well as the methods used for the statistical and qualitative analyses. The chapter closes with a detailed explanation of the computer text analysis programs utilized for text analysis of the written data. Table 3.5 presents a summary of the six research questions, the measurement instruments and the data analysis procedures discussed in this chapter. The next chapter will report and analyze the results of the present study.
Table 3.5: Overview of Research Questions and Methodology

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Measurement Instruments</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does writing performance vary across e-mail tasks of different rhetorical purposes?</td>
<td>• average sentence length = # of words per sentence &lt;br&gt; • ratio of subordinated structures = subordination / subordination + coordination &lt;br&gt; • lexical diversity = # of different words / # of words &lt;br&gt; • lexical density = # of lexical items / # of words &lt;br&gt; • ratio of sentence-level cohesive conjunction = # of sentence-level cohesive conjunction / # of sentences &lt;br&gt; • ratio of paragraph-level transitions = # of paragraph-level transitions / # of paragraphs &lt;br&gt; • ratio of # of grammatical error = # of grammatical errors / # of sentences &lt;br&gt; • ratio of types of grammatical errors = # of types of grammatical errors / # of sentence</td>
<td>• one-way repeated measures ANOVA tests ((\alpha = 0.05)) to compare the means of the 4 tasks on the 8 dependent variables &lt;br&gt; • follow-up contrast tests ((\alpha = 0.0063)) to examine which mean differs from which among the 4 tasks</td>
</tr>
<tr>
<td>2. Is there a difference in writing performance in structured vs non-structured e-mail tasks?</td>
<td>• the same as in Research Question #1</td>
<td>• follow-up contrast tests of one-way repeated measures ANOVAs to compare the mean difference of structured tasks vs non-structured tasks ((\alpha = 0.0063))</td>
</tr>
<tr>
<td>3. Is there a difference in writing performance in e-mail tasks involving an interactive vs a non-interactive audience?</td>
<td>• the same as in Research Question #1</td>
<td>• the same tests as in # 2 to compare the mean difference of tasks involving an interactive vs a non-interactive audience ((\alpha = 0.0063))</td>
</tr>
<tr>
<td>4. To what extent do motivation, attitude, anxiety and computer literacy account for the variation in writing performance?</td>
<td>• the same as in Research Question #1 &lt;br&gt; • pre- and post-activity questionnaires on students’ motivation, attitude, anxiety and computer literacy</td>
<td>• Multiple Regression Analyses to show the relationship between the independent variables and the dependent variables</td>
</tr>
<tr>
<td>5. What are the potential and limitations of using computerized text analysis programs for data analysis in L2 research?</td>
<td>• the same as in Research Question #1 &lt;br&gt; • average of the 2 ESL raters’ holistic scores &lt;br&gt; • average of the 2 ESL raters’ analytical scores in terms of a) statement of main ideas, b) clarity of purpose, c) audience awareness, d) flow of ideas, e) sentence structure, f) vocabulary, g) grammar</td>
<td>• Pearson Product-Moment correlational analyses to examine the correlation between the computer scores and the average scores of the ESL raters’</td>
</tr>
<tr>
<td>6. What are students’ perceptions and reactions to the e-mail activities? What are the problems they encountered in these activities?</td>
<td>• post-activity questionnaire to gather information on students’ reactions to the e-mail tasks &lt;br&gt; • classroom observations &lt;br&gt; • informal interviews during writing conferences</td>
<td>• coding into qualitative categories, summary of timelines</td>
</tr>
</tbody>
</table>
Chapter 4

Analyses and Results

Introduction

This chapter reports the results of the analyses conducted according to the procedures described in Chapter 3. A number of statistical tests have been performed to investigate the major research questions raised in this study. For research questions #1, #2, and #3, repeated measures ANOVA tests were used with appropriate contrasts to examine the variation in students' writing performance across e-mail tasks of different rhetorical purposes, different types of task structure and different kinds of audience. For research question #4, multiple regression analyses were performed to examine the extent to which motivation, attitude, anxiety and computer literacy contribute to students' writing performance on the e-mail tasks. To investigate research question #5, Pearson product-moment correlational analyses were performed to examine the correlation between the objective scores yielded by the computerized text analysis programs and the subjective assessment performed by the ESL raters. Finally, a qualitative analysis was conducted to address research question #6, which examines the students' affective reactions to the e-mail tasks.
In order to present the results of these analyses in a clear and coherent manner, the following discussion will proceed in an order following the major research questions and corresponding hypotheses.

**Research Question #1: Purpose of Writing and Writing Performance**

Research Question: Does writing performance vary across e-mail tasks with different rhetorical purposes?

H₀: There is no difference in writing performance across e-mail tasks with different rhetorical purposes.

The alternative hypothesis for this research question is that writing performance varies across e-mail tasks of different rhetorical purposes. To test this hypothesis, 8 repeated measures ANOVA tests were performed on the 8 dependent variables used to measure writing performance respectively, using the SPSS manova procedures. The results show that students' writing performance differed significantly across e-mail tasks of different rhetorical purposes in terms of most of the measurements, while no significant difference was found in two measurements.

Table 4.1 presents the means and standard deviation of the 8 dependent variables used to measure overall writing performance in terms of syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy. The following section discusses the details of the ANOVA results for each of these dependent variables.
Table 4.1

Means and Standard Deviations of the Dependent Variables Across Tasks (S. D. in Parentheses)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Task 1 (Narrative)</th>
<th>Task 2 (Informative)</th>
<th>Task 3 (Persuasive)</th>
<th>Task 4 (Expressive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slength</td>
<td>16.18 (6.39)</td>
<td>17.10 (3.15)</td>
<td>17.43 (3.73)</td>
<td>17.65 (4.63)</td>
</tr>
<tr>
<td>Subratio</td>
<td>.6057 (.1015)</td>
<td>.6103 (.0957)</td>
<td>.7084 (.0808)</td>
<td>.7134 (.1365)</td>
</tr>
<tr>
<td>Diversity</td>
<td>76.33 (2.81)</td>
<td>74.28 (2.77)</td>
<td>71.13 (2.74)</td>
<td>77.34 (2.58)</td>
</tr>
<tr>
<td>Density</td>
<td>82.78 (3.86)</td>
<td>77.05 (6.15)</td>
<td>78.62 (4.36)</td>
<td>81.12 (4.79)</td>
</tr>
<tr>
<td>Scohratio</td>
<td>.1371 (.0650)</td>
<td>.1991 (.0822)</td>
<td>.2526 (.1217)</td>
<td>.1955 (.1269)</td>
</tr>
<tr>
<td>Pcohratio</td>
<td>.4242 (.2441)</td>
<td>.3675 (.2036)</td>
<td>.3784 (.1911)</td>
<td>.2898 (.2617)</td>
</tr>
<tr>
<td>Ngrammar</td>
<td>.3805 (.2467)</td>
<td>.4892 (.2196)</td>
<td>.6011 (.3267)</td>
<td>.6142 (.3760)</td>
</tr>
<tr>
<td>Tgrammar</td>
<td>.2178 (.1024)</td>
<td>.3049 (.1100)</td>
<td>.2913 (.0997)</td>
<td>.3300 (.1682)</td>
</tr>
</tbody>
</table>
Syntactic Complexity

Two indexes were used to assess students' writing performance in terms of syntactic complexity: 1) average sentence length ($S_{\text{length}}$), which was measured by calculating the average number of words per sentence; 2) the ratio of subordinated structures ($\text{Subratio}$), which was measured by calculating the ratio of the number of subordinated clauses over the combination of subordinated and coordinated clauses in a text. Table 4.2 and Table 4.3 below display the results of the ANOVA analyses on these two dependent variables used to measure syntactic complexity.
Table 4.2

ANOVA Results for the Dependent Variable Average Sentence Length

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>27.8879</td>
<td>9.2959</td>
<td>.82</td>
<td>.488</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>714.8191</td>
<td>11.3463</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.3

ANOVA Results for the Dependent Variable Subordination Ratio

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>.23</td>
<td>.08</td>
<td>8.25</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>.59</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.2 indicates no significant difference in the average sentence length in writings performed across e-mail tasks of different rhetorical purposes (p = .488). The descriptive data presented in Table 4.1 earlier reveals that among the four tasks, students performed with the longest average sentence length in Task 4—expressive writing (mean = 17.65), whereas in Task 1—narrative writing, the average sentence length is the shortest.
(mean =16.18), with a difference of 1.47. The mean of Task 2—informative writing is 17.10 and the mean of Task 3—persuasive writing is 17.43. The difference is so slight that it does not lead to a significant difference.

The ANOVA results displayed in Table 4.3 above show that there is a significant difference in the ratio of subordinated clauses among the four e-mail tasks of different purposes (p <.001). This result indicates that when measured in terms of the occurrence of subordinated structures among the sentences, students performed with different levels of syntactic complexity when they wrote on e-mail for different rhetorical purposes.

**Lexical Complexity**

In terms of lexical complexity, two measurements were used: 1) lexical diversity (*Diversity*), which was calculated by obtaining the ratio of the number of different words including content and function words over the total number of running words, and 2) lexical density (*Diversity*), which was calculated by obtaining the ratio of the number of lexical items excluding function words over the total number of running words. Table 4.4 and Table 4.5 below display the results of the ANOVA analyses on these two dependent variables used to measure lexical complexity.
Table 4.4

ANOVA Results for the Dependent Variable Lexical Diversity

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>127.8671</td>
<td>42.6223</td>
<td>8.19</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>327.9514</td>
<td>5.2055</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.5

ANOVA Results for the Dependent Variable Lexical Density

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>425.3181</td>
<td>141.7727</td>
<td>12.23</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>730.3168</td>
<td>11.5923</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.4 indicates that there is a significant difference in lexical diversity (p <.001). Likewise, Table 4.5 shows that in terms of lexical density, there is also a significant difference (p <.001). Thus, it is concluded that there is a consistent significant
difference in writing performance in terms of lexical complexity across e-mail tasks of
different rhetorical purpose. In other words, students demonstrated different levels of
sophistication in their lexical choices when writing on e-mail for different rhetorical
purposes.

**Textual Cohesion**

To examine whether there is a significant difference in the way texts are organized
across e-mail tasks of different rhetorical purposes, two measurements were used to
assess writing performance in terms of textual cohesion: 1) the number of cohesive
conjunctions used at the sentence level (Scohratio), and 2) the number of transitional
expressions that occur at the beginning of paragraphs (Pcohratio). In order to control for
the variation caused by texts of unequal lengths, a ratio was calculated for each of these
two measurements. The ratio of sentence-level cohesive conjunctions was calculated with
the number of cohesive conjunctions divided by the total number of sentences. The ratio
of paragraph-level transitional expressions was calculated with the number of transitional
expressions divided by the total number of paragraphs. Table 4.6 and Table 4.7 below
display the results of the ANOVA analyses on these two dependent variables used to
measure textual cohesion.
Table 4.6

ANOVA Results for the Dependent Variable Sentence-Level Cohesive Conjunction

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>.15</td>
<td>.05</td>
<td>7.07</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>.44</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.7

ANOVA Results for the Dependent Variable Paragraph-Level Transitional Expression

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>2.61</td>
<td>.07</td>
<td>1.65</td>
<td>.186</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>.21</td>
<td>.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.6 reveals that there is a significant difference in sentence-level cohesive conjunctions across e-mail tasks of different rhetorical purposes (p <.001). This result indicates that students used significantly different numbers of cohesive conjunctions to link sentences when writing via e-mail on tasks of different rhetorical purposes. However, as shown in Table 4.7, at the paragraph level, no significant difference was found in the
use of transitional expressions (p = .186). The descriptive data displayed in Table 4.1 earlier reveals that the biggest variation occurs between Task 1--narrative writing (mean = .4242) and Task 4--expressive writing (mean = .2898), while the mean scores of Task 2--informative writing (mean = .3675) and Task 3--persuasive writing (mean = .3784) are close to each other.

The ANOVA results summarized in Table 4.6 and Table 4.7 suggest that there is a significant difference in students' writing performance across e-mail tasks of different rhetorical purposes in terms of the use of cohesive devices as linkages at the sentence level, but not at the paragraph level.

**Grammatical Accuracy**

To investigate the grammatical accuracy of the students' writing performance across e-mail tasks of different rhetorical purposes, two measurements were employed: 1) the number of grammatical errors ($N_{grammar}$), and 2) the number of types of grammatical errors ($T_{grammar}$). In order to control for the variation caused by unequal text lengths, a ratio was calculated with the number of grammatical errors divided by the total number of sentences. Likewise, for the second measurement of grammatical accuracy, a ratio was calculated with the number of types of grammatical errors divided by the total number of sentences. Table 4.8 and Table 4.9 below display the results of the ANOVA analyses on these two dependent variables used to measure grammatical accuracy.
Table 4.8

ANOVA Results for the Dependent Variable Number of Grammatical Errors

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>.79</td>
<td>.26</td>
<td>5.81</td>
<td>0.001**</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>2.85</td>
<td>.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

Table 4.9

ANOVA Results for the Dependent Variable Types of Grammatical Errors

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Degree of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>F Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>3</td>
<td>.15</td>
<td>.05</td>
<td>5.73</td>
<td>.002**</td>
</tr>
<tr>
<td>Residual</td>
<td>63</td>
<td>.56</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates significant at .05; ** indicates significant at .01 level.

As indicated by the ANOVA results in Table 4.8, a significant difference is found in the number of grammatical errors across e-mail tasks of different rhetorical purposes (p=.001). Similarly, Table 4.9 shows that there is a significant difference in the number of types of grammatical errors across all tasks (p=.002). From such results, it can be concluded that there is a significant difference in students' writing performance as
measured in terms of grammatical accuracy when they wrote on e-mail tasks for different rhetorical purposes.

Posthoc Tests

Given the overall ANOVA tests for 6 of the 8 dependent variables (i.e. Subordination Ratio, Lexical Diversity, Lexical Density, Sentence Level Cohesive Conjunction, Number of Grammatical Errors, Types of Grammatical Errors) yielded significant results, a series of posthoc tests were performed to find out which pairs of means are significant different. The Tukey test was chosen to run the contrast analyses in this section. The overall alpha level was set at .05. In order to protect inflation of alpha due to repeated tests, the Bonferroni procedure was used to adjust the alpha level by dividing the overall alpha level .05 by the number of tests, which is 8 in this section. The new alpha level at .006 was used to determine significance of the follow-up pairwise tests. The following section discusses the results of the posthoc tests performed on the 6 dependent variables which yielded significant overall ANOVA results, i.e. Subordination Ratio, Lexical Diversity, Lexical Density, Sentence Level Cohesive Conjunction, Number of Grammatical Errors, Types of Grammatical Errors.
### Table 4.10

Follow-up Contrasts: For the Variable Subordination Ratio

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Tasks</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Narrative vs Informative</td>
<td>-.153</td>
<td>.880</td>
</tr>
<tr>
<td>2.</td>
<td>Narrative vs Persuasive</td>
<td>3.406</td>
<td>.003*</td>
</tr>
<tr>
<td>3.</td>
<td>Narrative vs Expressive</td>
<td>3.572</td>
<td>.002*</td>
</tr>
<tr>
<td>4.</td>
<td>Informative vs Persuasive</td>
<td>3.254</td>
<td>.004*</td>
</tr>
<tr>
<td>5.</td>
<td>Informative vs Expressive</td>
<td>3.419</td>
<td>.003*</td>
</tr>
<tr>
<td>6.</td>
<td>Persuasive vs Expressive</td>
<td>-.166</td>
<td>.87</td>
</tr>
<tr>
<td>7.</td>
<td>Structured vs Non-structured</td>
<td>-4.826</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>8.</td>
<td>Interactive vs Non-interactive</td>
<td>.225</td>
<td>.824</td>
</tr>
</tbody>
</table>

Note:  
* $\alpha_B = \alpha / \text{number of contrasts} = 0.05 / 8 = 0.006$ significant at <.006  
** indicates significant at <.001  
Narrative = Task 1  
Informative = Task 2  
Persuasive = Task 3  
Expressive = Task 4  
Structured vs Non-Structured = (Task 1 + Task 3) vs (Task 2 + Task 4)  
Interactive vs Non-interactive Audience = (Task 1 + Task 3) vs (Task 2 + Task 4)

Contrast 1 shows that there is no significant difference between the subordination ratio mean scores of Task 1—narrative writing and Task 2—informative writing ($t = -.153$, $p = .880$). As displayed in Table 4.1 earlier in this chapter, the mean of the subordination ratio of Task 1 is .6057 while the mean of the subordination ratio of Task 2 is .6103. Obviously, the difference is so slight that it doesn't lead to a significant difference.
Contrast 2 indicates that there is a significant difference between the subordination ratio mean scores of Task 1—narrative writing and Task 3—persuasive writing (t = 3.406, p = .003). The mean of the subordination ratio of Task 1 is .6057 while the mean of the subordination ratio of Task 3 is 0.7084, showing a difference of .0927.

Contrast 3 indicates that there is a significant difference between the subordination ratio mean scores of Task 1—narrative writing and Task 4—expressive writing (t = 3.572, p = .002). The mean of the subordination ratio of Task 1 is .6057 while the mean of the subordination ratio of Task 4 is .7134, showing a difference of .1077.

Contrast 4 indicates that there is a significant difference between the subordination ratio mean scores of Task 2—informative writing and Task 3—persuasive writing. The mean of the subordination ratio of Task 2 is .6103 while the mean of the subordination ratio of Task 3 is .7084, showing a difference of .0981.

Contrast 5 indicates that there is a significant difference between the subordination ratio mean scores of Task 2—informative writing and Task 4—expressive writing (t = 3.419, p = .003). The mean of the subordination ratio of Task 2 is .6103 while the mean of the subordination ratio of Task 4 is .7134, showing a difference of .1031.

Contrast 6 shows that there is no significant difference between the subordination ratio mean scores of Task 3—persuasive writing and Task 4—expressive writing. The
mean of the subordination ratio of Task 3 is .7084 while the mean of the subordination ratio of Task 4 is .7134. The difference is too slight to lead to a significant difference.

Contrast 7 and 8 compare the mean difference of two grouping variables, Task 1 + Task 3 (structured tasks) versus Task 2 + Task 4 (non-structured tasks), and Task 2 + Task 3 (tasks involving an interactive audience) versus Task 1 + Task 4 (tasks involving a non-interactive audience). The results of these contrast analyses will be discussed in the later sections about Research Question #2 and #3.

Table 4.11
Follow-up Contrasts: For the Variable Lexical Diversity

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Tasks</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Narrative vs Informative</td>
<td>2.965</td>
<td>.007</td>
</tr>
<tr>
<td>2.</td>
<td>Narrative vs Persuasive</td>
<td>7.599</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>3.</td>
<td>Narrative vs Expressive</td>
<td>-1.468</td>
<td>.157</td>
</tr>
<tr>
<td>4.</td>
<td>Informative vs Persuasive</td>
<td>4.594</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>5.</td>
<td>Informative vs Expressive</td>
<td>-4.434</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>6.</td>
<td>Persuasive vs Expressive</td>
<td>-9.027</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>7.</td>
<td>Structured vs Non-structured</td>
<td>-4.286</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>8.</td>
<td>Interactive vs Non-interactive</td>
<td>8.480</td>
<td>&lt;.001**</td>
</tr>
</tbody>
</table>

Note: \* \( \alpha_B = \alpha / \text{number of contrasts} = .05 / 8 = .006 \) significant at <.006
** indicates significant at <.001
Contrast 1 shows that there is no significant difference between the lexical diversity mean scores of Task 1—narrative writing and Task 2—informative writing ($t = 2.965$, $p = .007$). The lexical diversity mean score of Task 1 is 76.33 while that of Task 2 is 74.28. The difference is too slight to lead to a significant difference.

Contrast 2 indicates that there is a significant difference between the lexical diversity mean scores of Task 1—narrative writing and Task 3—persuasive writing ($t = 7.559$, $p < .001$). The lexical diversity mean score of Task 1 is 76.33 while that of Task 3 is 71.13, showing a mean score difference of 5.20.

Contrast 3 indicates that there is no significant difference between the lexical diversity mean scores of Task 1—narrative writing and Task 4—expressive writing ($t = -1.468$, $p = .157$). The lexical diversity mean score of Task 1 is 76.33 while that of Task 4 is 77.34. The difference is too slight to lead to a significant difference.

Contrast 4 indicates that there is a significant difference between the lexical diversity mean scores of Task 2—informative writing and Task 3—persuasive writing ($t = 4.594$, $p < .001$). The lexical diversity mean score of Task 2 is 74.29 while that of Task 3 is 71.13, showing a mean score difference of 3.16.

Contrast 5 indicates that there is a significant difference between the lexical diversity mean scores of Task 2—informative writing and Task 4—expressive writing ($t = -4.434$, $p < .001$). The lexical diversity mean score of Task 2 is 74.28 while that of Task 4 is 77.34, showing a mean score difference of 3.06.
Contrast 6 indicates that there is a significant difference between the lexical diversity mean scores of Task 3—persuasive writing and Task 4—expressive writing ($t = -9.027, p < .001$). The lexical diversity mean score of Task 3 is 71.13 while that of Task 4 is 77.34, showing a mean score difference of 6.21.

Contrast 7 and 8 compare the mean difference of two grouping variables, Task 1 + Task 3 (structured tasks) versus Task 2 + Task 4 (non-structured tasks), and Task 2 + Task 3 (tasks involving an interactive audience) versus Task 1 + Task 4 (tasks involving a non-interactive audience). The results of these contrast analyses will be discussed in the later sections about Research Question #2 and #3.

Table 4.12
Follow-up Contrasts: For the Variable Lexical Density

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Tasks</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Narrative vs Informative</td>
<td>5.552</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>2.</td>
<td>Narrative vs Persuasive</td>
<td>4.013</td>
<td>.001**</td>
</tr>
<tr>
<td>3.</td>
<td>Narrative vs Expressive</td>
<td>1.588</td>
<td>.127</td>
</tr>
<tr>
<td>4.</td>
<td>Informative vs Persuasive</td>
<td>-1.539</td>
<td>.139</td>
</tr>
<tr>
<td>5.</td>
<td>Informative vs Expressive</td>
<td>-3.965</td>
<td>.001**</td>
</tr>
<tr>
<td>6.</td>
<td>Persuasive vs Expressive</td>
<td>-2.426</td>
<td>.024</td>
</tr>
<tr>
<td>7.</td>
<td>Structured vs Non-structured</td>
<td>2.211</td>
<td>.038</td>
</tr>
<tr>
<td>8.</td>
<td>Interactive vs Non-interactive</td>
<td>5.641</td>
<td>&lt;.001**</td>
</tr>
</tbody>
</table>
Contrast 1 shows that there is a significant difference between the lexical density mean scores of Task 1—narrative writing and Task 2—informative writing (t = 5.552, p < .001). The lexical density mean score of Task 1 is 82.78 while that of Task 2 is 77.05, showing a mean score difference of 5.73.

Contrast 2 indicates that there is a significant difference between the lexical density mean scores of Task 1—narrative writing and Task 3—persuasive writing (t = 4.013, p = .001). The lexical density mean score of Task 1 is 82.78 while that of Task 3 is 78.62, showing a mean score difference of 4.16.

Contrast 3 indicates that there is no significant difference between the lexical density mean scores of Task 1—narrative writing and Task 4—expressive writing (t = 1.588, p = .127). The lexical density mean score of Task 1 is 82.78 while that of Task 4 is 81.12. The difference is too slight to lead to a significant difference.

Contrast 4 indicates that there is no significant difference between the lexical density mean scores of Task 2—informative writing and Task 3—persuasive writing (t = -1.539, p = .139). The lexical density mean score of Task 2 is 77.05 while that of Task 3 is 78.63. The difference is too slight to lead to a significant difference.

Contrast 5 indicates that there is a significant difference between the lexical density mean scores of Task 2—informative writing and Task 4—expressive writing (t = -
The lexical density mean score of Task 2 is 77.05 while that of Task 4 is 81.12, showing a mean score difference of 4.07.

Contrast 6 indicates that there is no significant difference between the lexical density mean scores of Task 3—persuasive writing and Task 4—expressive writing ($t = -2.426, p = .024$). The lexical density mean score of Task 3 is 78.63 while that of Task 4 is 81.12. The difference is too slight to lead to a significant difference.

Contrast 7 and 8 compare the mean difference of two grouping variables, Task 1 + Task 3 (structured tasks) versus Task 2 + Task 4 (non-structured tasks), and Task 2 + Task 3 (tasks involving an interactive audience) versus Task 1 + Task 4 (tasks involving a non-interactive audience). The results of these contrast analyses will be discussed in the later sections about Research Question #2 and #3.
Table 4.13

Follow-up Contrasts: For the Variable Sentence-Level Cohesive Conjunction

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Tasks</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Narrative vs Informative</td>
<td>-2.056</td>
<td>.052</td>
<td></td>
</tr>
<tr>
<td>2. Narrative vs Persuasive</td>
<td>-3.831</td>
<td>.001**</td>
<td></td>
</tr>
<tr>
<td>3. Narrative vs Expressive</td>
<td>-1.937</td>
<td>.066</td>
<td></td>
</tr>
<tr>
<td>4. Informative vs Persuasive</td>
<td>-1.774</td>
<td>.090</td>
<td></td>
</tr>
<tr>
<td>5. Informative vs Expressive</td>
<td>.119</td>
<td>.906</td>
<td></td>
</tr>
<tr>
<td>6. Persuasive vs Expressive</td>
<td>1.894</td>
<td>.072</td>
<td></td>
</tr>
<tr>
<td>7. Structured vs Non-structured</td>
<td>-.115</td>
<td>.910</td>
<td></td>
</tr>
<tr>
<td>8. Interactive vs Non-interactive</td>
<td>-2.793</td>
<td>.011</td>
<td></td>
</tr>
</tbody>
</table>

Note: * $\alpha_B = \alpha / \text{number of contrasts} = .05 / 8 = .006$ significant at <.006
** indicates significant at <.001

Contrast 1 shows that there is no significant difference between the mean scores of the ratio of sentence-level cohesive conjunctions of Task 1—narrative writing and Task 2—informative writing ($t = -2.056, p = .052$). The conjunction ratio mean score of Task 1 is .1371 while that of Task 2 is .1991. The difference is so slight that it does not lead to a significant difference.

Contrast 2 indicates that there is a significant difference between the mean scores of the ratio of sentence-level cohesive conjunctions of Task 1—narrative writing and Task
3-persuasive writing \( (t = -.3.831, p = .001) \). The conjunction ratio mean score of Task 1 is .1371 while that of Task 3 is .2526, showing a difference of .1155.

Contrast 3 indicates that there is no significant difference between the mean scores of the ratio of sentence-level cohesive conjunctions of Task 1-narrative writing and Task 4-expressive writing \( (t = -1.937, p = .066) \). The conjunction ratio mean score of Task 1 is .1371 while that of Task 4 is .1955. The difference is too slight to lead to a significant difference.

Contrast 4 indicates that there is no significant difference between the mean scores of the ratio of sentence-level cohesive conjunctions of Task 2-informative writing and Task 3-persuasive writing \( (t = -1.774, p = .090) \). The conjunction ratio mean score of Task 2 is .1991 while that of Task 3 is .2526. The difference is too slight to lead to a significant difference.

Contrast 5 indicates that there is no significant difference between the mean scores of the ratio of sentence-level cohesive conjunctions of Task 2-informative writing and Task 4-expressive writing \( (t = .119, p = .906) \). The conjunction ratio mean score of Task 2 is .1991 while that of Task 4 is .1955. The difference is too slight to lead to a significant difference.

Contrast 6 indicates that there is no significant difference between the mean scores of the ratio of sentence-level cohesive conjunctions of Task 3-persuasive writing and Task 4-expressive writing \( (t = 1.894, p = .073) \). The conjunction ratio mean score of
Task 3 is .2526 while that of Task 4 is .1955. The difference is too slight to lead to a significant difference.

Contrast 7 and 8 compare the mean difference of two grouping variables, Task 1 + Task 3 (structured tasks) versus Task 2 + Task 4 (non-structured tasks), and Task 2 + Task 3 (tasks involving an interactive audience) versus Task 1 + Task 4 (tasks involving a non-interactive audience). The results of these contrast analyses will be discussed in the later sections about Research Question #2 and #3.

Table 4.14
Follow-up Contrasts: For the Variable Number of Grammatical Errors

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Tasks</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Narrative vs Informative</td>
<td>-3.648</td>
<td>.002*</td>
<td></td>
</tr>
<tr>
<td>2. Narrative vs Persuasive</td>
<td>-7.297</td>
<td>&lt;.001**</td>
<td></td>
</tr>
<tr>
<td>3. Narrative vs Expressive</td>
<td>-7.628</td>
<td>&lt;.001**</td>
<td></td>
</tr>
<tr>
<td>4. Informative vs Persuasive</td>
<td>-3.648</td>
<td>.002*</td>
<td></td>
</tr>
<tr>
<td>5. Informative vs Expressive</td>
<td>3.980</td>
<td>.001**</td>
<td></td>
</tr>
<tr>
<td>6. Persuasive vs Expressive</td>
<td>-.332</td>
<td>.743</td>
<td></td>
</tr>
<tr>
<td>7. Structured vs Non-structured</td>
<td>-7.974</td>
<td>&lt;.001**</td>
<td></td>
</tr>
<tr>
<td>8. Interactive vs Non-interactive</td>
<td>-2.345</td>
<td>.029</td>
<td></td>
</tr>
</tbody>
</table>

Note: * $\alpha_B = \alpha /$ number of contrasts $= .05 / 8 = .006$ significant at <.006
** indicates significant at <.001
Contrast 1 shows that there is a significant difference between the mean scores of the ratio of the number of grammatical errors in Task 1—narrative writing and Task 2—informative writing ($t = -3.648$, $p = .002$). The ratio of mean score of Task 1 is .3805 while that of Task 2 is .4892.

Contrast 2 indicates that there is a significant difference between the mean scores of the ratio of the number of grammatical errors in Task 1—narrative writing and Task 3—persuasive writing ($t = -7.297$, $p < .001$). The ratio of mean score of Task 1 is .3805 while that of Task 3 is .6011.

Contrast 3 indicates that there is a significant difference between the mean scores of the ratio of the number of grammatical errors in Task 1—narrative writing and Task 4—expressive writing ($t = -7.628$, $p < .001$). The ratio of mean score of Task 1 is .3805 while that of Task 4 is .6142.

Contrast 4 indicates that there is a significant difference between the mean scores of the ratio of the number of grammatical errors in Task 2—informative writing and Task 3—persuasive writing ($t = -3.648$, $p = .002$). The ratio of mean score of Task 2 is .4892 while that of Task 3 is .6011.

Contrast 5 indicates that there is a significant difference between the mean scores of the ratio of the number of grammatical errors in Task 2—informative writing and Task 4—expressive writing ($t = 3.980$, $p = .001$). The ratio of mean score of Task 2 is .4892 while that of Task 4 is .6142.
Contrast 6 indicates that there is no significant difference between the mean scores of the ratio of the number of grammatical errors in Task 3—persuasive writing and Task 4—expressive writing ($t = -.332$, $p = .743$). The ratio of mean score of Task 3 is .6011 while that of Task 4 is .6142. The mean score difference is too slight to lead to a significant difference.

Contrast 7 and 8 compare the mean difference of two grouping variables, Task 1 + Task 3 (structured tasks) versus Task 2 + Task 4 (non-structured tasks), and Task 2 + Task 3 (tasks involving an interactive audience) versus Task 1 + Task 4 (tasks involving a non-interactive audience). The results of these contrast analyses will be discussed in the later sections about Research Question #2 and #3.
Table 4.15

Follow-up Contrasts: For the Variable Types of Grammatical Errors

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Tasks</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Narrative vs Informative</td>
<td>-2.889</td>
<td>.009</td>
</tr>
<tr>
<td>2.</td>
<td>Narrative vs Persuasive</td>
<td>-2.438</td>
<td>.024</td>
</tr>
<tr>
<td>3.</td>
<td>Narrative vs Expressive</td>
<td>-3.721</td>
<td>.001**</td>
</tr>
<tr>
<td>4.</td>
<td>Informative vs Persuasive</td>
<td>.451</td>
<td>.657</td>
</tr>
<tr>
<td>5.</td>
<td>Informative vs Expressive</td>
<td>-.832</td>
<td>.475</td>
</tr>
<tr>
<td>6.</td>
<td>Persuasive vs Expressive</td>
<td>-1.284</td>
<td>.213</td>
</tr>
<tr>
<td>7.</td>
<td>Structured vs Non-structured</td>
<td>-2.950</td>
<td>.008</td>
</tr>
<tr>
<td>8.</td>
<td>Interactive vs Non-interactive</td>
<td>-1.135</td>
<td>.269</td>
</tr>
</tbody>
</table>

Note: * α_B = α / number of contrasts = .05 / 8 = .006 significant at <.006
** indicates significant at <.001

Contrast 1 shows that there is no significant difference between the mean scores of the ratio of the types of grammatical errors of Task 1—narrative writing and Task 2—informative writing (t = -2.889, p = .009). The ratio of mean score of Task 1 is .2178 while that of Task 2 is .0349. The difference is so slight that it doesn’t lead to a significant difference.

Contrast 2 indicates that there is no significant difference between the mean scores of the ratio of the types of grammatical errors of Task 1—narrative writing and
Task 3—persuasive writing \( (t = -2.438, p = .024) \). The conjunction ratio mean score of Task 1 is .2178 while that of Task 3 is .2913. The difference is too slight to lead to a significant difference.

Contrast 3 indicates that there is a significant difference between the mean scores of the ratio of the types of grammatical errors of Task 1—narrative writing and Task 4—expressive writing \( (t = -3.721, p = .001) \). The conjunction ratio mean score of Task 1 is .2178 while that of Task 4 is .3300.

Contrast 4 indicates that there is no significant difference between the mean scores of the ratio of the types of grammatical errors of Task 2—informative writing and Task 3—persuasive writing \( (t = .451, p = .657) \). The conjunction ratio mean score of Task 2 is .2178 while that of Task 3 is .2913. The difference is too slight to lead to a significant difference.

Contrast 5 indicates that there is no significant difference between the mean scores of the ratio of the types of grammatical errors of Task 2—informative writing and Task 4—expressive writing \( (t = -.832, p = .475) \). The conjunction ratio mean score of Task 2 is .3049 while that of Task 4 is .3300. The difference is too slight to lead to a significant difference.

Contrast 6 indicates that there is no significant difference between the mean scores of the ratio of the types of grammatical errors of Task 3—persuasive writing and Task 4—expressive writing \( (t = -1.284, p = .213) \). The conjunction ratio mean score of
Task 3 is .293 while that of Task 4 is .3300. The difference is too slight to lead to a significant difference.

Contrast 7 and 8 compare the mean difference of two grouping variables, Task 1 + Task 3 (structured tasks) versus Task 2 + Task 4 (non-structured tasks), and Task 2 + Task 3 (tasks involving an interactive audience) versus Task 1 + Task 4 (tasks involving a non-interactive audience). The results of these contrast analyses will be discussed in the subsequent sections about Research Question #2 and #3.

Summary

The overall ANOVA tests on the 8 dependent variables used to measure students' writing performance show significant differences across e-mail tasks of different rhetorical purposes at the following levels: 1) syntactic complexity in terms of subordination ratio, 2) lexical complexity in terms of both lexical diversity and lexical density, 3) textual cohesion in terms of sentence-level cohesive conjunctions, and 4) grammatical accuracy in terms of the number and the types of grammatical errors. Such results render strong support to the hypothesis that ESL students' writing performance varies across e-mail tasks of different rhetorical purposes.

The results of the posthoc contrast tests further reveal more detailed findings about the differences in students' writing performance among the different tasks. Table 4.16 presents a summary of the posthoc pairwise contrast tests which yielded significant results.
Table 4.16

Posthoc Contrasts with Significant Results

<table>
<thead>
<tr>
<th>Variables</th>
<th>T1 vs T2</th>
<th>T1 vs T3</th>
<th>T1 vs T4</th>
<th>T2 vs T3</th>
<th>T2 vs T4</th>
<th>T3 vs T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subratio</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diversity</td>
<td>**</td>
<td>**</td>
<td></td>
<td>**</td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>**</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>Scohratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td></td>
</tr>
<tr>
<td>Ngrammar</td>
<td>*</td>
<td>**</td>
<td></td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Tgrammar</td>
<td></td>
<td></td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * $\alpha_B = \alpha / \text{number of contrasts} = .05 / 8 = .006$ significant at $<.006$
** indicates significant at $<.001$

To sum up, in terms of the mode of writing as related to a particular rhetorical purpose, it is obvious that the most differences were found between Task 1 (narrative writing) and Task 3 (persuasive writing), which was shown in the fact that among the 6 possible pairs of contrasts, 5 of them revealed significant differences between these two tasks, with the only exception for the variable of types of grammatical errors. In contrast, between Task 3 (persuasive writing) and Task 4 (expressive writing), the least difference was found, which could be seen in that only one variable, lexical diversity, yielded significant difference between these two tasks. Table 4.16 also indicates that fewer significant differences were found the contrast between Task 1 (narrative writing) and
Task 2 (informative writing) than in the contrast between Task 2 (informative writing) and Task 4 (expressive writing).

When examined in terms of linguistic features, the posthoc contrast tests suggest another pattern of variation in student’s writing performance among the different tasks. As shown in Table 4.16, students’ writing performance differed significantly the most in terms of the number of grammatical errors they made while performing different tasks. With the exception of the contrast between Task 3 (persuasive writing) and Task 4 (expressive writing), all contrasts showed significant difference in the variable of the number of grammatical errors made per text. Interestingly, when grammatical accuracy was measured in terms of the types of errors, the least significant difference was found among all tasks: only the contrast between Task 1 (narrative writing) and Task 4 (expressive writing) was found to be significantly different. Likewise, the variable of sentence-level cohesive conjunction yielded only one significant result, i.e. between Task 1 (narrative writing) and Task 3 (persuasive writing); all the other contrasts were non-significant. Besides, substantially significant differences were found consistently in the measurement of lexical complexity, in terms of both lexical diversity and lexical density.

The results of the posthoc contrasts indicate the complexity of the assessment of writing performance, which will be discussed in a later chapter.
Research Question #2: Audience and Writing Performance

Research Question: Is there a difference in writing performance in e-mail tasks involving an interactive versus a non-interactive audience?

$H_0$: There is no difference in students' writing performance in e-mail tasks involving an interactive versus a non-interactive audience.

Research Question #2 can be answered by examining contrast 8 which compares the mean scores of Task 2 + Task 3 (tasks involving an interactive audience) vs Task 1 + Task 4 (tasks involving a non-interactive audience) in the posthoc tests displayed in the previous section. Table 4.17 below presents the means and standard deviations of these two groups of tasks.
Table 4.17

Means and Standard Deviations of the Dependent Variables of Tasks Involving an Interactive Audience (Task 2 + Task 3) vs Tasks Involving a Non-interactive Audience (Task 1 + Task 4)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Interactive Audience (Task 2 + Task 3)</th>
<th>Non-interactive Audience (Task 1 + Task 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S. D.</td>
</tr>
<tr>
<td>Slength</td>
<td>17.27</td>
<td>3.42</td>
</tr>
<tr>
<td>Subratio</td>
<td>.6590</td>
<td>.1006</td>
</tr>
<tr>
<td>Diversity</td>
<td>76.84</td>
<td>2.72</td>
</tr>
<tr>
<td>Density</td>
<td>81.93</td>
<td>4.37</td>
</tr>
<tr>
<td>Scohratio</td>
<td>.2259</td>
<td>.0160</td>
</tr>
<tr>
<td>Pcohratio</td>
<td>.3729</td>
<td>.1954</td>
</tr>
<tr>
<td>Ngrammar</td>
<td>.5451</td>
<td>.2809</td>
</tr>
<tr>
<td>Tgrammar</td>
<td>.2981</td>
<td>.1040</td>
</tr>
</tbody>
</table>

Note:
- Slength (average sentence length) = Total number of words / Total number of sentence
- Subratio (subordination ratio) = Subordinations / Subordinations + Coordinations
- Diversity (lexical diversity) = Number of different words including content and function words / Total number of words
- Density (lexical density) = Lexical items (content words) / Total number of words
- Scohratio (ratio of sentence-level cohesive conjunction) = Number of cohesive conjunction at the sentence level / Total number of sentences
- Pcohratio (ratio of paragraph-level transitional expressions) = Number of transitional expressions at the paragraph level / Total number of sentences
- Ngrammar (number of grammatical errors) = Number of grammatical errors / Total number of sentences
Tgrammar (type of grammatical errors) = Number of types of grammatical errors / Total number of sentences

Table 4.18 below represents a summary of the results from the posthoc tests performed in contrast 8 for all the 8 dependent variables:

Table 4.18

Follow-up Contrasts: Tasks Involving an Interactive Audience (Task 2 + Task 3) vs Tasks Involving a Non-interactive Audience (Task 1 + Task 4)

<table>
<thead>
<tr>
<th>Variable</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_length</td>
<td>-.487</td>
<td>.631</td>
</tr>
<tr>
<td>Subratio</td>
<td>.993</td>
<td>.009</td>
</tr>
<tr>
<td>Diversity</td>
<td>8.480</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Density</td>
<td>5.641</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Scohratio</td>
<td>-2.793</td>
<td>.011</td>
</tr>
<tr>
<td>Pcohratio</td>
<td>-.374</td>
<td>.712</td>
</tr>
<tr>
<td>Ngrammar</td>
<td>-2.345</td>
<td>.029</td>
</tr>
<tr>
<td>Tgrammar</td>
<td>-1.135</td>
<td>.269</td>
</tr>
</tbody>
</table>

Note: * α_B = α / number of contrasts = .05 / 8 = .006 significant at <.006
** indicates significant at <.001

Table 4.18 indicates that there are significant differences between tasks involving an interactive audience (Task 2 and Task 3) and tasks involving a non-interactive
audience in the mean scores of the two lexical measurements, i.e. lexical diversity \(t = 8.480, p <.001\), lexical density \(t = 5.641, p = <.001\). The contrast tests of the other measurement variables do not show any significant differences. Such a result suggests that it is only at the level of lexical complexity that significant difference was observed in students' writing performance on e-mail tasks involving a different audience.

The descriptive statistics provided in Table 4.17 above reveals some consistent results in the differences between tasks involving an interactive audience versus tasks involving a non-interactive audience. In terms of lexical complexity which yielded significant differences between these two types of tasks, it is shown that there was a consistently higher level of lexical complexity in terms of both lexical diversity and lexical density in the tasks involving an interactive audience (mean of Diversity = 76.84, mean of Density = 81.93) as versus tasks involving a non-interactive audience (mean of Diversity = 75.71, mean of Density = 77.84). Similar consistent results were also found in the measurement of textual cohesion in terms of sentence-level cohesive conjunctions and paragraph-level transitional expressions. On both measurements, there was a higher frequency of occurrence of such cohesive devices in the tasks involving an interactive audience (mean of Scohratio = .2259, mean of Pcohratio = .3729) than in tasks involving a non-interactive audience (mean of Scohratio = .1663, mean of Pcohratio = .3570). Mixed results were found in the measurements of syntactic complexity: while there was a longer average sentence length in the texts produced in the tasks involving an interactive audience (mean = 17.27) than in the tasks involving a non-interactive audience (mean =
16.92), the subordinated clauses in the texts produced in the tasks involving an interactive audience were slightly fewer (mean = .6590) than in those produced in tasks involving a non-interactive audience (mean = .6595). Again, an interesting result was observed in the measurement of grammatical accuracy: in terms of both the number and the types of grammatical errors, there was a higher frequency of occurrence of errors in the tasks involving an interactive audience (mean of \( N_{\text{grammar}} = .5451, T_{\text{grammar}} = .2981 \)) than in the tasks involving a non-interactive audience (mean of \( N_{\text{grammar}} = .4974, T_{\text{grammar}} = .2739 \)). Such results suggest a tendency for students to make more grammatical errors when they were involved with more active interaction with the audience, the implication of which will be further explored in the subsequent chapter of this dissertation.

**Research Question #3: Task Structure and Writing Performance**

Research Question: Is there a difference in writing performance in structured versus non-structured e-mail tasks?

**H₀:** There is no difference in students' writing performance on e-mail in structured vs non-structured tasks.

Research Question #3 can be answered by examining contrast 7 which compares the mean scores of Task 1 + Task 3 (structured tasks) vs Task 2 + Task 4 (non-structured tasks) in the posthoc tests displayed in the previous section. Table 4.19 presents the means and standard deviations of the structured tasks vs the non-structured tasks.
Table 4.19

Means and Standard Deviations of the Dependent Variables of Structured Tasks (Task 1 + Task 3) Vs Non-structured Tasks (Task 2 + Task 4)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Structured Tasks (Task 1 + Task 3)</th>
<th>Non-structured Tasks (Task 2 + Task 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S. D.</td>
</tr>
<tr>
<td>Slength</td>
<td>16.81</td>
<td>5.21</td>
</tr>
<tr>
<td>Subratio</td>
<td>.6570</td>
<td>.1045</td>
</tr>
<tr>
<td>Diversity</td>
<td>75.81</td>
<td>3.06</td>
</tr>
<tr>
<td>Density</td>
<td>79.09</td>
<td>5.82</td>
</tr>
<tr>
<td>Scohratio</td>
<td>.1948</td>
<td>.1127</td>
</tr>
<tr>
<td>Pcohratio</td>
<td>.4013</td>
<td>.2179</td>
</tr>
<tr>
<td>Ngrammar</td>
<td>.4908</td>
<td>.307</td>
</tr>
<tr>
<td>Tgrammar</td>
<td>.2546</td>
<td>.1065</td>
</tr>
</tbody>
</table>

Note:

- Slength (average sentence length) = Total number of words / Total number of sentence
- Subratio (subordination ratio) = Subordinations / Subordinations + Coordinations
- Diversity (lexical diversity) = Number of different words including content and function words / Total number of words
- Density (lexical density) = Lexical items (content words) / Total number of words
- Scohratio (ratio of sentence-level cohesive conjunction) = Number of cohesive conjunction at the sentence level / Total number of sentences
- Pcohratio (ratio of paragraph-level transitional expressions) = Number of transitional expressions at the paragraph level / Total number of sentences
- Ngrammar (number of grammatical errors) = Number of grammatical errors / Total number of sentences
- Tgrammar (type of grammatical errors) = Number of types of grammatical errors / Total number of sentences
Table 4.20 below represents a summary of the results from the posthoc tests performed in contrast 7 for all the 8 dependent variables:

Table 4.20
Follow-up Contrasts: Structured Tasks (Task 1 + Task 3) vs Non-structured Tasks (Task 2 + Task 4)

<table>
<thead>
<tr>
<th>Variable</th>
<th>T Value</th>
<th>T Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slength</td>
<td>-8.808</td>
<td>.428</td>
</tr>
<tr>
<td>Subrati o</td>
<td>4.826</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Diversity</td>
<td>-4.286</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Density</td>
<td>2.211</td>
<td>.038</td>
</tr>
<tr>
<td>Scohratio</td>
<td>-2.264</td>
<td>.016</td>
</tr>
<tr>
<td>Pcohratio</td>
<td>1.448</td>
<td>.162</td>
</tr>
<tr>
<td>Ngrammar</td>
<td>-7.974</td>
<td>&lt;.001**</td>
</tr>
<tr>
<td>Tgrammar</td>
<td>-2.950</td>
<td>.008</td>
</tr>
</tbody>
</table>

Note: * α_B = α / number of contrasts = .05 / 8 = .006 significant at <.006
** indicates significant at <.001

Table 4.20 indicates that there are significant differences between structured tasks (Task 1 and Task 3) and non-structured tasks (Task 2 and Task 4) in the mean scores of subordination ratio (t = 4.826, p <.001), lexical diversity (t = -4.286, p <.001), and the
ratio of number of grammatical errors ($t = -7.974, p < .001$). The contrast tests of the other measurement variables do not show any significant differences.

Besides, the descriptive statistics presented in Table 4.19 above show that students tended to perform with a higher level of syntactic complexity in the non-structured tasks (mean of $S_{\text{length}} = 16.81$, mean of $S_{\text{ratio}} = .6570$) than in the structured tasks (mean of $S_{\text{length}} = 17.38$, mean of $S_{\text{ratio}} = .6618$). Similar results were found in the measurements of lexical complexity: both the measurement of lexical diversity and lexical density showed a consistent level of higher lexical complexity in the nonstructured tasks (mean of $D_{\text{diversity}} = 76.73$, mean of $D_{\text{density}} = 80.69$) than in the structured tasks (mean of $D_{\text{diversity}} = 75.81$, mean of $D_{\text{density}} = 79.09$). Mixed results were found in the measurements of textual cohesion: while students tended to use slightly more sentence-level cohesive conjunctions in the non-structured tasks (mean = .1973) than in the structured tasks (mean = .1948), there were fewer transitional expressions at the paragraph level in the non-structured tasks (mean = .3286) than in the structured tasks (mean = .4013). An interesting result was found in the measurement of grammatical accuracy: in terms of both the number and the types of grammatical errors, there was a higher frequency of occurrence of errors in the nonstructured tasks (mean of $N_{\text{grammar}} = .5571$, $T_{\text{grammar}} = .3174$) than in the structured tasks (mean of $N_{\text{grammar}} = .4908$, $T_{\text{grammar}} = .2546$). Such results suggest a tendency for students to make more grammatical errors when the tasks gave them more freedom and flexibility in
performance. The importance of this finding will be further discussed in the subsequent chapter of this dissertation.

**Research Question #4: Motivation, Attitude, Anxiety, Computer Literacy and Writing Performance**

Research Question: To what extent do motivation, attitude, anxiety, and computer literacy account for the variation in the writing performance of ESL students composing in an electronic mode?

H_0: Motivation, attitude, anxiety and computer literacy do not contribute significantly to the variation in writing performance on E-mail tasks.

To test this hypothesis, a series of multiple regression analyses were performed using motivation, attitude, anxiety and computer literacy as the predictor variables and the 8 measurement variables as the dependent variables in the multiple regression equation.

Simultaneous, block regression analyses were used to estimate how the independent variables contributed to the variance in the dependent variables. This procedure of multiple regression analysis is performed by entering all the independent variables (motivation, attitude, anxiety and computer literacy) into the multiple regression equation at the same time and controlling for intercorrelations among independent variables by partialing out shared variance and measuring the unique contribution of the
block variables entered into the regression. It thus allows the researcher to examine to
what extent motivation, attitude, anxiety and computer literacy may account for the
variance in writing performance as measured on different linguistic and textual levels in
both a combined and a separate manner. Table 4.21 summaries the results of the multiple
regression analysis on the 8 dependent variables used to measure writing performance.
Table 4.21

Multiple Regression Analysis of Effects of Computer Literacy, Motivation, Attitude and Anxiety on Writing Performance

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sentence Length</th>
<th>Subordination Ratio</th>
<th>Lexical Diversity</th>
<th>Lexical Density</th>
<th>Number of Grammatical Errors</th>
<th>Type of Grammatical Errors</th>
<th>Cohesive Conjunctions at Sentence Level</th>
<th>Transitional Expressions at Paragraph Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>β</td>
<td>β</td>
<td>β</td>
<td>β</td>
<td>β</td>
<td>β</td>
<td>β</td>
</tr>
<tr>
<td>Computer</td>
<td>.14</td>
<td>.13</td>
<td>-.10</td>
<td>.00</td>
<td>.01</td>
<td>.10</td>
<td>.14</td>
<td>.05</td>
</tr>
<tr>
<td>Unique R²</td>
<td>.02</td>
<td>.02</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
<td>.01</td>
<td>.02</td>
<td>.00</td>
</tr>
<tr>
<td>Motivation</td>
<td>.07</td>
<td>.03</td>
<td>.35**</td>
<td>.41**</td>
<td>-.30*</td>
<td>-.24</td>
<td>.34**</td>
<td>.21</td>
</tr>
<tr>
<td>Unique R²</td>
<td>.00</td>
<td>.00</td>
<td>.08**</td>
<td>.11**</td>
<td>.06*</td>
<td>.03</td>
<td>.07**</td>
<td>.03</td>
</tr>
<tr>
<td>Attitude</td>
<td>.26</td>
<td>.24</td>
<td>.32*</td>
<td>.09</td>
<td>-.29</td>
<td>-.39**</td>
<td>.51**</td>
<td>.45**</td>
</tr>
<tr>
<td>Unique R²</td>
<td>.03</td>
<td>.03</td>
<td>.05*</td>
<td>.00</td>
<td>.04</td>
<td>.07**</td>
<td>.13**</td>
<td>.10**</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.31*</td>
<td>.08</td>
<td>-.13</td>
<td>.38**</td>
<td>-.16</td>
<td>-.05</td>
<td>.02</td>
<td>.06</td>
</tr>
<tr>
<td>Unique R²</td>
<td>.07*</td>
<td>.00</td>
<td>.01</td>
<td>.10**</td>
<td>.02</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>Overall R²</td>
<td>.10</td>
<td>.07</td>
<td>.14</td>
<td>.22</td>
<td>.08</td>
<td>.10</td>
<td>.18</td>
<td>.35</td>
</tr>
<tr>
<td>Overall F</td>
<td>2.32</td>
<td>1.63</td>
<td>3.51**</td>
<td>5.95**</td>
<td>1.81</td>
<td>2.40</td>
<td>4.41**</td>
<td>2.83*</td>
</tr>
<tr>
<td>d.f.</td>
<td>4, 83</td>
<td>4, 83</td>
<td>4, 83</td>
<td>4, 83</td>
<td>4, 83</td>
<td>4, 83</td>
<td>4, 83</td>
<td>4, 83</td>
</tr>
</tbody>
</table>

Note: * p ≤ .05; ** p ≤ .01 (two-tailed test).
Table 4.21 reports the results of the multiple regression analyses. It shows that motivation had a strong positive influence on the following dependent variables: lexical diversity ($R^2 = .08, p \leq .01$), lexical density ($R^2 = .11, p \leq .01$), cohesive conjunctions at the sentence level ($R^2 = .07, p \leq .01$). The more motivated students tended to perform with a higher level of lexical complexity and used more cohesive conjunctions at the sentence level. Besides, motivation had a significantly negative correlation with the number of grammatical errors, which means the more motivated learners made fewer grammatical mistakes ($R^2 = .06, p \leq .05$).

Attitude was found to significantly influence writing performance in terms of lexical diversity ($R^2 = .05, p \leq .05$), cohesive conjunctions at the sentence level ($R^2 = .13, p \leq .01$), and transitional expressions at the paragraph level ($R^2 = .10, p \leq .01$). Attitude was found to have a significant negative relationship with the type of grammatical errors ($R^2 = .07, p \leq .01$), which means that learners who had a more positive attitudes towards the e-mail tasks and using computers to write tended to produce fewer types of grammatical errors.

The affective variable anxiety had a strong impact on 2 dependent variables, i.e., average sentence length ($R = .07, p \leq .05$) and lexical density ($R = .10, p \leq .01$). Note that due to reverse coding, a higher anxiety score indicates a lower level of anxiety. Thus, it can be concluded from the results that learners with a lower level of computer anxiety produced texts of longer average sentence length and used more different lexical items.
Surprisingly, computer literacy was not found to predict significantly any of the 8 dependent variables because none of the R square changes caused by computer literacy was found to be significant, indicating that computer literacy did not account for a significant portion of the variance in any of the dependent variables.

When the variables of motivation, attitude, anxiety and computer literacy were combined to predict writing performance, it was found that the combination of these variables had a significant contribution to the variation in writing performance in 4 of the 8 dependent variables used to measure writing performance, i.e. lexical diversity (Overall $R^2 = .14, \ p \leq .01$), lexical density (Overall $R^2 = .22, \ p \leq .01$), sentence-level cohesive conjunctions (Overall $R^2 = .18, \ p \leq .01$), paragraph-level transitional expressions (Overall $R^2 = .35, \ p \leq .05$). Such results suggest that this group of social, affective and cognitive variables combined together can account for a significant amount of variance in students’ writing performance on the e-mail tasks in terms of lexical complexity and textual cohesion.
Research Question #5: Potentials and Limitations of Computerized Analysis

Research Questions: What are the potential and possible limitations of using computerized text analysis programs for data analysis in L2 research?

This research question was addressed by 1) comparing the results of textual analysis performed by the computer and the holistic/analytic evaluation conducted by ESL raters, and 2) exploring the advantages and disadvantages of the computer programs used to conduct the textual analysis. The first part of this question was investigated by means of statistical analyses performed on the computerized scores and the scores assigned by the raters. The following sub-questions were raised:

1) Is there a significant correlation between the computer scores on linguistic and textural features and the correspondent analytical scales assigned by the ESL raters?

H₀: There is no significant correlation between the computer scores on linguistic and textural features and the correspondent analytical scales assigned by the ESL raters.

2) Is there a significant correlation between the computer scores on linguistic and textural features and the holistic and combined analytical scores assigned by the ESL raters?

H₀: There is no correlation between the computerized text analysis scores and the ESL Raters' assessments of writing performance using holistic and combined analytical scores?
In order to answer this question, a series of Pearson product-moment correlational analyses were performed to test the null hypothesis of zero correlation between the two kinds of evaluation.

Before performing the correlational analyses between the computerized scores and the scores assigned by the ESL raters, a reliability test was conducted to test the level of interrater reliability between the two ESL raters on both their holistic scoring and the analytical scales. Table 22 reports the results of the interrater reliability test:
Table 4.22
Interrater Reliability of the Scores Given by the Two ESL Raters for the Dependent Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean of Scale</th>
<th>S.D.</th>
<th>Correlation Coefficient</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>HoliScore</td>
<td>6.47</td>
<td>.76</td>
<td>.61</td>
<td>.76</td>
</tr>
<tr>
<td>ComScore</td>
<td>46.09</td>
<td>8.78</td>
<td>.65</td>
<td>.78</td>
</tr>
<tr>
<td>Main Idea</td>
<td>6.11</td>
<td>1.18</td>
<td>.46</td>
<td>.63</td>
</tr>
<tr>
<td>Purpose</td>
<td>6.53</td>
<td>1.66</td>
<td>.56</td>
<td>.70</td>
</tr>
<tr>
<td>Audience</td>
<td>7.01</td>
<td>1.67</td>
<td>.60</td>
<td>.75</td>
</tr>
<tr>
<td>Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow</td>
<td>6.57</td>
<td>1.39</td>
<td>.44</td>
<td>.62</td>
</tr>
<tr>
<td>Sentence</td>
<td>6.57</td>
<td>1.54</td>
<td>.57</td>
<td>.72</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>6.60</td>
<td>1.23</td>
<td>.45</td>
<td>.62</td>
</tr>
<tr>
<td>Grammar</td>
<td>6.69</td>
<td>1.12</td>
<td>.44</td>
<td>.61</td>
</tr>
</tbody>
</table>

Note: ComScore = The 2 raters’ combined score of the 7 analytical scales; Maximum = 70

HoliScore = The 2 raters’ holistic score; Maximum = 10

Table 4.22 shows that the reliability coefficients of all variables are at least above 0.60, indicating a reasonable interrater reliability level between the scores assigned by the two ESL raters in all categories. The highest levels of interrater reliability are found in the
single holistic scoring at a five-point scale ($\alpha = 0.76$) and the combined score of all the analytical scales ($\alpha = 0.78$). Although the interrater reliability levels of the analytical scales are all lower than that of the holistic and combined scores, as stated above, they are all above a reasonable level of 0.60.

Having established interrater reliability of the two ESL raters’ scoring, an average score was computed by adding the two raters’ scores divided by 2. This average score was obtained for the holistic and combined scores as well as all the analytical scales. The average scores of the two ESL raters were then used to correlate with the computerized scores.

First, the computer-performed analyses at the linguistic and textual levels were correlated with the ESL raters’ assessments in the corresponding categories, i.e. the scores of syntactic complexity (sentence length, subordination ration) were correlated with the score of Sentence; the scores of lexical complexity (lexical diversity, lexical density) were correlated with the score of Vocabulary; the scores of textual cohesion (cohesive conjunctions at the sentence level, transitional expressions at the paragraph level) were correlated with the score of Flow; the scores of grammatical accuracy (number of grammatical errors, types of grammatical errors) were correlated with the score of Grammar. Figure 4.1 diagrams the variables of the correlational analyses:
Table 4.23 through Table 4.26 below report the results of the correlational analyses of the computerized scores and the scores assigned by the ESL raters in the corresponding categories. It should be noted that an average score obtained by adding the two ESL raters’ scores divided by 2 was used to correlate with the computerized score for each of the corresponding categories. For example, the score of the category Sentence is
the average score of the scores given by the two raters on the scale *Sentence*, which assess the sentence structures used in the text. The same procedure applies to the categories of *Vocabulary, Flow and Grammar*.

Table 4.23

Intercorrelations of Computerized Text Analysis Scores and ESL Raters Scores for Syntactic Measurement

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>Sentence</th>
<th>Slength</th>
<th>Subratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentence</td>
<td>32.87</td>
<td>7.69</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slength</td>
<td>17.10</td>
<td>4.59</td>
<td>-0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subratio</td>
<td>.66</td>
<td>.12</td>
<td>-0.07</td>
<td>.04</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: ** indicates p ≤ .01; * indicates p ≤ .05

Table 4.23 shows that there is no significant relationship between the computerized scores and the ESL raters' scoring in terms of syntactic measurement (r = -0.09 between sentence length and score of *Sentence*, r = -0.07 between subordination ratio and score of *Sentence*).
Table 4.24

Intercorrelations of Computerized Text Analysis Scores and ESL Raters' Scores for Lexical Measurement

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>Vocabulary</th>
<th>Diversity</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary</td>
<td>33.01</td>
<td>6.12</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diversity</td>
<td>76.27</td>
<td>2.94</td>
<td>-.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>79.89</td>
<td>5.27</td>
<td>-.14</td>
<td>0.61**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: ** indicates p ≤ .01; * indicates p ≤ .05

Table 4.24 shows that there is no significant relationship between the computerized scores and the ESL raters' scoring in terms of lexical measurement (r = -.18 between lexical diversity and score of Vocabulary, r = -.14 between lexical density and score of Vocabulary). However, lexical diversity and lexical density are significantly correlated (r = .61, p < .01), indicating that these two scales work together well to measure lexical complexity.
Table 4.25

Intercorrelations of Computerized Text Analysis Scores and ESL Raters’ Scores for Textual Cohesion

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>Flow</th>
<th>Scohratio</th>
<th>Pcohratio</th>
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<tr>
<td>Flow</td>
<td>32.84</td>
<td>6.94</td>
<td>1.00</td>
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<td></td>
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<tr>
<td>Scohratio</td>
<td>.20</td>
<td>.11</td>
<td>.07</td>
<td></td>
<td></td>
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<tr>
<td>Pcohratio</td>
<td>.37</td>
<td>.29</td>
<td>.16</td>
<td>.40**</td>
<td>1.00</td>
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</tbody>
</table>

Note: ** indicates $p \leq .01$; * indicates $p \leq .05$

Table 4.25 shows that there is no significant relationship between the computerized scores and the ESL raters’ scoring in terms of textual cohesion ($r = .07$ between the number of sentence-level cohesive conjunction and the score of *Flow*, $r = .16$ between the number of paragraph-level transitional expression and the score of *Flow*). However, sentence-level cohesive conjunction and paragraph-level transitional expression are significantly correlated ($r = .40$, $p < .01$), indicating that these two scales work together well as indexes of textual cohesion.
Table 4.26 shows that in terms of the measurement of grammatical accuracy, the computerized scores are significantly correlated with the ESL raters' scoring on grammar ($r = -.32$, $p < .01$ between number of grammatical error and the scoring on grammar, $r = -.26$, $p < .01$ between types of grammatical error and the scoring on grammar). It should be noted that the significant correlation between the computerized scores of number and types of grammatical errors and the ESL raters' scoring on grammar is in the negative direction, which suggests that the more number and types of grammatical errors a text contains, the lower it will be scored on the scale of Grammar by the ESL raters.

Furthermore, there is a significant correlation between the number of grammatical errors and the number of types of grammatical error, indicating that these two measurements work well together to assess grammatical accuracy in writing performance.
To sum up, the results of the correlational analyses performed between the computerized scores of the separate linguistic and textual features and the correspondent analytical scores assigned by the ESL raters show that it is only in the category of grammatical accuracy that a significant correlation was found in these two types of scoring. No significant correlation was found in the other categories.

In order to validate the correlational analyses between the computerized scores and the ESL raters' scoring, a second correlational analysis was conducted using the computerized scores and the ESL raters' holistic scores and the combined scores of the analytical scales. The total of the holistic score for each piece of writing is 5 on a 5-point scale. The combined score of the analytical scales for each piece of writing is 35, which was obtained by adding the maximum scores for all the 7 categories on the Evaluation Form for ESL raters (See Appendix D for the details of this Evaluation Form). An average score for both the holistic and the combined score was obtained by adding the two raters' scores divided by 2. The averaged scores were used to compare with the computerized scores. Table 4.27 reports the results of the second correlational analysis.
Table 4.27

Intercorrelations of the Computerized Scores and ESL Raters’ Scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
<th>8</th>
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<td>3. Slength</td>
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<td>4. Subratio</td>
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<td>-.05</td>
<td>-.04</td>
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<td>6. Density</td>
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<td>-.15</td>
<td>.28**</td>
<td>.06</td>
<td>.61**</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>7. Scohratio</td>
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<td>-.13</td>
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<td>.05</td>
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<td>8. Pcohratio</td>
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<td>-.08</td>
<td>-.18</td>
<td>-.02</td>
<td>-.03</td>
<td>.01</td>
<td>.40**</td>
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<td></td>
<td></td>
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<td>9. Ngrammar</td>
<td>-.26*</td>
<td>-.30**</td>
<td>.47**</td>
<td>-.01</td>
<td>.11</td>
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<td>-.06</td>
<td>-.26*</td>
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<tr>
<td>10. Tgrammar</td>
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<td>-.30**</td>
<td>.49**</td>
<td>.01</td>
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<td>-.23*</td>
<td>.79**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note:  
** indicates p < .01;  * indicates p < .05  
Total = The average of the 2 raters’ combined scores of the 7 analytical scales  
Mscore = The average of the 2 raters’ holistic scores for each piece of writing
Table 4.27 reveals that there is a significant correlation between the ESL raters' holistic score and the combined score of the analytical scales, indicating a high level of internal consistency in the raters' scoring ($r = .97, p < .01$).

When comparing the computerized scores with the raters' holistic and combined scores, an interesting pattern was observed. Among the eight dependent variables measuring writing performance in terms of syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy, there is a significant correlation between the computerized scores and the raters' scores in the category of grammatical accuracy, in terms of both the number of grammatical error and type of grammatical error. The significant correlation was consistently observed when using both the raters' holistic and combined scores to correlate with the computerized scores ($r = .30, p < .01$ between the raters' holistic score and number of grammatical error, $r = .26, p < .05$ between the raters' combined score and number of grammatical error, $r = .30, p < .01$ between the raters' holistic score and types of grammatical error, $r = .26, p < .05$ between the raters' combined scores and types of grammatical error). Such results are also consistent with those found in the set of correlational analyses which focus on comparing the computerized scores and the raters' scores in terms of syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy. In that analysis, a significant correlation was found in the measurements of grammatical accuracy between the computerized analysis and the ESL raters' evaluation. In the previous analysis using the separate computerized scores to correlate with the ESL raters' analytical scores of the
correspondent categories, e.g. the scores of syntactic complexity as indicated by the average sentence length and subordination ratio, grammatical accuracy was the only category in which significant correlation was found between the computerized scores and the scores assigned by the ESL raters. No significant results were found in the other categories. An interesting consistence was found in the second correlational analysis using the ESL raters' average holistic and combined scores to compare with the separate computerized scores. Here, it is only in the category of grammatical accuracy that a significant correlation was observed between these two types of scoring. Such a result suggests that grammatical accuracy seems to be a feature of writing performance that is relatively easy to detect and assess in both a holistic and a discrete manner. The implication of such a finding will be further discussed in the subsequent chapter of this dissertation.

Table 4.27 also shows that among the computerized scores, there is a high level of internal consistency in the two measurements used to assess writing performance in terms of linguistic and textual features. Except the syntactic measurements, all others show a significant correlation between the two subcategories, i.e. there is a significant correlation between lexical diversity and lexical density ($r = .61, p < .01$), sentence-level cohesive conjunction and paragraph-level transitional expression ($r = .40, p < .01$), number of grammatical error and types of grammatical error ($r = .79, p < .01$). These results suggest a high level of internal consistency in the two indexes used to measure each of these linguistic and textual features as indicators of writing quality, consequently reflecting a
high level of internal reliability for the measurement instruments used to evaluate writing quality in the present study.

Summary

Several major results were obtained through the correlational analyses performed using the computerized scores and the ESL raters' holistic and analytical scores: 1) in terms of discrete-point linguistic and textual features, a significant correlation was found between these two types of scoring in the category of grammatical accuracy, i.e. there was a significant correlation between the computerized scores on the two measures of grammatical accuracy (number and types of grammatical errors) and the ESL raters' average score for the evaluation of grammar in writing. No significant correlation was found in the other categories of linguistic and textual features. 2) When using the ESL raters' holistic scores and the combined scores of their analytical scales to correlate with the computerized scores, a similar finding was obtained: it is only in the category of grammatical accuracy that a significant correlation was found between these two types of scoring. 3) Significant correlations were found between the two indexes used to measure lexical complexity (lexical diversity and lexical density), textual cohesion (sentence-level cohesive conjunctions and paragraph-level transitional expressions) and grammatical accuracy (number and types of grammatical errors). Such correlations show a high level of internal consistency in the two types of measurements used to assess these linguistic and textual features, assuring the reliability of the analytical schemes used for data
analysis in the present study. It should also be noted that the measurements used to assess syntactic complexity (average sentence length and subordination ratio) did not yield a significant correlation, indicating a weak relationship between these two indexes for syntactic measurement. The implication of such findings for L2 writing assessment will be discussed in the subsequent chapter of this dissertation.

**Research Question #6: Students' Attitudes and Reactions**

In order to obtain information about students’ attitudes and reactions to the e-mail tasks which were integrated into the writing course, a post-activity questionnaire was administered to the students in the final week of the semester (See Appendix C for a copy of the questionnaire). The first part of this questionnaire consisted of 15 Likert-type questions with a seven-point scale, designed to identify students’ level of motivation, attitude and anxiety concerning computers and learning in general, and participation in the e-mail activities in particular. The second part of this questionnaire was presented in either multiple-choice or open-ended questions. The items in this part were designed to gather information on students’ affective reactions to the e-mail tasks as well as their ways of approaching the tasks.

Results from the first part of the questionnaire show that students’ response to the questions asked to assess their motivation yielded a group mean score of 26 (total possible score = 35), indicating a high level of motivation for using the computers to
practice writing in English in general and for the e-mail activities in particular. The group mean score of attitude is 28 (total possible score =35), reflecting very positive attitudes among the students towards using computers to write via e-mail. In general, there was a level of anxiety among the students about using computers to write via e-mail, yet this anxiety level was relatively low considering the fact that out of a total of 35 for the anxiety scales, the group mean was 23 (As a result of reverse coding, a higher anxiety score indicates a lower level of anxiety).

An examination of the students’ response to the question “How did you usually write the e-mail assignments”, 70% of the students reported that they “wrote directly on the computer” while 30% of them said they “wrote on paper first”, then typed on the computer. Such a response indicates that the students were able to perform with a certain level of comfort while completing the e-mail assignments on the computer.

A qualitative examination of the students’ responses to the open-ended questions on the questionnaire provides further insights into the students’ affective reactions to the e-mail tasks. In general, most of the students had very positive reactions to the e-mail activities and thought such activities were helpful and useful. Following is a summary of the students’ positive responses to the open-ended questions on the questionnaire:

Q: What do you think of the e-mail assignments you did for this class in general?

- rather helpful in improving my English
- useful for exchanging ideas with classmates
- useful for more practice out of class
- great for learning with computers
- interesting activities
- ideas come out easier on e-mail than on paper
helpful for learning more about computers
helpful for exploring ideas
give and send feedback to each other
efficient—immediate feedback from classmates
provide the opportunity to read the other’s writing
able to come back to the ideas easily
help improve writing skills and helpful for writing the essays
benefit from peer’s writing for gather ideas for an essay

The above summary of the students’ responses to the general evaluative question about the e-mail assignments show that the students felt positively about the e-mail activities in general, and they regarded doing the e-mail assignments as a beneficial learning experience. To sum up, three main themes emerge out of the students’ responses to the question, which reflect their positive attitudes towards the e-mail activities: 1) The e-mail activities gave them the opportunity to share ideas with others easily; 2) They benefited from such activities through more practice in writing; 3) They enjoyed learning to write with computers. Such positive responses from the students suggest that the e-mail assignments were successfully integrated into the ESL writing course and they were implemented well to facilitate the students’ writing process. The most obvious benefit students felt about doing the e-mail activities is the easy and convenient access to sharing and exchanging ideas with others about their writing on-line. Through such exchanges, students benefited from giving and receiving feedback with each other in the process of exploring their topics and ideas for writing the academic essays. For example, one student said: “I can read my classmates’ writing before I started my essay. It gave me a lot of ideas”. Another student wrote: “I found the e-mail assignments very helpful for the
preparation of my essay. With just a few minutes I was able to read my classmates’ ideas. Some of their ideas gave me good examples to write my paper”. Such student responses indicate that the e-mail activities served to facilitate students’ writing process in the planning phase when they focused on exploring ideas for their topics. Besides, students felt the e-mail activities were helpful because they had the opportunity to do a lot of out-of-class practice to improve their writing skills in English. Most of them also felt using e-mail to write helped them to learn more about computers, which was important for their academic studies.

The students’ positive attitudes towards the e-mail activities were further reflected in their responses to a more specific question asked about their perception of the e-mail activities:

Q: What do you like best about the e-mail activities?

• share ideas with classmates easily
• practice typing
• fast, save time
• feel free to express opinions
• feel more comfortable doing journals on e-mail
• feel free to write
• good way to communicate
• exchange information with partner
• opportunity to know more about the interests of classmates and cultural exploration
• get ideas from classmates’ writing
• quite convenient to write on e-mail compared with handwriting
• help improve writing

It is apparent that the students expressed similar positive attitudes about the beneficial aspects of the e-mail activities as they responded to the previous general
question, i.e. they liked the easy, fast and convenient access to information exchange with classmates via e-mail. It is interesting to note that they also made comments in a comparative manner, i.e. they tried to compare writing on e-mail and writing with pen and paper, and they seemed to prefer the advantages they could benefit from the aid of technology. For example, one student wrote: “I think the e-mail assignments are very useful and interesting. I like writing on e-mail because the ideas come out easier than if I have to write on paper”. Such comments indicate students' preference for making use of computer technology for writing practice.

The students’ responses to the question which asked them about what they didn’t feel good about the e-mail activities reflect, to a certain extent, the kinds of problems they encountered in the process of completing the assignments:

Q: What do you like least about the e-mail activities?

- can’t write directly on computer, so take a lot of time to finish the assignment
- limited feedback from the instructor
- too many journals on e-mail to read
- need to wait for getting a computer in the lab sometimes
- not graded, so students did not care about grammar, spelling, clarity
- too many messages in the inbox of e-mail account
- hard to type on e-mail
- need to have computer knowledge
- require a lot of time
- cannot send e-mail late at night

Apparently, technology access posed one of the major complaints voiced by the students. For those students who did not possess a computer at home, the e-mail assignments compelled them to work at the school labs, which might be crowded during
certain periods in the semester and thus took up more of the students’ time. Several times over the semester when this study was being carried out, off-campus access to the university’s computer system was cut off due to disk break-down problems on the university servers. One of such technological break-downs happened to occur during a week when one of the e-mail tasks was assigned to the students. Under such circumstances, even those students with a computer at home would have to come to complete the assignment in one of the labs at school. For those students who did not feel comfortable enough to write directly on computers (30% of the class reported writing on paper first, then typing up on the computer), it meant extra time to do the typing on the computer.

Lack of organizational skill with e-mail accounts also caused another problem for students, which could be seen from students’ comments about having too many messages from classmates in their e-mail in-box at a time. A computer workshop was offered to the students in the second week of the semester. During the workshop, the students were given some basic instructions about sending and receiving messages via a listserv, basic commands of using the Pine E-mail program to do e-mail as well as some useful tips for managing one’s e-mail account such as creating separate folders to save important messages in different categories, deleting unwanted messages, forwarding messages, etc. Some students picked up the tips immediately and created a special folder named Eng106 to save all important messages from the class while deleting unimportant ones, yet some others failed to do so. An instance of problems caused by the lack of good management
of one’s e-mail account came out in the middle of the semester when a student reported not being able to receive any messages from the class mailing list. The instructor accompanied the student to the computer lab, logged into the student’s e-mail account, and found that the student’s in-box had been filled up—because she never deleted any incoming messages, what she had in the in-box had exceeded the quota allocated by the university’s computer center to each student user, thus any incoming messages were blocked out. Even though the majority of the students did not think using computer to do the assignment created difficulty for them, a few of them reported frustrations about doing the assignments via e-mail, especially in the first few weeks of the semester.

It is important to point out that several students felt that if they could receive more feedback on e-mail from the instructor, it would be more helpful for them to improve their writing. One student pointed out that because of the lack of attention to grammar, spelling and style of writing when students composed on e-mail, the quality of writing suffered. The implication of such responses from the students regarding the benefits and drawbacks of the e-mail activities will be further discussed in a later chapter of this dissertation.

On the questionnaire, there are two questions which asked students to comment on the four e-mail tasks in terms of their usefulness:
Q: Which particular assignment do you think is the most useful? Why would you think so?
Q: Which particular assignment do you think is the least useful? Why would you think so?

The students' responses show that more than half of them (56%) thought that Task 2 (cultural exchange with partner—informative writing) was the most useful, and 25% of them regarded Task 3 (debating with partner—persuasive writing) as the most useful. These two tasks both consisted of two parts, requiring students to engage in exchanges with their partners. Based on such results, it can be concluded that the majority of the students perceived the tasks involving interaction with their peers were more useful than the tasks without active interaction with their peers. Most students liked Task 2 (cultural exchange) because it helped them to explore cultural information and learn more about the other cultures. One student commented: “I think the most useful is the comparison and contrast essay, about exchanging cultural information with my partner. I got a variety of information by exchanging cultural experiences with my partner. It helped me to gain a better understanding of the other culture and my own culture. It was very useful for developing my comparison/contrast essay”. For those students who thought Task 3—(debating with partner) was the most useful, the opportunity to engage in on-line debate with a partner and hear all the possible counterarguments to an argument was most valued by the students. For example, one student said: “Assignment #10—arguing with partner is the most useful. I was able to realize what others may disagree with me and find more counterarguments for my essay.”
Given the overall positive reactions to the e-mail assignments, only a few students responded to the question which asked them which assignment was the least useful. Most of them simply wrote: “None”, or “All of them were useful”. For example, one student said: “I think all of assignments are useful. From the personal story, we can share our experiences which were interesting. From the arguing assignment, we can learn to debate and give our comments”. Among the few comments on this question, one student expressed a feeling of discomfort with Task 1—personal narrative. She commented: “Assignment #4—personal story. I think it is rather personal and some of us might not be comfortable sharing something personal with others”. This student’s comment raised a legitimate concern, but this concern was not echoed by other class members. Another student felt that the persuasive assignment (Task 3) was not very useful because his partner did not really respond to his argument. A similar complaint was voiced by a student who thought the cultural exchange assignment (Task 2) was not useful for her because her partner did not give her enough information she wanted to know about the other culture. Such comments from students are worthy of the teacher’s attention because it concerns the issue of partnership in a collaborative learning context, which will be discussed further in the next chapter of this dissertation.

The last question on the questionnaire asked the students to provide suggestions for improving the use of e-mail in a writing class:

Q: What other activities do you think we can do using e-mail?
• more social exchanges among class members
• free discussions
• receive instructor’s feedback on e-mail
• share comments and information about the course, give feedback and suggestions about the class
• exchange information
• turn in second drafts before submitting the final paper
• a tool to keep in touch with friends
• personal communication

From the students' responses, it seems that the students preferred to have a more flexible use of the class mailing list besides its academic purpose. For example, a number of students commented that they would like to use e-mail for personal communication with friends, free discussions on topics of personal interests, or exchange information related or unrelated to the course. There was a suggestion for using e-mail to turn in an intermediate draft for the instructor's comments before the final essay was due. Again, the need for more feedback from the instruction on e-mail was expressed by several students.

Summary

In general, the students' affective reactions to the e-mail activities were quite positive. Overall, they enjoyed participating in the e-mail activities and found them useful and helpful. They felt they benefited the most from being able to share their ideas with peers freely and easily, practice various writing skills out-of-class, and learn more about computers. They thought the e-mail tasks helped them to explore their topics for essay writing, exchange ideas and information with peers, and improve their writing skills. Among the four major e-mail tasks, the students regarded those involving active
interaction with peers more helpful than those without exchanges with peers, and they felt they benefited greatly from reading each other's writings on e-mail. The students also reported some problems they encountered with the e-mail tasks, among which access to computer and technological problem were the most frequently reported. There was also a concern about feeling less comfortable about sharing a personal narrative via e-mail with others, and there was the complaint from a few students about the lack of cooperation from their partners in completing some of the e-mail tasks. The students also expressed their expectation for receiving more feedback from the instructor on e-mail.

Conclusion

This chapter has presented the results of both the statistical and the qualitative analyses conducted on the data collected for investigating the six research questions raised in the present study. The major findings of each research questions are summarized below.

Research Question #1

The overall ANOVA tests on the 8 dependent variables used to measure students' writing performance show significant differences across e-mail tasks of different rhetorical purposes at the following levels: 1) syntactic complexity in terms of subordination ratio, 2) lexical complexity in terms of both lexical diversity and lexical density, 3) textual cohesion in terms of sentence-level cohesive conjunctions, and 4)
grammatical accuracy in terms of the number and the types of grammatical errors. Such results render strong support to the hypothesis that ESL students’ writing performance varies across e-mail tasks of different rhetorical purposes.

The results of the posthoc contrast tests indicate that in terms of the mode of writing, the most differences were found between Task 1 (narrative writing) and Task 3 (persuasive writing) whereas the least difference was found between Task 3 (persuasive writing) and Task 4 (expressive writing).

When examined in terms of linguistic features, the posthoc contrast tests show that students’ writing performance differed most significantly in terms of the number of grammatical errors they made while performing different tasks. Substantial significant results were found consistently in the measurement of lexical complexity, in terms of both lexical diversity and lexical density.

**Research Question #2**

Significant differences were found between tasks involving an interactive audience (Task 2 and Task 3) and tasks involving a non-interactive audience in the mean scores of the two lexical measurements, i.e. lexical diversity and lexical density. The contrast tests of the other measurement variables did not show any significant differences. Such a result suggests that it is only at the level of lexical complexity that significant difference was observed in students’ writing performance on e-mail tasks involving a different audience.
Two consistent results were found in the differences between tasks involving an interactive audience versus tasks involving a non-interactive audience: 1) There was a consistently higher level of lexical complexity in terms of both lexical diversity and lexical density in the tasks involving an interactive audience versus tasks involving a non-interactive audience. 2) There was a higher frequency of occurrence of cohesive devices at both the sentence and the paragraph level in the tasks involving an interactive audience than in tasks involving a non-interactive audience. In terms of syntactic complexity, there was a longer average sentence length in the texts produced in the tasks involving an interactive audience than in the tasks involving a non-interactive audience, however, the subordinated clauses in the texts produced in the tasks involving an interactive audience were slightly fewer than in those produced in tasks involving a non-interactive audience. In the measurement of grammatical accuracy, a higher frequency of occurrence of errors was found in the tasks involving an interactive audience than in the structured tasks, which suggests a tendency for students to make more grammatical errors when they were involved with more active interaction with their peers.

**Research Question #3**

Follow-up contrast tests with significant ANOVA results show that there are significant differences between structured tasks (Task 1 and Task 3) and non-structured tasks (Task 2 and Task 4) in the mean scores of several dependent variables used to measure writing performance: subordination ratio, lexical diversity, and the ratio of
number of grammatical errors. Besides, it was found that students tended to perform with a higher level of syntactic complexity in the non-structured tasks than in the structured tasks, and there was a higher level of lexical complexity in the nonstructured tasks than in the structured task. In the measurements of textual cohesion, it was found that students tended to use slightly more sentence-level cohesive conjunctions in the non-structured tasks than in the structured tasks, but there were fewer transitional expressions at the paragraph level in the non-structured tasks than in the structured tasks. In the measurement of grammatical accuracy, a higher frequency of occurrence of errors was found in the nonstructured tasks than in the structured tasks, suggesting a tendency for students to make more grammatical errors when the tasks gave them more freedom and flexibility in performance.

Research Question #4

Results of the multiple regression analyses show that motivation had a strong positive influence on several dependent variables used to measure writing performance: lexical diversity, lexical density, cohesive conjunctions at the sentence level. The more motivated students tended to perform with a higher level of lexical complexity and used more cohesive conjunctions at the sentence level. Besides, motivation had a significantly negative correlation with the number of grammatical errors, which indicates that the more motivated learners made fewer grammatical mistakes. Attitude was found to significantly influence writing performance in terms of lexical diversity, cohesive conjunctions at the
sentence level, and transitional expressions at the paragraph level. Attitude was also found to have a significant negative relationship with the type of grammatical errors, which means that learners who had a more positive attitudes towards the e-mail tasks and using computers to write tended to produce fewer types of grammatical errors. The affective variable anxiety had a strong impact on two dependent variables: average sentence length and lexical density. It was found that learners with a lower level of computer anxiety produced texts of longer average sentence length and used more different lexical items. Computer literacy was not found to predict significantly any of the eight dependent variables.

When the variables of motivation, attitude, anxiety and computer literacy were combined to predict writing performance, it was found that the combination of these variables had a significant contribution to the variation in writing performance in four of the eight dependent variables used to measure writing performance: lexical diversity, lexical density, sentence-level cohesive conjunctions, paragraph-level transitional expressions. Such results suggest that this group of social, affective and cognitive variables combined together can account for a significant amount of variance in students’ writing performance on the e-mail tasks in terms of lexical complexity and textual cohesion.
Research Question #5

The correlational analyses performed using the computerized scores and the ESL raters’ holistic and analytical scores yielded several results: 1) In terms of discrete-point linguistic and textual features, a significant correlation was found between the computerized scores on the two measures of grammatical accuracy (number and types of grammatical errors) and the ESL raters’ average score for the evaluation of grammar in writing. No significant correlation was found in the other categories of linguistic and textual features. 2) When using the ESL raters’ holistic scores and the combined scores of their analytical scales to correlate with the computerized scores, it was found that only in the category of grammatical accuracy was there a significant correlation between these two types of scoring. 3) Significant correlations were found between the two indexes used to measure lexical complexity (lexical diversity and lexical density), textual cohesion (sentence-level cohesive conjunctions and paragraph-level transitional expressions) and grammatical accuracy (number and types of grammatical errors). Such correlations show a high level of internal consistency in the two types of measurements used to assess these linguistic and textual features, assuring the reliability of the analytical schemes used for data analysis in the present study.

Research Question #6

The students’ expressed positive attitudes towards the e-mail activities in general and found the e-mail activities useful and helpful, especially with regard to the following
aspects: 1) sharing their ideas with peers freely and easily, 2) practicing various writing
skills out-of-class, and 3) learning more about computers. They thought the e-mail
activities helped them to prepare for writing the academic essays related to the journal
assignments done via e-mail. Among the four major e-mail tasks, the students regarded
those involving active interaction with peers more helpful than those without exchanges
with peers, and they felt they benefited greatly from reading each other's writings on e-
mail. The students also reported some problems they encountered with the e-mail tasks,
among which access to computer and technological problem are the most frequently
reported. Besides, some students expressed the need for receiving more feedback from
the instructor on e-mail.

The results of the analyses performed in response to the six research questions
raised in the present study will be discussed in the next chapter in light of the theoretical
and empirical findings obtained from previous research on second language learning and
the application of computer technology to second language instruction. Chapter 5 will
also present the pedagogical implications of the findings of the present study, discuss the
limitations of the present research design, and provide suggestions for future research in
integrating computer technology into second language instruction as well as using
computers as research tools for conducting research in second language learning and
teaching.
Chapter 5

Discussion and Conclusion

Introduction

As stated in Chapter 1, the main objective of this dissertation was to investigate the efficacy of using task-based e-mail activities to help ESL students develop academic writing skills in a process-oriented writing classroom. In particular, this study examined the differences in the students' writing performance on e-mail writing tasks of different rhetorical purpose, task structure and audience. Social, affective and computer skill variables were also analyzed to account for the variation in students' writing performance. The combination of computerized text analysis and ESL raters' holistic/analytical assessment allowed the researcher to examine the correlation between these two kinds of analyses on the data, which provided evidence for discussing the potentials and limitations of using computer programs for the analysis of second language written data. Lastly, the qualitative analysis of students' affective reactions to the e-mail activities provided further insights from the students' perspective for effective integration of e-mail activities into the second language writing curriculum.

Based on the results of analyses presented in the preceding chapter, this chapter will first discuss the findings with reference to previous studies on second language
writing and the application of computer technology to second language writing instruction. This discussion will proceed following the order in which the major research questions and corresponding hypotheses are presented. Then the limitations of the study will be reviewed, followed by pedagogical implications for computer-mediated second language writing instruction. The last section of the chapter will provide recommendations for future research.

Discussion

Writing Performance on E-mail Tasks of Different Rhetorical Purpose

The findings from this study indicate significant differences in ESL students’ writing performance on e-mail tasks of different rhetorical purposes as measured at different linguistic and textual levels. In particular, the differences were observed in the measurements of syntactic complexity, lexical complexity, textual cohesion and grammatical accuracy. Such results render strong support to the hypothesis that ESL students’ writing performance varies across e-mail tasks of different rhetorical purposes.

The results of this study are supported by both theoretical and empirical findings from previous research. In composition studies, strong claims have been made about the importance of considering the purpose of writing for effective communication. In light of rhetorical considerations, the purpose of writing defines what and how one wants to write. From a cognitive standpoint, writing is a multifaceted intellectual act which involves a
composite of strategic elements, hierarchical procedure levels and processing adjustments (Flower & Hayes, 1980; Scardamalia & Bereiter, 1982). Thus, the composing process requires writers to adapt their writing to the rhetorical/linguistic requirements of the task as specified by its particular purpose. In this study, each of the four e-mail tasks defined a particular purpose for writing, each with a different rhetorical specification, requiring students to write in a different genre of academic discourse. The observed differences in students’ writing performance across the four tasks confirm the findings of previous studies in both L1 and L2 writing, which have demonstrated that variation in writing performance is related to varying rhetorical purposes which in turn, elicit different modes of writing (Foster & Skehan, 1996; Koda, 1993; Oliver, 1995; Perron, 1977; Prater, & Padia, 1983; San Jose, 1972).

Furthermore, the more detailed analysis of the students’ writing reveal that in terms of the mode of writing, the most differences were found between the students’ narrative writing and their persuasive writing. This finding is consistent with previous composition studies which found expository and argumentative writing to be more demanding and difficult than narrative and descriptive writing (Perren, 1977). The findings of this study also indicate that the least differences were observed between students’ persuasive writing and expressive writing. This result is not unexpected because expressive writing falls within the category of expository writing, which was identified in previous studies to be as demanding and difficult as persuasive writing, and there was evidence of a higher level of syntactic complexity associated with expository and
argumentative writing in comparison with narrative and descriptive writing (e.g. Perren 1977).

When examined in terms of linguistic features, substantial significant results were found consistently in the measurement of lexical complexity, in terms of both lexical diversity and lexical density. This suggests that vocabulary use is a distinct feature for detecting variation in writing performance, which corroborates Koda’s (1993) study on FL composition which found significant variation in vocabulary delivery in different modes of writing.

While the previous studies have found differences mostly at the syntactic and lexical level, the present study also discovered significant differences in terms of textual cohesion and grammatical accuracy. Results of the measurement of textual cohesion show a significant difference between narrative and persuasive writing in terms of the use of sentence-level cohesive devices. The students tended to use more cohesive conjunctions to link sentences in persuasive writing than in the narrative writing task. This difference can be explained by the different rhetorical and linguistic requirements of these two modes of writing. The general purpose of a narrative piece of writing is to relate a series of events, usually in the form of story telling. A narrative can use a very flexible order, e.g. it can follow a chronological sequence, begin in the middle or end of the event, and employ the technique of flashback to move around in time and place. In contrast, persuasive writing requires a relatively more rigid organizational structure. To develop a convincing argument places more demand on the use of linear reasoning and coherent presentation of evidence.
Thus, it is reasonable to observe more use of cohesive conjunctions between sentences in the persuasive writing than in the narrative piece.

Perhaps the most striking result comes from the measurement of grammatical accuracy. The data suggests that students' writing performance on the different e-mail writing tasks differed significantly the most in terms of the number of grammatical errors they made. It is interesting to note that while students tended to perform with a higher level of syntactic complexity in persuasive writing than in narrative writing, they were also inclined to make a greater number of grammatical errors in persuasive writing than in narrative writing. This finding points to the importance of the tradeoff effects between complexity and accuracy in measuring performance on L2 learning (Foster & Skehan, 1996). Foster and Skehan (1996) maintain that complexity in L2 learners' use of language indicates a greater willingness to experiment and to take risks, whereas accuracy reflects a focus on form to achieve freedom from errors. In their study on the influence of planning and task type on second language performance, Foster and Skehan (1996) also found that a task which generated a highest level of complexity was associated with the lowest accuracy measure. They argue that complexity and accuracy are two competing goals for L2 learners. Operating under information-processing constraints, L2 learners have to allocate attention to particular goals at the expense of other goals. In the present study, such a tradeoff effect between complexity and accuracy can be observed in students' writing performance on the two most distinctive writing tasks, i.e. narrative and persuasive. It explains why students performed with a higher level of syntactic
complexity in the persuasive writing tasks than in the narrative writing task while they also tended to make more grammatical errors in the former mode of writing.

It should be noted that none of the previous studies have examined variation in writing performance in a computer-mediated writing environment. Therefore, the findings of this study suggest that the findings from composition studies about the effect of rhetorical purpose for writing can be applied to the study of writing performance in the computer-assisted learning context.

Writing Performance on E-mail Tasks Involving Different Audience

Related to the purpose of writing is the audience for whom the purposed is directed. The audience plays an important role in deciding what and how one writes. For academic writing in a second language, audience is a particularly crucial concern because L2 writers need to understand the characteristics of the audience in academia and write to fulfill the audience's expectations (Johns, 1988; Horowitz, 1986; Spack, 1988). Previous composition studies have found that the specification of different target audiences may have significant effects on the quality of writing in terms of syntactic complexity (e.g. Crowhurst & Piche, 1979; Rubin & Piche, 1979; Smith & Swan, 1978). The differences that were observed in this study in students’ writing performance on tasks of difference audience are consistent with previous findings from composition studies on the effect of audience on writing performance.
In the present study, a significant difference of lexical complexity in terms of lexical diversity and lexical density was found in tasks involving an interactive audience versus tasks involving a non-interactive audience. It was found that ESL students used richer and more diverse vocabulary when they were engaged in active interaction with their peer audience, e.g. when they were exchanging cultural information with each other, or when they were engaged in a debate over an issue of mutual interest. In addition, in the tasks involving an interactive audience, there was a significant difference in the use of cohesive devices at both the sentence and the paragraph level. It is obvious that the students used more cohesive conjunctions and phrases to link sentences and paragraphs when they were writing to a peer audience with the expectation of getting peer feedback and responding to such feedback. In the syntactic measurement, a significant difference was found in sentence length. In the interactive tasks, the average sentence length surpassed that in the non-interactive tasks. These findings indicate a higher level of linguistic complexity syntactically and lexically, and a higher awareness of textual cohesion when the students were engaged in active interaction with their peer audience via on-line writing. This finding gets support from previous research investigating collaboration within writing classes where writing is situated as a social activity (Strasma and Foster, 1992). Strasma and Foster used ethnographic methodology to collect data from multiple sources in collaborative writing classrooms and found that collaborative activities in the writing classroom increased students’ engagement in writing and resulted in “substantially more complete and detailed work of writing “ (p.115). Strasma and Foster further state that students’ engagement in
interacting and challenging each other helps to create a concrete sense of audience, from which they learn to write more effectively. The data from the present study support Strasma and Foster’s claim about the positive effect of collaboration through peer interaction on networked computers on the development of writing. It thus points to the importance of creating a positive writing environment where students are engaged in interactive writing activities. Likewise, Leppanen and Kalaja (1995) rightly point out the pedagogical advantage of using the e-mail system as “a flexible means of exchanging ideas and commenting in the written form, and consequently, of transforming writing into a social and interactive activity” (p. 35). The findings from this study further indicate that interaction with peer audiences on networked computers is beneficial for enhancing L2 writing abilities.

It is interesting to note that while the interaction with a peer audience seemed to lead to more complex sentence structures, richer and more diverse vocabulary, and more explicit textual cohesion, there was, however, a higher frequency of grammatical errors in the texts. The data reveals that students tended to make more grammatical errors of more types when they exchanged feedback and information, or argued with peers interactively than when they narrated a personal story, or expressed their personal opinions without interacting with peers. It seemed that interaction with a peer audience helped the students to generate more complex and sophisticated use of written language, but at the same time, the grammatical accuracy of their language suffered. This finding corroborates Kern’s (1995) study which examines the characteristics of FL written communication on networked computers. One of
Kern's findings is that while students' written production on the networked computers displayed an overall greater level of sophistication and more variety of discourse functions, the grammatical accuracy of their written expression suffered. Nevertheless, it should be pointed out that the type of data Kern (1995) examined was different from the texts being analyzed in the present study. While Kern looked at brief and shorter passages of written interaction produced in synchronous computer conferencing sessions, this dissertation examined longer and more coherent informal pieces of pre-writing texts produced by students on e-mail in an asynchronous mode. Incidentally, the result here is consistent with what has been discussed about the findings of Research Question #1 above. In both instances, the same tradeoff effect is observed between linguistic complexity and accuracy in L2 learners' written language development. The consistency of this finding further reinforces the importance of the issue of using both linguistic complexity and accuracy as criteria in the measurement of L2 learning outcome, especially in terms of L2 writing assessment.

Writing Performance on E-mail Tasks of Different Task Structure

Task implementation, which involves the manipulation of task conditions, is recognized as an important factor related to learning outcomes in recent proposals for task-based approaches to L2 instruction (Foster & Skehan, 1996; Long, 1989; Long & Crookes, 1991; Skehan, 1996). Studies have found evidence of variation in learning performance under different task conditions (Crookes, 1989; Ellis, 1987; Foster &
Skehan, 1996). In the present study, significant differences were found in the syntactic and lexical measures of students' writing performance between structured and non-structured tasks. It was also found that students tended to perform with a higher level of syntactic complexity in the non-structured tasks than in the structured tasks, and there was a higher level of lexical complexity in the nonstructured tasks than in the structured task. In the measurements of textual cohesion, it was found that students tended to use slightly more sentence-level cohesive conjunctions in the non-structured tasks than in the structured tasks. Such findings suggest that when the writing task allowed the students to make choices of topic selection and more freedom to express their ideas on their chosen topic, they tended to use more complex sentences and richer and more diverse vocabulary than when the task required them to write on specific topics and respond to specific questions. In other words, the students were able to produce more complex written language in a task condition under which they had more freedom of decision making about what they wanted to write than in a task condition under which they were restricted in the content of their writing. This finding gains support from recent claims about the empowerment of students learning with computer networks.

Proponents of computer-mediated collaborative learning claim that computer networks have increased students' control of the content of learning, fostered student autonomy, and developed learning skills and language abilities (Warschauer, 1996c; Warschauer, Turbee, & Roberts, 1994). In L2 literature, there have been strong claims about the importance of student autonomy for the enhancement of L2 learning. It is believed
that when students assume more responsibilities and more control of their own learning, they will be able to learn faster and better (O’Malley & Chamot, 1990; Oxford, 1990; Wenden & Rubin, 1987). Such claims can be used to explain the finding of more sophisticated use of language in the non-structured e-mail tasks in the present study. In the non-structured e-mail tasks, the students were given more freedom to decide what they wanted to write about, and there were fewer restrictions on the details and amount of information they could include in their writing than in the structured tasks. Thus, it is natural to observe that the students gained a greater control of their language use in the non-structured e-mail tasks, and their writing performance displayed more sophisticated use of written language as demonstrated in a higher level of both syntactic and lexical complexity than in the structured tasks.

However, it is worth noting that in the measurement of grammatical accuracy, a higher frequency of occurrence of errors was found in the non-structured tasks than in the structured tasks, suggesting a tendency for students to make more grammatical errors when the tasks gave them more freedom and flexibility in performance. This result is consistent with the previous discussion on the measurement of grammatical accuracy in tasks of different rhetorical purposes, or tasks involving different audiences. It is crucial to point out that there seemed to be always tradeoff effects between linguistic complexity and grammatical accuracy in the students’ writing. Perhaps such effects are more obvious when the students are writing on line with networked computers rather than writing in the traditional way. Since no previous studies have been conducted to compare students’
writing quality in the networked writing environment versus that in the traditional writing condition in terms of both linguistic complexity and grammatical accuracy, there is a need for empirical support for the observation made in the present study through further investigation.

Motivation, Attitude, Anxiety, Computer Literacy and Writing Performance

The discussions above have focused on the effects of various task variables on students’ writing performance on the e-mail tasks. Informed by theoretical and empirical understanding of the second language acquisition process, this study also attempted to examine students’ writing performance in relation to the variables of motivation, attitude, and anxiety, which are evidenced as importance factors in the processes and outcomes of second language acquisition. Since this study was conducted in a computer-mediated writing environment, the students’ computer knowledge and skills were also taken into account to form a variable of computer literacy, which was used to correlate with students’ e-mail writing performance. The following section will discuss the findings of the effects of each of these variables on students’ writing performance on the e-mail tasks.

Motivation
Results of the multiple regression analyses show that motivation had a strong positive effect on the students' writing performance on e-mail in terms of vocabulary use. The more motivated students tended to perform with a higher level of lexical complexity as measured through lexical diversity and lexical density. Besides, the more motivated students also tended to produce texts with more explicit sentence linkages, which can lead to a better textual flow. The fact that motivation had a significantly negative correlation with the number of grammatical errors indicates that the more motivated learners made fewer grammatical mistakes. Therefore, the results of the analyses on motivation and writing performance suggest that motivation exerted an important influence on students' writing while they performed the e-mail tasks. Apparently, this finding is in agreement with the well-established literature on the role of motivation on second language learning (Gardner & Lambert, 1972; Brown, 1994; Dornyei, 1994; Gardner & Tremblay, 1994a, 1994b; Oxford & Shearin, 1994). It is also consistent with recent studies on the motivational aspects of computer-mediated communication and second language learning, which have yielded strong evidence to support the claim that motivation plays a crucial role for learning in the computer-mediated environment as it does in the traditional language learning situations (Barson et al., 1993; Beauvois, 1994; Kelm, 1992; Kern, 1993; Meunier, 1997; Wang, 1993; Warschauer, 1996c). Based on the results of a factor analysis on a survey involving ESL and EFL students from different countries, Warschauer (1996b) concluded that using computers for writing and communication is motivating for students in terms of three common factors: communication, empowerment
and learning. In contrast to Warschauer's study which focused on students' perceptions of the role of motivation on using computers for writing and communication, the present study examined the relationship between L2 students' motivation and their actual performance on writing with networked computers. While Warschauer's study reveals that writing on networked computers leads to different motivational aspects which are facilitative to L2 writing development, the present study further confirms Warschauer's study by showing the extent to which motivation can account for the differences in L2 students' writing performance in the networked writing environment.

**Attitude**

Second language acquisition research has demonstrated that learner attitudes have an impact on language learning. In general, positive attitudes towards the second language, its speakers, and its culture are more likely to enhance language learning, whereas negative attitudes may impede learning (Brown, 1994). This theoretical principle regarding attitudes towards second language learning can be used to support the findings of the present study.

The multiple regression analyses show that attitude had a significant contribution to variation in students' writing performance in terms of the diversity of vocabulary and the use of cohesive expressions. Attitude was also found to have a significant negative relationship with types grammatical errors, which means that students who had a more positive attitudes towards the e-mail tasks and using computers to write tended to produce
fewer types of grammatical errors. This finding further confirms recent studies on students’ attitudes towards language learning on networked computers (Beauvois, 1995; Kern, 1995; Meunier, 1997; Warschauer, 1996c). It has been shown that computer learning networks increase students’ interest in language learning, promote interactions among the learners, and provide a non-threatening environment for learners to engage in communication using the target language. However, while previous studies have shown the motivating effects of computer networks and computer-mediated communication that takes place on such networks, none of the previous studies have examined the relationship between attitude and the outcomes of learning with computers. The findings of this study help to extend our understanding of the role attitude plays in second language learning in the computer-mediated environment.

Anxiety

There has been strong indication that second language learners frequently experience “language anxiety” associated with attempts to learn a second language and communicate in it. Thus, anxiety has been shown to be an important factor in second language acquisition (Horwitz, Horwitz & Young, 1986; Horwitz & Young, 1991; MacIntyre & Gardner, 1991). Furthermore, it is assumed that anxiety is related to situation-specific learning experience (Gardner, 1991). In the present study, the affective variable of anxiety was found to contribute significantly to some variation in the students’ writing performance on the e-mail tasks. It was shown that learners with a lower level of
computer anxiety tended to produce texts of longer average sentence length and used more diverse vocabulary in their writing. This finding provides more evidence to account for the role of anxiety in second language learning in general, and second language writing on networked computers in particular.

Research in computers and L2 writing instruction has yielded evidence to show that using a computer to write reduces writing apprehension and helps L2 writers overcome writer's block (Phinney, 1991). Studies in computer-mediated communication and second language learning have also found that computer networking provides a less threatening environment than face to-face discussion for students to communicate in the target language, thus minimizing language anxiety (Beauvois, 1995; Hoffman, 1996; Kern, 1995; Meunier, 1997; Warschauer, 1996b). However, none of the previous studies have attempted to examine the relationship between anxiety about learning with computers and students' actual learning performance. The findings of the present study thus add to our understanding of the effect of anxiety and second language learning in the computer-mediated context.

**Computer literacy**

One of the surprising results from this study is that the students' computer literacy did not influence their writing performance on the e-mail tasks as measured in terms of the eight dependent variables related to syntactic, lexical, textual and grammatical features. This result may be due to the fact that there was no wide-range difference in the
subjects' computer literacy level. The result from the pre-activity survey shows that the students participating in the present study had some computer literacy which accounted for their knowledge and experience with computers in terms of word processing, e-mail and the World Wide Web. In fact, with the wide spread of computers in education nowadays, there are fewer and fewer novice computer users at the university, even among students from other countries where computer use has been low in the past. Given the little variability of the subjects' level of computer literacy, this variable did not account for a significant portion of the variation in writing performance on the e-mail tasks. For further investigation of the effect of students' computer knowledge and experience with computers on e-mail writing performance, there is a need to compare experienced computer users with novice users of computers as subjects of study.

Correlation between Computerized Analysis and ESL Raters' Assessment

As stated in the introduction of this dissertation, a secondary purpose of the present investigation was to examine the potentials and limitations of using computer programs to analyze texts written by second language learners. To achieve this goal, two kinds of analyses were done with the written texts produced by the ESL students, yielding two kinds of scores for data analysis, i.e. computerized scores and scores assigned by ESL raters. Several major results were obtained through the correlational analyses performed using the computerized scores and the ESL raters' holistic and analytical scores, which will be discussed in greater detail in the following section.
The first analysis used the computerized scores to correlate with the scores assigned by the ESL raters to the analytical scales pertaining to the linguistic features of the written texts. In this analysis, a significant correlation was found between these two kinds of scores in the category of grammatical accuracy, i.e. the computerized scores on the two measures of grammatical accuracy (number and types of grammatical errors) were significantly correlated with the ESL raters' average score for the evaluation of grammar in writing. No significant correlation was found in the other categories of linguistic and textual features. When using the ESL raters' holistic scores and the combined scores of their analytical scales to correlate with the computerized scores in the second correlational analysis, a similar finding was obtained: it is only in the category of grammatical accuracy that a significant correlation was found between these two types of scoring.

Such results are consistently revealing. It is apparent that while the ESL raters' subjective judgments on the texts failed to match the computerized analyses on statistically significant terms at the syntactic, lexical and textual levels, there was a consistent fit of the computer and the human analyses at the level of grammaticality. This observation can be explained with reference to the literature on second writing assessment, which abounds in controversial issues. In a critical discussion of holistic assessment for ESL writing in academic contexts, Vaughan (1991) points out that findings from previous research suggests that raters may depend on some characteristics in the texts which are easier to pick out, among which mechanical errors are counted as
an example of “the obvious ones”. Since grammatical errors are common in ESL writing compared with texts written by native writers, they draw the attention of the ESL raters more easily. Thus, it is reasonable to assume that when the ESL raters read the texts, they were more apt to arrive at the judgment of grammatical accuracy based on the frequency of grammatical errors in a particular text. As a result, there was a good fit between their evaluation of grammatical accuracy and the computer’s calculation of the number of grammatical errors. In this case, the computerized analysis and the human assessment constitute a good combination to ensure the reliability of writing assessment for grammatical accuracy.

However, it should be pointed out that in the other measurements at the syntactic, lexical and textual level, no significant correlations were observed between the computerized scores and the ESL raters’ scores. A possible explanation of this mismatch can be attributed to the differences in the kinds of linguistic features that each of these two kinds of assessments attend to. At the syntactic level, the computerized analysis focuses on features that indicate syntactic complexity exclusively. The two indexes used for computerized analysis, i.e. average sentence length and subordination ratio, reflect only the degree of syntactic complexity, but not other syntactic features such as clarity and variety, which were two major criteria used by the ESL raters’ to judge the students’ writing on the scale of Sentence in the grading chart. Likewise, at the lexical level, the computerized analysis examined lexical use in terms of lexical density and diversity, which are indicators of the learner’s vocabulary size. However, the criteria used by the
ESL raters' evaluation of vocabulary use in the texts include clarity, appropriateness and preciseness. Thus, it is apparent that while the computerized analysis focused mainly on the degree of lexical complexity as manifested in the vocabulary size of each text, the ESL raters' evaluation took into account the textual context of vocabulary use by examining not only how many different words were used, but also how well these words were used and how well they fit into the context of the text. With regard to the measurement of cohesion, the computer searched for the number of cohesive devices at the sentence and the paragraph level. Although these cohesive expressions can serve as indicators of textual cohesion, there are other elements of cohesion in the texts that are not only reflected in the use of linguistic terms, but also in the overall organization and logic, which the computer cannot detect. Thus, it is apparent that the computerized analysis is quantitative in nature, whereas the human raters seem to focus on more qualitative aspects of language use.

Given the discussion above, it is not unexpected to obtain non-significant correlations when the scores from the computerized analysis and the ESL raters were compared. On the other hand, these two kinds of analyses can be seen as complementary. It is unimaginable that the raters could manually calculate the discrete-point linguistic features in a large corpus of texts such as that in the present study, let alone the tremendous efforts one has to expend for ensuring interrater and intrarater reliability. With the computer programs, internal consistency is ensured. Even if the program fails to detect a particular item in one text, it will also exclude the same item in all the other texts.
Although the issue of accuracy of measurement and qualitative versus quantitative analysis with computerized analysis still remains, there is strong evidence for the claim of high internal consistency with the use of computers for textual analysis. The results of the computerized analysis in the present study provide further support for this claim.

In the computerized analysis, two indexes were used respectively for the measurement of each of the linguistic and textual levels, i.e. syntactic, lexical, cohesive, and grammatical. It is important to point out that except in the category of syntactic complexity, all the other categories show significant correlations between the two indexes of measurement. For example, lexical diversity was significantly correlated with lexical density; sentence-level cohesive conjunctions was significantly correlated with paragraph-level transitional expressions, and the number of grammatical errors was significantly correlated with the number of types of grammatical errors. Such correlations show a high level of internal consistency in the two measurement indexes used to assess these linguistic and textual features, assuring the reliability of using computers to perform textual analysis of linguistic and textual features in corpora of second language written data.

The discussion above shows that computerized programs can be used as useful tools for research involving corpora of second language written data. The computer can provide efficient and reliable analysis of the linguistic and textual characteristics of written texts at different levels and produce ready statistics of the frequency of each feature in a given text. Thus, there is great potential for utilizing the computer as a
research tool to detect, extract, and summarize various linguistic features in written texts produced by second language learners. However, it is worth noting that computerized analysis of second language writing has its limitations due to the fact that the computer can only search for and examine particular linguistic items and provide relevant statistics. Discourse level analysis of written texts including rhetorical features that address the overall writing such as development of ideas, audience awareness, logical reasoning, can only be assessed by human raters. In fact, previous studies involving the use of computer programs for textual analysis all tended to focus on the linguistic structures and characteristics of written texts (e.g. Biber, 1996; Ferris, 1993). As illustrated in this study, the results of computerized analysis and the ESL raters' evaluation each offer different information about students' writing performance on the e-mail tasks. Therefore, a combination of both computerized analysis of linguistic features and human raters' evaluation of overall rhetorical features should be advocated for investigating the quality of writing produced by second language learners.

Students' Affective Reactions to the E-mail Activities

The last question of this dissertation investigated the students' affective reactions to the e-mail activities. The results show that in general, the students' affective reactions to the e-mail activities were quite positive. Overall, they enjoyed participating in the e-mail activities and found them interesting and helpful. Recent studies in using computer-mediated communication in second language classrooms have also reported L2 learners'
positive reactions to participating in learning tasks on networked computers (Beauvois, 1995; Barson et al., 1995; Ittzes, 1997; Kelm, 1992; Kern, 1995; Meunier, 1997; Warschauer, 1996c). Beauvois' (1995) survey of FL students' attitudes towards learning a foreign language on a real-time electronic network found that the computer networks made the experience of foreign language learning more interesting, more enjoyable and less stressful. Warschauer (1996c) discussed in depth the motivating effects of computer-mediated communication on second language learning. Using factor analysis, Warschauer concluded that communication, empowerment and learning constitute three major motivating factors in language learning on networked computers. The students' reported self-reflections of their learning experience in the present study support Warschauer's (1996c) conclusion.

In the present study, students reported that the most obvious benefit of the e-mail activities was the opportunity to communicate with each other easily and freely about their ideas for writing. They found that the on-line exchanges they shared with each other helped them to explore their topics for essay writing, gathered information and ideas, and received helpful feedback. The benefit of such sharing on the computer networks is apparent, as stated by Hoffman (1996): “The writing that is shared becomes more than a demonstration of learning for a teacher: it is communication” (p. 64). The communication aspect of the e-mail activities not only increased students' motivation to write, but also helped students to get started with their writing by lowering their anxiety about writing essays. This affective effect was achieved through sharing ideas and feelings about the
writing process among the students. When the students feel more confident about themselves and about their own writing, they are able to assume more responsibilities for their learning and take greater control of the writing process. Thus, they would become more aware of their cognitive and affective processes in the course of composing. Such awareness can been seen as a reflection of the students’ empowerment, which was discussed by Warschauer (1996c). The third motivating factor identified by Warschauer, i.e. learning, is also prominent in the students’ self-reports in the present study. They felt that the opportunity to practice writing in English outside the writing classroom on the computer network helped them improve their writing skills in English. Since the e-mail tasks were tied into the syllabus of the writing course and related to the major academic essay assignments, the students were able to practice various writing skills that are related to different genres of academic discourse.

It should be mentioned that the students also reported some problems with the e-mail tasks, among which access to computers and technological problems were the most frequent. These problems seem to be common concerns in innovative use of computer technology in language learning and teaching (Shetzer, 1997; Wang, 1993). In a qualitative study of the use of e-mail for the teaching of English as a second language, Shetzer (1997) presented the details of the implementation process of a one-to-one e-mail project between a class of ESL and another class of American students at two universities in the United States. Among the problems she identified in the eight-week project, technical difficulties experienced by students were reported to cause problems in the
successful implementation of the e-mail project. The other problems she identified include timing of response and student participation, which might affect the e-mail exchanges between the two classes of students. In the present study, the problems reported by students and observed by the teacher-researcher are largely technical ones, e.g. access to computer equipment and unfamiliarity with the e-mail system. There are also the major problems identified by Wang (1993) in her study of the use of e-mail as dialogue journals between ESL students and their instructor in an ESL reading and writing classroom. Related to the technical problems is the issue of time, because limited access to the use of computers and insufficient computer skills demand more time for students to complete the e-mail tasks. Both Wang’s (1993) and Shetzer’s (1997) classroom-based studies report that time constraints caused problems for students in completing the e-mail tasks as required. In the present study, time was a concern for some of the students. While Shetzer’s (1997) study reports student participation as one of the major problems in ensuring smooth e-mail exchanges between the partners, a few of the students participating in the present study also voiced some complaints about lack of cooperation from their partners during the e-mail exchanges. These reported problems bring up the important issue of the role of the teacher in a computer-based language learning classroom, an issue which has drawn a great deal of attention in the field.

Advocates of CMC speak of the teachers’ extended role in integrating computer-mediated communication in L2/FL language pedagogy:

Teachers must add to their ‘traditional’ roles as imparters of knowledge a new and very vital function, namely that of being managers.
of the process over time. They support students in selecting goals, deciding on reasonable approaches and proceeding with the execution of plans (Barson & Debski, 1996).

In speaking of the effects of computers on the social interaction in the second language classroom, Johnson (1991) also argues that “it is not computer use that creates social effects, but the way teachers structure classroom interaction involving computer use” (p. 62). In her study of the use of e-mail for communicative EFL instruction, Liaw (1997) concludes that teachers play multiple roles in computer-assisted language instruction, acting as “designer, coach, guide, mentor, and facilitator” (p. 21). In particular, the teacher is expected to provide additional feedback on student assignments (Levy, 1997). In Liaw’s (1997) study, the students expressed the need to have more guided instruction from the teacher regarding the topic and format of e-mail exchanges. A similar concern was observed from the students’ self-report in the present study: some students expressed the need to have more feedback from the teacher, which they thought would be helpful for them to develop their ideas and improve their writing. As Levy (1997) contends, in a collaborative CALL project, the teacher plays a crucial role in organizing and facilitating the implementation of the project, ensuring that the project guidelines and tasks are clear, and the technology works to support the completion of the project. In the case of computer-mediated communication in the second language classroom where the computer network is used as a tool and channel of communication, the teacher is responsible for setting tasks and guiding students in the optimal use of the computer in completing the tasks. Besides, the teacher is expected to participate actively in the
interaction between students and provide students with resources of help. Therefore, more demands are placed on the teacher in computer-mediated teaching contexts than in the traditional classrooms, which bears important implications for second language teacher training and development. The next section will discuss the implications of the findings from this study.

**Pedagogical Implications**

This dissertation has focused on examining the written language produced in computer-assisted writing activities as well as the learners' attitudes about technology-enhanced learning. The findings from the present study bear important implications in several aspects for computer-assisted second language writing instruction.

First, in order to make use of e-mail to enhance writing instruction, it is important to design effective e-mail writing tasks that are not only interesting, but also meaningful and relevant to the objectives and content of the writing course. In the context of academic writing in English as a second language, e-mail task design should take into account the rhetorical elements of academic writing and aim at helping ESL students develop academic writing skills that demonstrate an awareness of purpose, audience and style of composition. E-mail tasks that are meant for such aims should define clearly the specific purpose and audience of the writing assignment with appropriate writing prompts that will elicit practice in different genres of academic writing. E-mail writing activities
will be more constructive and meaningful when they are related to the objectives of the writing course and tied to the course content rather than simply being adds-on activities.

Secondly, in integrating e-mail activities into second language writing, teachers should take full advantage of the on-line communication channel provided by computer networks to stimulate interaction among the students, foster communication, and encourage collaborative writing. For example, e-mail assignments which require the exchange of information, ideas, or debates of controversial issues will generate a great deal of written interaction among the students in the process of completing the assignments. Making such written interaction accessible to all students on line in the form of a class mailing list further reinforces the social aspect of writing and allows students to help and benefit from each other through collaborative work. Besides, pairing up students for particular e-mail exchange projects will give students the opportunity to practice writing to a real, specific audience for a given purpose. Thus, the networked environment can be used to increase students’ rhetorical awareness of the purpose and audience of writing through interacting with the audience in the writing process.

Third, teachers involved in applying computer-mediated communication to second language writing instruction should assume appropriate, multiple roles in different phases of the project from planning, implementation to evaluation. Besides designing effective learning tasks and constructing appropriate writing prompts, teachers should also be responsible for monitoring the students’ performance on the tasks and ensuring that the tasks are completed in ways that their objectives and goals are met. Furthermore, teachers
should be highly accessible on line to provide ready responses to students’ questions and concerns. More importantly, teachers should also be active participants in the learning activities and provide ready feedback to students to facilitate their learning process.

Fourth, teachers should make conscious efforts to promote students’ motivation for learning to write on networked computers, to help students develop positive attitudes towards using computers to write, and to lower students’ possible anxiety about on-line writing. Teachers themselves should update the computer knowledge and skills that are needed to be the designers of computer-assisted learning tasks in the second language classroom. Furthermore, the application of computer technology to second language instruction also requires support and understanding from the institutions in which such projects are being carried out. Without strong institutional support, individual teachers will encounter greater difficulties in implementing projects that involve institution-based access to computer technology.

Lastly, there is the need to further explore the use of computerized text analysis programs for second language instruction. The concordance program used for data analysis in the present study shows potentials for pedagogical use in terms of second language vocabulary acquisition. Because of its capacity to provide the contexts in which particular lexical items occur in a text, the concordance program can be used to help second language teachers develop learning materials based on linguistic corpora of natural language use, thus providing context-rich, authentic learning materials for second language learners.
**Limitations of the Study**

Although the findings of the present study have supported the major hypotheses raised, several factors need to be taken into account when interpreting the results before generalizing the findings.

First of all, the subjects of this study were twenty-two ESL students enrolled in a freshman ESL writing class. They were placed in English 106 because they were identified through a written placement exam as needing one more semester’s writing instruction than the other ESL students who were enrolled in English 107. Thus, the findings are limited to subjects with a profile similar to those participating in this project. Moreover, a larger number of subjects may have allowed the researcher to apply and generalize the findings of this study to other language learning contexts.

Second, since no information was gathered about students’ final written products, i.e. the formal academic essays related to the pre-writing e-mail assignments, caution must be taken to avoid making claims about the relationship between such e-mail writing tasks and students’ achievements in traditional academic essay writing. A research design which involved data from students’ final written essays related to the e-mail tasks of pre-writing could have revealed stronger evidence for the effectiveness of such e-mail writing on developing academic writing skills in English.

Third, the four e-mail tasks from which data was collected in this study involved student informal writing in different modes of writing that are representative of typical
genres of academic writing in English. There are other common genres of academic
discourse, for example, the research paper, which requires a great deal of planning and
pre-writing efforts, that were not explored in this study.

Lastly, the types of data in this study were mainly written products and student
self-reports. There was no direct observation of students' actual performance on the
networked computers while they were completing the e-mail tasks. Besides, although
there was a length limit to control the amount of language output, there was no control of
the amount of time the students spent on completing each of the e-mail tasks. Such factors
should be taken into consideration before generalizations can be made.

Recommendations for Future Research

Given the findings and the limitations of the present study, several
recommendations can be made for future research to further investigate the effectiveness
of using e-mail for enhancing second language writing instruction, particularly in the
context of academic writing in a second language.

First of all, an experimental or quasi-experimental design could be used to
compare the writing performance of students engaged in pre-writing activities in both the
online and the offline writing environment. The same pre-writing tasks could be
assigned to both the experimental group and the control group of students. While the
experimental group would use e-mail in the form of a class mailing list to complete the
tasks, students in the control group would write and exchange their writings on paper.

With such a research design, the following questions could, as examples, be investigated:

1) Does e-mail have an effect on the writing performance of ESL students in terms of linguistic complexity and grammatical accuracy? 2) Does e-mail have an effect on the writing performance of ESL students in terms of rhetorical organization? 3) Does e-mail have an effect on students in developing a sense of audience in the writing process?

Second, to gain further insights into the effects of e-mail as a technological aid to second language writing, a follow-up study could be designed. In this study, qualitative data from students’ writing processes in completing the tasks in the on-line and the off-line writing conditions could be collected. Questions like the following could be explored: 1) Does e-mail provide a better social environment for students to communicate with each other in the writing process than group work in the classroom? 2) In the phase of planning for essay writing, how does student interaction on e-mail and in classroom group work differ? 3) What kinds of interaction can help students generate more or better ideas for writing? 4) What kinds of interaction enable students to provide and receive more feedback from each other?

Third, since e-mail writing is conducted in an asynchronous manner while real-time computer conferencing is held synchronously, it would be interesting to compare students’ writing performance under these two kinds of on-line conditions. The following questions could be investigated: 1) What are the characteristics of ESL students’ language production in synchronous and asynchronous computer conferencing? 2) Are there
differences in the characteristics of ESL students' language production between synchronous and asynchronous computer conferencing? 3) In what ways can synchronous and asynchronous computer conferencing be used effectively to facilitate second language writing instruction?

Fourth, to better understand the use of e-mail in facilitating second language students' writing process, a research project could be designed to examine the relationship between what students write about in the e-mail pre-writing tasks that plan for academic essay writing, and the characteristics and quality of their final essays. For this inquiry, a combination of quantitative and qualitative methods of investigation is in order. The questions to be asked could include: 1) To what extent do pre-writing activities on e-mail facilitate ESL students' composing process in writing academic essays? 2) What is the relationship between e-mail pre-writing activities and academic essay writing in terms of the characteristics of language production for ESL students?

Lastly, to probe deeper into the composition process of writing in the particular electronic medium of e-mail, it would be interesting to study the writing strategies students use and compare the differences between such strategies and those used in the traditional writing mode. Consideration of individual learner differences such as motivation, attitude, gender, learning style and how such variables may affect the use of e-mail strategies in the electronic composing process could also lead to a future research project that may add substantially to the literature on computer-assisted language learning.
Conclusion

The findings of this dissertation indicate that there were syntactic, lexical, textual and grammatical differences in ESL students' writing performance on e-mail writing tasks of different rhetorical purposes, and there was also variation between e-mail tasks involving an interactive audience and those involving an non-interactive audience, and between structured versus non-structured e-mail tasks. In particular, in e-mail tasks in which an interactive audience was present, students tended to produce texts that were linguistically more complex. Besides, students wrote with a higher level of syntactic and lexical complexity in the non-structured e-mail tasks than in the structured ones, indicating more sophisticated use of language when the student writers were given more freedom and control of the learning activities. Such findings bear important implications for designing effective task-based e-mail writing tasks for enhancing second language writing development. However, the results of this dissertation also show obvious tradeoff effects between linguistic complexity and accuracy, i.e. while students produced texts that were linguistically more complex, there was less attention to grammatical accuracy. This may be due to the information-processing constraints which require learners to allocate attention to particular goals at the expense of other goals. There is therefore the need to balance the development of both linguistic complexity and accuracy in second language writing. The analysis of data in the present study also suggests that motivation, attitude, and anxiety, which have been evidenced as factors affecting the second language acquisition process,
had some significant contribution to the variation in ESL students' writing performance while they composed in an electronic mode. Such findings reinforce the necessity of framing the investigation into computer-assisted language learning in terms of theoretical and empirical understandings of the second language acquisition process in general. The findings of this study provide pedagogical implications for the application of computer technology in second language instruction, particularly in terms of designing effective writing tasks that could facilitate L2 students' writing process in a computer-mediated learning environment for the enhancement of L2 writing development. Using computerized text analysis programs for data analysis, this study has also demonstrated that computerized text analysis programs can be useful research tools for conducting research involving second language written data.
APPENDIX A: Assignment Sheets of the Four E-mail Tasks

Task 1

Task and Requirements:
For this assignment, you will practice using descriptive and narrative skills to tell a personal story. You may use this exercise as a starting point for the Personal Narrative Essay. This assignment should be done on e-mail and sent to the class mailing list at the address: eng106@listserv.arizona.edu. Your story should be at least 350 words long. You will have a week to complete this assignment.

Topic:
Describe an interesting experience you had when you first came to the US. In your description, include details about the following questions: What happened? Where and when did it happen? Who were involved? What surprised you? What caused that surprise? How did you feel about this experience? What did you learn from this experience?

Task 2

Task and Requirements:
For this assignment, you are expected to work with your partner and exchange cultural information on your chosen topic for Essay 2—The Cultural Comparison/Contrast Essay. This assignment should be done on e-mail and sent to the class mailing list at the address: eng106@listserv.arizona.edu. There are two parts for this assignment. Each part should have at least 350 words. You will have a week to complete each part of this assignment.

Part One
Topic:
Write a letter to your partner to provide him/her with the needed information about your own country on a particular cultural topic. You may refer to Student's Guide pp. 87-88 for a list of possible topics. You should negotiate this topic with your partner because it should also be one he/she is interested in. When you write this letter, you need to keep in mind the questions your partner might have about this topic, e.g. What does he/she want to know? You need to work together with your partner to decide on a topic you know a lot about and you are both interested in. Your main goal is to inform your classmate of something particularly interesting about your country which he/she wants to compare or contrast with his/her own.
Part Two

Topic:

Now you have got a letter from your partner telling you something about his/her country you are interested in. Has he/she provided you with what you need? Is there anything in the letter you find confusing and want to clarify with the writer? Is there anything else you want to know about?

Write a letter to your partner, responding to what he/she told you in the previous letter (Part 1 of this assignment). In your letter, let your partner know how useful his/her information is for you, ask questions you still have about the topic, and tell your partner how things in your country are either similar to, or different from his or hers (when you do this, you will practice the technique of comparison and contrast).

Task 3

Task and Requirements:

For this assignment, you are expected to practice the strategies of persuasion and gather ideas for Essay 3—the Persuasive Essay. You may consider developing what you write for this assignment into Essay 3. This assignment should be done on e-mail and sent to the class mailing list at the address: eng106@listserv.arizona.edu. There are two parts for this assignment. Each part should have at least 350 words. You will have a week to complete each part of this assignment.

Topic:

Write down some ideas you have about the argument you want to make in the Persuasive Essay and explore these ideas.

Questions to Consider:

— What do you want to argue about? Why? Explain the reasons for your position on the issue.
— Whom do you want to persuade? Why? Explain your reasons for targeting this audience.
— What are your main points of argument? In other words, what are the major claims you will make to develop your main argument?
— What are your reasons for such arguments? What evidence do you have to support each of these arguments? Give some examples you will use as evidence and support for your argument.
— What do you think are some possible counterarguments from people who may disagree with you? How are you going to deal with them?
Part Two

This part of the assignment is meant for you to help each other in developing a strong and convincing argument with consideration of possible objection from the opposite side. By playing the role of the opponent (the disagreeing party) to your partner's argument, you will practice the art of arguing in a more authentic context.

Topic:
Serve as your partner's opponents and raise your counterarguments to the arguments he/she raised. Suppose that you disagree with some major points he/she made.

Questions to consider:

--Which point your partner raised seems to be the weakest? Why? Is it reasonable? Is it logical? Is it consistent with his/her other arguments? How can you refute (prove incorrect or untrue) it?
--What evidence do you have to support your counterargument to that point?
--How about your partner's other arguments? Suppose you don't agree with your partner on these points either, what can you say to persuade him/her to give up those ideas?

Task 4

Task and Requirements:
For this assignment, you will practice writing in response to a source text, i.e. an article on a particular topic. You will be asked to express your personal reactions to what you read and express your personal opinions about the ideas discussed in the article. This assignment should be done on e-mail and sent to the class mailing list at the address: engl.06@listserv.arizona.edu. Your response should be at least 350 words long. You will have a week to complete this assignment.

Topic:
Read "The Right to Fail" by William Zinsser (American Dreams, pp. 132-135) and write a reader response to the ideas he proposed in this article.

General Questions to Consider:

What do you think of the author's main argument in this essay? Do you agree with him? Are you persuaded by him? Does he sound convincing to you? Feel free to express your personal reactions to the ideas of success and failure Zinsser argued about in this article, and explain your personal opinions on success and failure.
APPENDIX B: Pre-Activity Survey

Student Background Information Questionnaire

Please give your answers to the following questions:

Name: ___________________________ Sex ______ Nationality ______________________

Native language ___________ Major ___________ TOEFL score ___________

Length of residence in the U.S. ___________ Year at UA ___________

Time and place of English study: time _______ years, place __________________

Please rate your writing ability in English:
poor ______ fair ______ good ______ very good ______ excellent ______

Please rate your typing ability:
poor ______ fair ______ good ______ very good ______ excellent ______

Please rate your knowledge of computers:
poor ______ fair ______ good ______ very good ______ excellent ______

How you ever used a computer to do the following things?:
word processing: never ______ a little ______ a lot ______
E-mail: never ______ a little ______ a lot ______
World Wide Web: never ______ a little ______ a lot ______

Have you ever subscribed to a list serve?: Yes ______ No ______
If yes, what list serve have you subscribed to?: ______________________

Have you ever taken a course which requires e-mail assignments? Yes ______ No ______
If yes, what is the course?: ______________________

What are you expectations/goals for this course? Write a paragraph to answer this question in the following space:
APPENDIX C: Post-Activity Survey

Instructions: Since you have done a lot of e-mail writings in this course, how do you feel about what you have done? Please take a few minutes to reflect upon your experience in this course and respond to the following questions. Please circle the appropriate answer based on the following number-meaning representation and give your answers to the questions that follow:

1: strongly disagree, 2: disagree, 3: somewhat disagree, 4: neutral, 5: somewhat agree, 6: agree, 7: strongly agree

1. I enjoyed using e-mail to write. 1 2 3 4 5 6 7
2. I was concerned about making mistakes while I wrote on e-mail. 1 2 3 4 5 6 7
3. I was interested in reading what my classmates wrote on e-mail. 1 2 3 4 5 6 7
4. I felt comfortable sharing my ideas with others on e-mail. 1 2 3 4 5 6 7
5. I thought learning how to write using computers would be important for my college studies. 1 2 3 4 5 6 7
6. I was not interested in what my classmates wrote about on e-mail. 1 2 3 4 5 6 7
7. I thought the e-mail activities could help me improve my writing in English. 1 2 3 4 5 6 7
8. I was not comfortable sharing my ideas with others on e-mail. 1 2 3 4 5 6 7
9. I was not worried about making mistakes while I wrote on e-mail. 1 2 3 4 5 6 7
10. I liked to share my ideas on e-mail with my classmates. 1 2 3 4 5 6 7
11. I would like to spend more time learning how to write better using computers. 1 2 3 4 5 6 7
12. I did not feel comfortable when using a computer to write. 1 2 3 4 5 6 7
13. I spent a lot of time doing the assignments because they were required and they were evaluated. 1 2 3 4 5 6 7
14. I was interested in using computers for writing.  

15. I didn't find the e-mail assignments helpful for improving my writing.  

16. How did you usually write your papers for class?  
   a) I write my first draft [ ] directly on the computer [ ] on paper first  
   b) I revise my paper [ ] directly on the computer [ ] on paper first  

17. How did you usually write the e-mail assignments?  
   [ ] write directly on the computer [ ] write on paper first  

18. Did you usually read over what you had written before sending it out? [ ] yes [ ] no  
   If you answer Yes, explain what you usually did before sending it out:  

19. Besides writing the class assignments, have you used e-mail for other assignments in other courses? [ ] yes [ ] no  
   If you answer Yes, explain briefly the other class assignments for which you have used e-mail.  

20. How often did you use a computer to do the following:  
   word processing: never_____ a little_____ a lot_______  
   e-mail: never______ a little_______ a lot________  
   World Wide Web: never______ a little_______ a lot________  

21. What do you think of the e-mail assignments you did for this class in general?  

22. Please provide your comments on the e-mail assignments. Give concrete examples if possible.  
   a) What do you like best about them?  
   b) What do you like least about them?  
   c) Which particular assignment do you think is the most useful? Why would you think so?  
   d) Which particular assignment do you think is the least useful? Why would you think so?  
   e) What other activities do you think we can do using e-mail?
APPENDIX D: Evaluation Form for the ESL Raters

<table>
<thead>
<tr>
<th>Note: Excellent(5), Good(4), Adequate(3), Poor(2), Failing(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall rating</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>1. Development of main idea</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>2. Clarity of purpose</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>3. Audience awareness</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>4. Flow of ideas</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>5. Sentence structure</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>6. Vocabulary</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
<tr>
<td>7. Grammar</td>
</tr>
<tr>
<td>5 4 3 2 1</td>
</tr>
</tbody>
</table>
APPENDIX E: English 106 Course Syllabus

English 106 Syllabus
Fall, 1997

Course Description and Objectives:
English 106 is designed to help international students succeed in writing academically. It is an introduction to some of the kinds of writing and thinking you will be doing at an American university. In this course, you will be doing a great deal of reading, writing, and thinking. You will share your ideas and writing with others in the class and gain feedback on your writing from both the instructor and class members. You will become familiar with the writing process from invention and drafting to revising and editing. You will learn to develop strategies to read critically and write effectively, which will prepare you to work successfully with reading materials and writing assignments from other courses.

Required Assignments:
The following table list all assignments and their point values. Required assignments which carry no point values must be completed in order for you to receive full credit for the course.

<table>
<thead>
<tr>
<th>Major Assignments</th>
<th>Percentage Allotted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit I: The Narrative Essay</td>
<td></td>
</tr>
<tr>
<td>First version (due 9/18)</td>
<td>Required</td>
</tr>
<tr>
<td>Final version (due 9/25)</td>
<td>15%</td>
</tr>
<tr>
<td>Unit II: The Comparison/Contrast Essay</td>
<td></td>
</tr>
<tr>
<td>First version (due 10/23)</td>
<td>Required</td>
</tr>
<tr>
<td>Final version (due 10/30)</td>
<td>25%</td>
</tr>
<tr>
<td>Unit III: The Persuasive Essay</td>
<td></td>
</tr>
<tr>
<td>First version (due 11/20)</td>
<td>Required</td>
</tr>
<tr>
<td>Final version (due 12/2)</td>
<td>20%</td>
</tr>
<tr>
<td>Informal writing assignments</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm Exam (10/9)</td>
<td>10%</td>
</tr>
<tr>
<td>Final Exam (Dec.12)</td>
<td>15%</td>
</tr>
</tbody>
</table>
Course Policies:

Attendance: Regular attendance is required. If you miss more than two classes, you may be administratively dropped from the class with a grade of E. You are responsible for finding out about and making up any missed assignments, including journals and in-class writings. See pp.182-183 in the Student's Guide for the official departmental policy on attendance.

Conferences: I will schedule individual or small-group conferences during the semester in place of class meetings. You should come to your conference prepared to discuss your work. A missed conference counts as an absence.

Manuscript Preparation: Please consider every piece of writing you do for this class to be "public property". We will discuss your writing in pairs or groups. As both your classmates and I will read and comment on your papers, it is essential that the essays are clearly typed. Be sure to keep a copy of each assignment in the (rare) event that I lose it. If you do not have a copy, you will have to rewrite the lost assignment. You must type up all drafts of the formal essays. You don't have to type the journals, but they must be written in legible handwriting.

Grading Policy: Your final grade depends on your successful completion of all assignments. My evaluation of your essays will consider content, organization, expression and mechanics according to the grading standards of the Composition Program. I will explain specific requirements for each particular essay you will write. You must complete all assignments in order for you to receive full credit for the course. Your final portfolio should include all drafts, informal writing assignments and peer evaluations.

Informal Assignments: These include journals, in-class writings, and peer reviews. These writings are related and keyed to the essays and must be turned in with each essay in order for that essay to receive full credit. If you are not in class the day journal entries are assigned, you are responsible for finding out about and making up any missed assignment. Note: A journal is usually due in the next class after it has been assigned. You will be expected to bring your journal to class to exchange with your classmates.

Late Papers: All assignments are due at the beginning of class on the due date. Late papers will be marked one-third of a letter grade for each day late. Supporting materials (informal writing assignments and peer-reviews) will not be accepted after the portfolio due day. Note: If you do not have a typed rough draft prepared on the rough draft due day, with copies for your peer-review group, you final version will be marked down one-third of a letter grade.
Academic Dishonesty and Plagiarism: All UA students are responsible for upholding the Code of Academic Integrity, available through the Office of the Dean of Students. Read carefully the synopsis of the code published in the Student's Guide (pp. 189-192).

Guidelines for Classroom Interaction: The following guidelines will help you make the most of the opportunities this class offers: 1) always come to class prepared for the day's activities; always bring the journal assigned for the day before to class; 2) cooperate with your classmates in small-group activities and discussions; 3) cooperate with me, especially when you want to come talk about a paper, by coming prepared to ask questions and making sure you understand what you need to do for an assignment; and 4) use all aspects of this course--essays, journals, readings, discussions in class and via e-mail, peer reviews, exams, research, comments on written work, and grades--as opportunities to grow and learn, to expand your skills and abilities. This is an attitude to develop for all of your classes and for your future work to enhance your chances of success.

Making use of technology: Your writing job will be much easier if you use a word processor or word-processing program on a computer. So you'd better write your first draft on a computer. This way you can do extensive rewriting quickly. Besides, you will also learn to use e-mail to practice writing by communicating with your classmates and share your ideas for writing. If you don't have an e-mail account, you should apply for one with CCIT during the first week. You will learn to use e-mail to do some of the assignments in this course. You will find that knowing how to use the computer well is an important skill for success at the university.

Schedule: Be aware that a syllabus is occasionally subject to change due to time constraints, unexpected disruptions, or needs of the class. Therefore, pay attention to class announcements of any changes in the assignments.

The texts are abbreviated as follows:
SG—Student's Guide
AD—American Dreams
HW—Homework

Reminder: Always bring the required textbooks to class!

Week 1
T 8/26 Course overview. Introductions. In-class writing.
HW: Read SG pp. 7-16 ("Writing in a University Setting: An Instructor's Perspective"), pp. 22-38 ("Tips on Writing") and pp. 39-55 ("The Writing You Will Do in English 100 or 106"). Read AD pp. 21-35 ("The Writing Process").

TH 8/28 The Narrative Essay. The writing process and invention strategies.
HW: Read AD pp.7-13 ("Summarizing") for discussion of the distinction between summary and response. Read AD pp.280-285 ("My Name is Margaret"), and pp.304-307 ("An American Childhood"). Write Journal #1.

Week 2
T 9/2 Computer workshop in Modern Languages Building, Room 511. Subscribing to the class mailing list and using e-mail.
HW: Read SG pp.63-67 ("A Day to Remember"), pp.68 ("Don't Run the Race: Design the Track"). Write Journal #2.

HW: Read SG pp.75-79 ("Mr. Nice Guy-Not!"). Read AD pp.312-315 ("From Talking to High Monks in the Snow"). Write Journal #3.

Week 3
T 9/9 Discuss assigned readings and exchange journals.
HW: Write Journal #4 (on e-mail).

TH 9/11 Share ideas and concerns for the narrative essay. Sample essay.
HW: Read SG pp.56-58 ("The Differences between Responding to and Grading Writing"), and pp.58-60 ("What to Do Once Your paper is Graded"). Start planning for essay 1. Write an outline for the Narrative Essay and bring it to the next class.

Week 4
T 9/16 In-class workshop on outline. Discuss revision and grading.
HW: Start drafting for the Narrative Essay.

TH 9/18 First Draft of the Narrative Essay due at the beginning of class. Bring 3 copies of your paper to class. Sign up for conferences. Peer review.

Week 5
T 9/23 No class. Conferences with the instructor in Room 3204, Badcock Building.

TH 9/25 Final Version of the Narrative Essay due. Turn in your final portfolio with the following items:
--first draft and final version of the Narrative Essay;
--journal #1, #2, #3, #4 (on e-mail);
--all in-class writings;
--peer reviews of two essays of your classmates.
Week 6
T 9/30  Overview of Unit II: Comparison/Contrast Essay.
HW: Read AD pp.405-408 ("Two American Dreams"), and pp.308-311 ("Growing Up In The U.S."). Write Journal #5.

TH 10/2  Discuss assigned readings and exchange journals. Explore your topic for Essay 2.

Week 7
T 10/7  Organization and elements of essays. Methods of comparison and contrast.

TH 10/9  Mid-term exam (one-hour in-class writing).

Week 8
T 10/14  In class group work. Narrowing down your topic and getting a focus for comparison/contrast.
HW: Write Journal #7--Part One (on e-mail).

TH 10/16  In class group work. Planning for Essay 2.
HW: Write Journal #7--Part Two (on e-mail).

Week 9
T 10/21  In-class workshop. Share and explore ideas for Essay 2.

TH 10/23  First draft of the Comparison/Contrast Essay due at the beginning of class. Bring 3 copies of your paper to class. Peer reviews. Sign up for conferences. Peer review.

Week 10
T 10/28  No class. Conference with the instructor in Room 3204, Badcock Building.
HW: Revise the Comparison/Contrast Essay.

TH 10/30  No class. Revise Essay 2.
Week 11
T 11/4  Final portfolio of Essay 2 due. Portfolio of Essay 2 due. Turn in the following:
   --final version of Essay 1.
   --first draft and final version of Essay 2;
   --journal #5, #6, #7 (on e-mail);
   --peer review of your partner's essay.
HW:  Overview of Unit III: The Persuasive Essay.

HW:  Read AD pp.58-65("Writing Essays of Argument and Persuasion"). Read AD pp.409-413("From Horatio Alger Farewell! The End of the American Dream"), and pp.132-135("The Right to Fail"). Write Journal #9 (on e-mail).

Week 12
T 11/11  Veteran's Day. No class.

HW:  Write Journal #10—Part 1(on e-mail).

Week 13
T 11/18  In-class group work. Sharing concerns and ideas for the Persuasive Essay.
HW:  Write a first draft of the Persuasive Essay.

TH 11/20  First draft of Essay 3(The Persuasive Essay) due. Bring two copies of your essay to class. Peer review.
HW:  Write Journal #10—Part 2 (on e-mail).

Week 14
T 11/25  No class. Conference with the instructor in Room 3204, Badcock Building.

TH 11/27  Thanksgiving. No class.

Week 15
T 12/2  Final version of the Persuasive Essay due. Turn in your final portfolio with the following items:
   --final version of the Narrative Essay;
--final version of the Comparison/Contrast Essay;
--first draft of the Persuasive Essay;
--final version of the Persuasive Essay;
--journal #8, #9, #10 (on e-mail);
--peer review of your partner's essays.
Overview of the final exam.

TH 12/4  Prepare for final exam.
HW:       Write Journal #11 (on e-mail).

Week 16
T 12/9    Prepare for final exam.

F 12/12   Final Exam: 8am-10am, Location:TBA

GOOD LUCK ON ALL YOUR FINALS AND HAVE A GREAT CHRISTMAS VACATION!
APPENDIX F: List of Function Words in English

again, ago, almost, already, also, always, anywhere, back, else, even, ever, everywhere, far, hence, here, hither, how, however, near, nearby, nearly, never, not, now, nowhere, often, only, quite, rather, sometimes, somewhere, soon, still, then, thence, there, now, well, therefore, thither, thus, today, tomorrow, too, underneath, very, when, whence, where, whither, why, yes, yesterday, yet, am, are, aren't, be, been, being, can, can't, could, couldn't, did, didn't, do, does, doesn't, doing, done, don't, get, gets, getting, got, had, hadn't, has, hasn't, have, haven't, having, he'd, he'll, he's, I'd, I'll, I'm, is, I've, isn't, it's, may, might, must, mustn't, ought, oughtn't, shall, shan't, she'd, she'll, she's, should, shouldn't, that's, they'd, they'll, they're, was, wasn't, we'd, we'll, were, we're, weren't, we've, will, won't, would, wouldn't, you'd, you'll, you're, you've, about, above, after, along, although, among, and, around, as, at, before, because, below, beneath, beside, between, beyond, but, by, down, during, except, for, from, if, in, into, near, nor, of, off, on, or, out, over, round, since, so, than, that, though, through, till, to, towards, under, unless, until, up, whereas, while, with, within, without, a, all, an, another, any, anybody, anything, both, each, either, enough, every, everybody, everyone, everything, few, fewer, he, her, hers, herself, him, himself, his, I, it, its, itself, less, many, me, mine, more, most, much, my, myself, neither, no, nobody, none, noone, nothing, other, others, our, ours, ourselves, she, some, somebody, someone, something, such, that, the, their, theirs, them, themselves, these, they, this, those, us, we, what, please, which, who, whom, whose, you, your, yours, yourself, yourselves, much, few, not, quite, really, more, away, rather, too, just, across, oh,
APPENDIX G: List of Coordinating Conjunctions in English

and, or, neither, nor, but, for, so, yet, as well as, neither...nor, both...and, either...or, not only...but also
APPENDIX H: List of Subordinating Conjunctions in English

although, though, while, whereas, because, since, as if, as though, as far as, as long as, so as, when, whenever, before, after, till, until, once, where, wherever, in order that, in that, such that, so that, whether...or, if, lest, what, whatever, which, whichever, why, how, however, who, whom, whoever, unless, in case, in order to, given that, granted that, provide that, granting that, seeing that, supposing that, now that, rather than, sooner than, no matter what, when, how, which, where
APPENDIX I: List of Cohesive Conjunctions in English

Additive Conjunctions:
nor, or, furthermore, in addition, besides, alternatively, incidentally, by the way, in the same way, I mean, in other words, such, for example, for instance, thus, likewise, similarly, on the other hand, by contrast, in contrast, another

Adversative Conjunctions:
yet, though, but, however, nevertheless, despite, in fact, as a matter of fact, actually, at the same time, at that time, instead, rather, on the contrary, at least, in any case, in that case, in this case, in either case, in both cases, whichever, anyhow, at any rate

Causal Conjunctions:
so, then, hence, thus, therefore, consequently, because of this, for this reason, on account of this, as a result, to sum up, in summary, in conclusion, in consequence, for this purpose, with this in mind, for, because, it follows, on this basis, to this end, in such an event, under the circumstances, under any circumstances, under other circumstances, otherwise, in this respect, in this regard, with reference to this, in other respects, aside from this

Temporal Conjunctions:
next, after, then, just then, previously, before that, finally, last, at last, first, at first, in the end, at once, thereupon, soon, for the first time, next time, after a time, at that time, on another occasion, later, meanwhile, until then, at this moment, at that moment, secondly, in conclusion, now, up to now, from now on, at this point, here, to sum up, in short, briefly, to return to the point, to resume
APPENDIX J: List of Grammatical Rules Used in the Grammar Checker

Adjectives
Example: Tim felt badly when the winder broke.

Adverbs
Example: He writes bad.

Article
Example: A honest person would not do that.

Common splice or confused sentence:
Example: It was late, the boys were hungry.

Comparative or superlative
Example: Writing is often more easier than we expect.

Conditional clause
Example: If they would have called first, we could have reserved a room.

Conjunction
Example: I have to choose between security or higher pay.

Double negative
Example: We couldn’t hardly keep up with the orders.

Homonym
Example: Who’s is that?

Incomplete sentence
Example: All but the rock samples.

Incorrect verb form
Example: He had ran out of time.

Missing modifier
Example: This is incomplete report.

Noun phrase
Example: These banana are almost ripe.

Object of verb
Example: John came the store with us.

Possessive form
Example: The doctors office was empty.

Pronoun case
Example: John and myself lift weights.

Pronoun number agreement
Example: I like many of his idea.

Relative pronoun agreement
Example: One person which I respected was Jim.

Subject-verb agreement
Example: One of the most important files are missing.

Subjunctive
Example: If she was rich, she could go.

Subordination
Example: Because the weather was sunny.

Tense shift
Example: He left and takes a nap.
REFERENCES


Pennington, M. C., & Stevens, V. (Eds.), *Computers in applied linguistics: An international perspective* (pp. 79-109). Clevedon: Multilingual Matters Ltd.


